



Catalog SM06EN

Stepper Products



Motors

- TorquePower Series
- TorquePower Plus Series
- TorquePower Enhanced Series

Drives

- SA-Series
- PRO Series



For over 60 years, ElectroCraft has been helping engineers translate innovative ideas into reality – one reliable motor at a time. As a global specialist in custom motor and motion technology, we provide the engineering capabilities and worldwide resources you need to succeed.



This guide has been developed as a quick reference tool for ElectroCraft products. It is not intended to replace technical documentation or proper use of standards and codes in installation of product.

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this product must satisfy themselves that all necessary steps have been taken to ensure that each application and use meets all performance and safety requirements, including all applicable laws, regulations, codes and standards.

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Designed by stilbruch · www.stilbruch.me

Table of Contents



Typical Applications 3

Which Stepper Motor 5

TPP & TPE Drive Product Matrix 6

TorquePower Enhanced Series 7

TPE17 7

TPE23 11



TorquePower Plus Series 15

TPP11 15

TPP17 19

TPP23 23

TPP34 27



TorquePower Series 31

TP23 31

TP34 33

TP42 35



SA-Series 37

SA45 37



PRO Series 39

PRO-A04V36 41

PRO-A08V48 43

PRO-A10V80 45

PRO-A20V80 47



Connection Diagrams 49

System Matrix 52

Other Products 53

Drives Accessories 56

TPE

TPP

TP

SA

PRO



Typical applications for ElectroCraft Stepper Motors:

- Custom OEM applications
(Our Specialty)
- Packaging
- Semiconductor handling and testing
- Antenna positioning
- Laboratory equipment
- Rapid prototyping machines
- Medical equipment
- Dispensing



Dialysis Machine

Situation: A next generation kidney dialysis machine was being designed with two modifications to the original stepper motor used for the blood pump due to problematic issues during operation. The first design challenge was the mechanism that coupled the motor shaft to the machine was a cause of long-term failure due to stress caused by point loading. The second challenge was the noise inherent to stepper motor operation was bothersome to patients who were connected to the machine for hours at a time.

Solution: The motor shaft was designed and machined such that it mated directly to the pump by customizing the shaft diameter, tapping a concentric threaded hole, providing a thru-hole for set-screw and incorporating a ridge for an O-ring seal. The rotor was designed to eliminate the detent torque by skewing the normally straight laminations on the teeth. This patented design provides reduced vibration and noise from the motor when operated in all full, half and micro-stepping resolutions.

Results: Working with the ElectroCraft engineering team, the medical machine manufacturer was able to resolve several problems in their original machine design with an updated design that better integrated the motor into the machine improving both the reliability and the patient experience.



A redesigned motor from ElectroCraft improved both machine reliability and the patient experience

Industrial Surveillance Equipment

Situation: A manufacturer of outdoor pan-and-tilt surveillance cameras experienced a problem with their newly-designed system. The stock stepper motors they had integrated into their design kept breaking at the shaft, and their motor vendor could not remedy the issue.

Solution: ElectroCraft created a stepper with a larger, more rugged shaft that could be retrofit into the customer's products already in the field. The custom stepper motors were built into the newer models to maintain long-term product durability.

Results: Over 1000 surveillance systems have shipped with the custom stepper motor system installed. Since the stepper switch, not one stepper motor shaft failure has been reported.



Custom rock-solid steppers gave surveillance cameras the added security of long life.

Medical Diagnostic Imaging Equipment

Situation: A medical diagnostic imaging machine manufacturer kept experiencing stepper motor failures in its imaging machines, and customers of their higher-priced units were complaining about reliability.

Solution: ElectroCraft built a fully customized, compact and ultra-rugged stepper that would fit more securely into the imager. The new motor included a custom-designed housing, shaped to fit into the machine itself.

Results: By working with ElectroCraft's engineering team to integrate in the new system, the company cut their anticipated time to market by one quarter. In addition, the new motor integration prompted a successful product marketing launch and helped the manufacturer gain significant market share.

A fully-customized, ultra-rugged stepper became the heart of a new, market-leading line of medical diagnostic image machines.





Select your Stepper Products!



ElectroCraft TorquePower™

Sizes: Nema 23, 34 & 42

Torque: up to 2100 oz-in or 1482 Ncm

Features:

- Conventional stepper
- Environmentally sealed
- Imperial sizes
- Housed motor reduces radiated magnetic flux
- High step accuracy

ElectroCraft TorquePower™ Plus

Sizes: Nema 11, 17, 23 & 34

Torque: up to 1190 oz-in or 840 Ncm

Features:

- High torque stepper
- High performing
- Metric and imperial sizes
- High step accuracy

ElectroCraft TorquePower™ Enhanced Series

Sizes: Nema 17 & 23

Torque: up to 294 oz-in or 208 Ncm

Features:

- Highest performing

- Metric and imperial sizes

TPP & TPE Drive Product Matrix

| | | Bipolar Stepper Drive | | | | | |
|------------------------------------|--------|-----------------------------|----------|-------------------------|------------|------------|------------|
| | | ElectroCraft CompletePower™ | | ElectroCraft PRO Series | | | |
| | | SA4505 | SA4510 | PRO-A04V36 | PRO-A08V48 | PRO-A10V80 | PRO-A20V80 |
| Product Description | | | | | | | |
| See on page | | 37 | 37 | 41 | 43 | 45 | 47 |
| Power Features | | | | | | | |
| Min. Voltage (VDC) | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Max. Voltage (VDC) | 48 | 48 | 36 | 48 | 80 | 80 | 80 |
| Dual Bridge MOSFET Driver | ● | ● | ● | ● | ● | ● | ● |
| Chopping Frequency (kHz) | 50 kHz | 50 kHz | up to 60 | up to 60 | up to 60 | up to 60 | up to 60 |
| Power Ratings | | | | | | | |
| Nominal Current | 3.5 | 7.1 | 2.8 | 5.7 | 7.07 | 14.1 | |
| Adjustable Current | ● | ● | ● | ● | ● | ● | ● |
| Max Power (W) | 240 | 480 | 144 | 385 | 800 | 1600 | |
| Control Modes | | | | | | | |
| Max. Step Input Frequency | 40 kHz | 40 kHz | | | | | |
| Microstepping up to 1/16 | ● | ● | | | | | |
| Internal Oscillator | ● | ● | | | | | |
| External Pulse Train (5-24 Logic) | ● | ● | | | | | |
| Fallback Current | ● | ● | | | | | |
| Analog Command (VDC) | 1-5 | 1-5 | 0-5 | 0-5 | 0-5, ±10 | 0-5, ±10 | |
| Torque Control | | | ● | ● | ● | ● | |
| Speed Control | ● | ● | ● | ● | ● | ● | |
| Position Control | | | ● | ● | ● | ● | |
| Fully Programmable Instruction Set | | | ● | ● | ● | ● | |
| Communication / Compliance | | | | | | | |
| CE Compliance (LV Directive) | ● | ● | ● | ● | ● | ● | |
| Optically Isolated Control Logic | ● | ● | | | | | |
| Programmable I/O | | | ● | ● | ● | ● | |
| CAN-Bus 2.0B / CANopen | | | ● | ● | ● | ● | |
| Physical Enclosure | | | | | | | |
| Totally Enclosed | ● | ● | ● | ● | ● | ● | |
| Case Type: Book Shelf | ● | ● | ● | ● | ● | ● | |
| Case Type: PCB Mount | | | ● | ● | | | |



Still need help?

Easily build your own motor at
www.configureamotor.com



Don't see exactly what you need?

Have ElectroCraft build you a
custom winding, stack length or
fully customized motor... that's
our specialty!

TPE17 & TPE17M : ElectroCraft TorquePower™ Enhanced | Stepper Motor

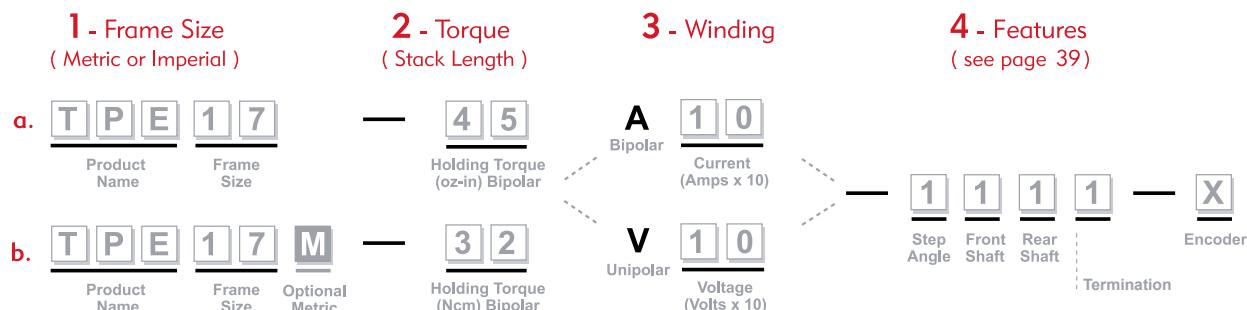
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------|-------------------------------|---------------------|
| Nema 17 | 78(55) | 80 |



Compact. Powerful.

The ElectroCraft Torque Power™ Enhanced Nema 17 is a high performance stepper motor incorporating creative design and manufacturing techniques to offer improved holding torque. Motors are available in both bipolar and unipolar windings with a variety of shaft configurations and encoder options to meet the needs of any application.

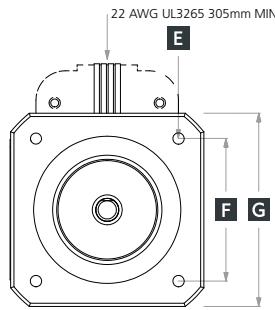
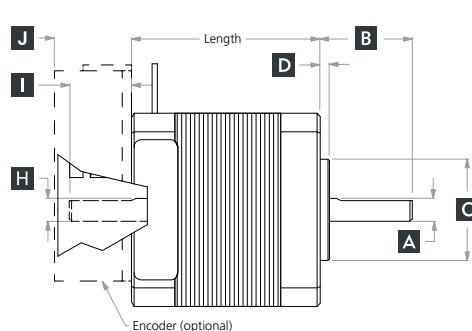
To build your own motor, choose the:

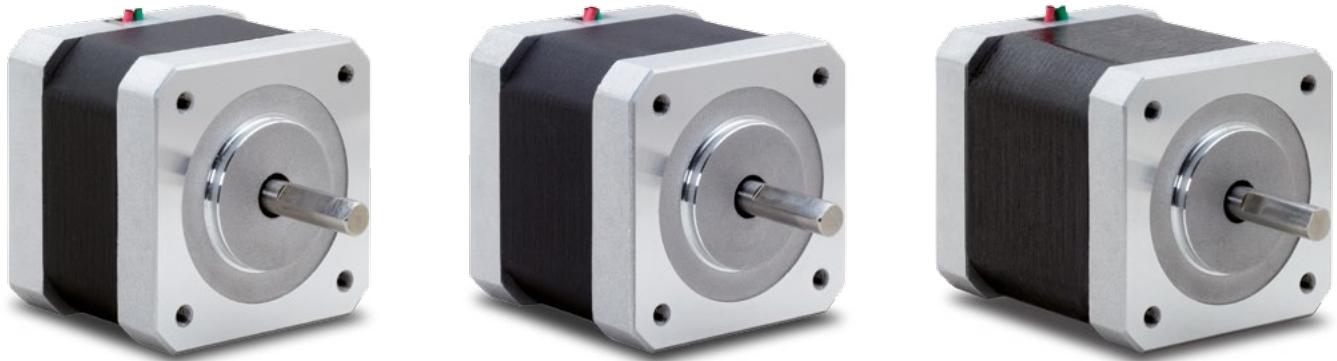


Step 1:

TPE17 & TPE17M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|--------------------|----------------------|--------------------|----------------|--------------|-------------------------------------|--------------------------|---------------------------------|---------------------|--------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPE17-45 | TPE17-35 | 1.42 in ± 0.03 | 0.1968 in | 0.79 in | 0.8660 in | 0.08 in | [4] 4-40 UNC-2B 0.17 in Deep Min | 1.22 in ± 0.07 | 1.65 in square | 0.1968 in | 0.53 in ± 0.04 | 0.70 in |
| TPE17-63 | TPE17-48 | 1.62 in ± 0.03 | 0.1963 in | | | | | | | | | |
| TPE17-78 | TPE17-60 | 1.93 in ± 0.03 | | | | | | | | | | |
| TPE17M-32 | TPE17M-25 | 36.1 mm ± 0.8 | 4.999 mm | 20 mm | 22.00 mm | 2.0 mm | (4) M3 x 0.5-6H 4.31 mm Deep min | 31.0 mm ± 0.15 | 42 mm square | 4.999 mm | 13.5 mm ± 1.0 | 17.8 mm |
| TPE17M-44 | TPE17M-34 | 41.1 mm ± 0.8 | 4.986 mm | ± 0.8 | 21.97 mm | | | | | | | |
| TPE17M-55 | TPE17M-42 | 49.1 mm ± 0.8 | | | | | | | | | | |





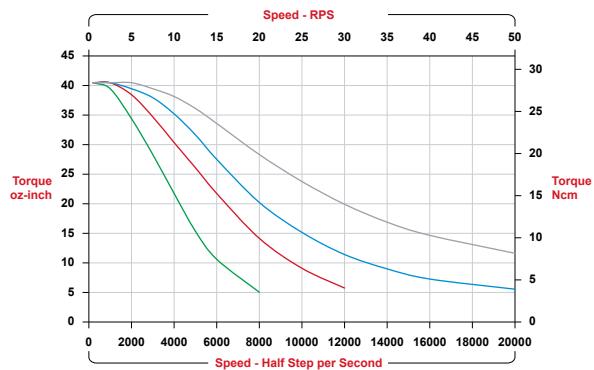
| Step 2: | | TPE17 & TPE17M Torque and Mechanical Data | | | | | |
|--------------------------------------|------------------|---|------------------|------------------|------------------|------------------|--|
| Stack Size Models | | Bipolar | | | Unipolar | | |
| Imperial | 45A | 63A | 78A | 35V | 48V | 60V | |
| Metric | 32A | 44A | 55A | 25V | 34V | 42V | |
| Holding Torque oz-in (Ncm) | 45 (32) | 63 (44) | 78 (55) | 35 (25) | 48 (34) | 60 (42) | |
| Step Angle °/step | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | |
| Rotor Inertia oz-in-sec² (kg-cm²) | 0.00058 (0.0407) | 0.00086 (0.0606) | 0.00117 (0.0827) | 0.00058 (0.0407) | 0.00086 (0.0606) | 0.00117 (0.0827) | |
| Weight oz (g) | 9 (250) | 11 (300) | 13 (370) | 9 (250) | 11 (300) | 13 (370) | |

| Step 3: Available Windings | | | | | | | | | |
|------------------------------|-------|-------|--------|-------|-------|--------|-------|-------|--------|
| Bipolar | | | | | | | | | |
| Imperial | 45A10 | 45A15 | 45A20 | 63A10 | 63A15 | 63A20 | 78A10 | 78A15 | 78A20 |
| Metric | 32A10 | 32A15 | 32A20 | 44A10 | 44A15 | 44A20 | 55A10 | 55A15 | 55A20 |
| Current Bipolar (A/Phase) | 1.00 | 1.50 | 2.00 | 1.00 | 1.50 | 2.00 | 1.00 | 1.50 | 2.00 |
| Phase Resistance (ohm) | 4.28 | 1.90 | 1.07 | 4.99 | 2.22 | 1.25 | 6.12 | 2.72 | 1.58 |
| Phase Inductance (mH) | 7.55 | 3.36 | 1.89 | 9.30 | 4.14 | 2.32 | 14.42 | 6.42 | 3.40 |
| Unipolar | | | | | | | | | |
| Imperial | 35V40 | 35V60 | 35V120 | 48V40 | 48V60 | 48V120 | 60V40 | 60V60 | 60V120 |
| Metric | 25V40 | 25V60 | 25V120 | 34V40 | 34V60 | 34V120 | 42V40 | 42V60 | 42V120 |
| Unipolar (V/Phase) | 4.0 | 6.0 | 12.0 | 4.0 | 6.0 | 12.0 | 4.0 | 6.0 | 12.0 |
| Unipolar (A/Phase) | 1.05 | 0.70 | 0.35 | 1.27 | 0.85 | 0.45 | 1.47 | 0.98 | 0.49 |
| Phase Resistance (ohm) | 3.81 | 8.56 | 34.24 | 3.15 | 7.06 | 26.68 | 2.72 | 6.12 | 24.49 |
| Phase Inductance (mH) | 3.37 | 7.56 | 30.24 | 2.93 | 6.58 | 26.33 | 3.21 | 7.21 | 28.86 |
| Bipolar (A/Phase)* | 0.74 | 0.50 | 0.25 | 0.90 | 0.60 | 0.32 | 1.04 | 0.69 | 0.35 |

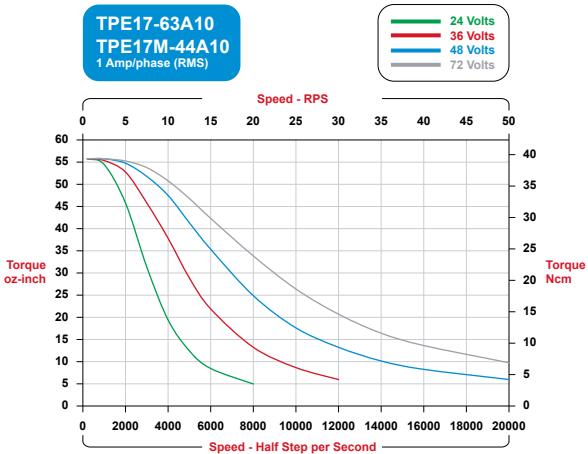
TPE17 & TPE17M Speed - Torque Curves

Bipolar

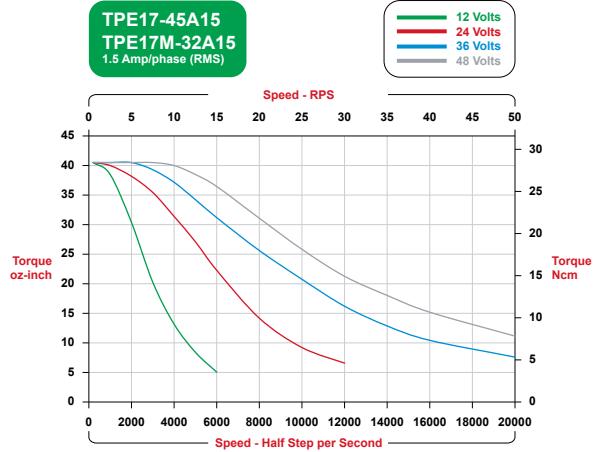
**TPE17-45A10
TPE17M-32A10**
1 Amp/phase (RMS)



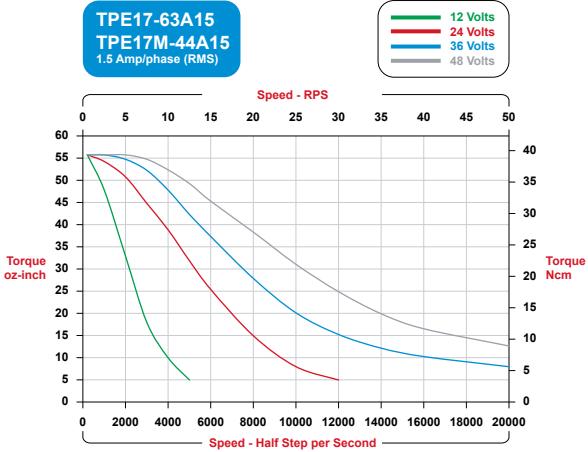
**TPE17-63A10
TPE17M-44A10**
1 Amp/phase (RMS)



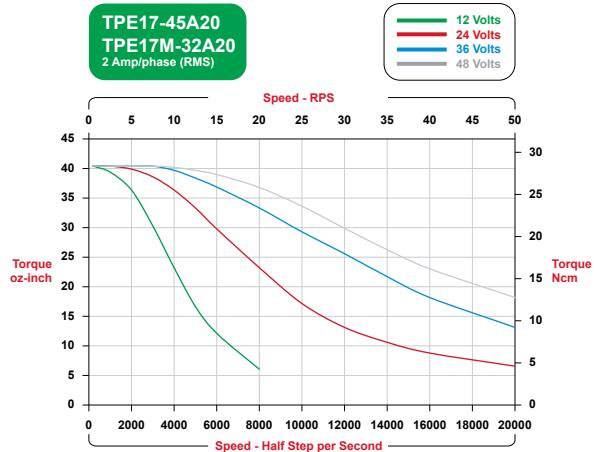
**TPE17-45A15
TPE17M-32A15**
1.5 Amp/phase (RMS)



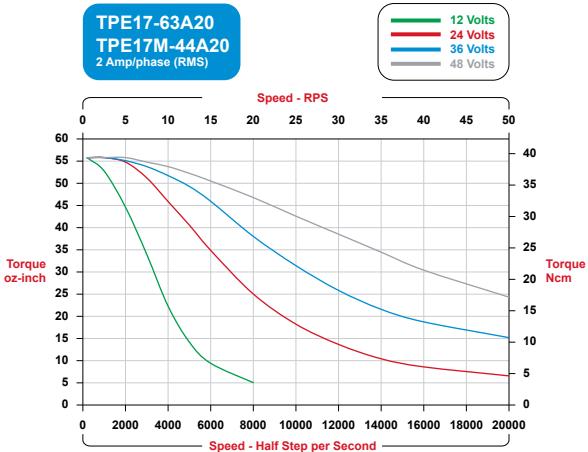
**TPE17-63A15
TPE17M-44A15**
1.5 Amp/phase (RMS)



**TPE17-45A20
TPE17M-32A20**
2 Amp/phase (RMS)

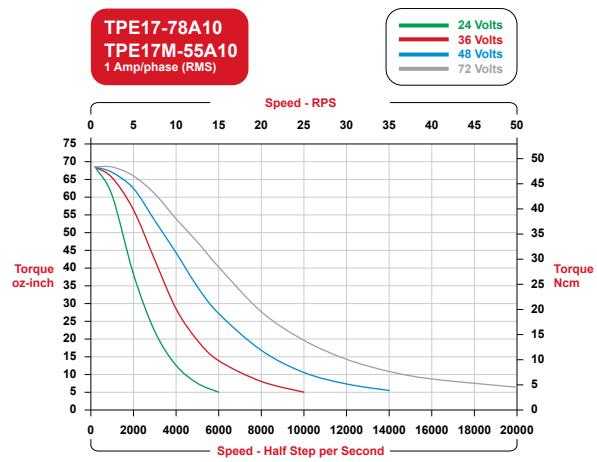


**TPE17-63A20
TPE17M-44A20**
2 Amp/phase (RMS)

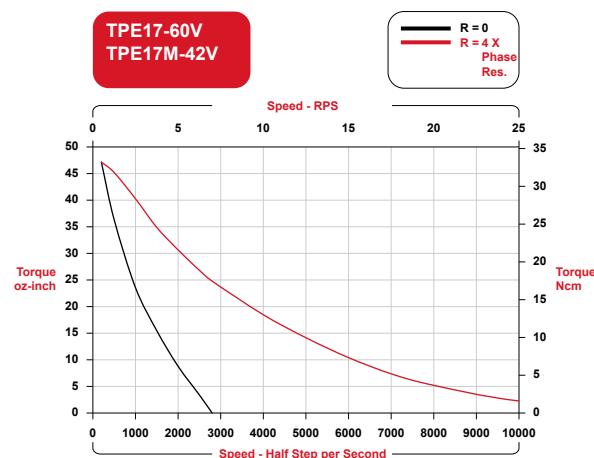
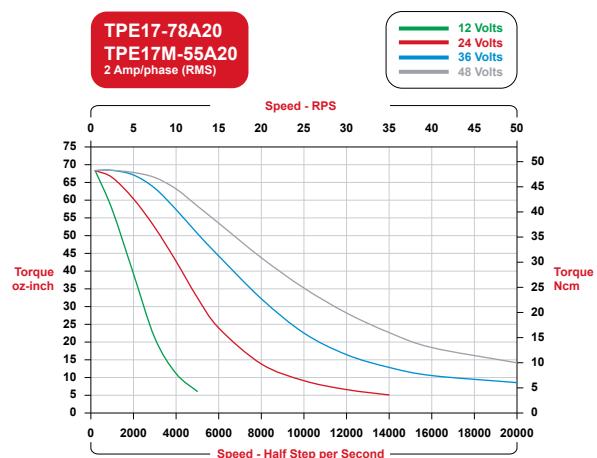
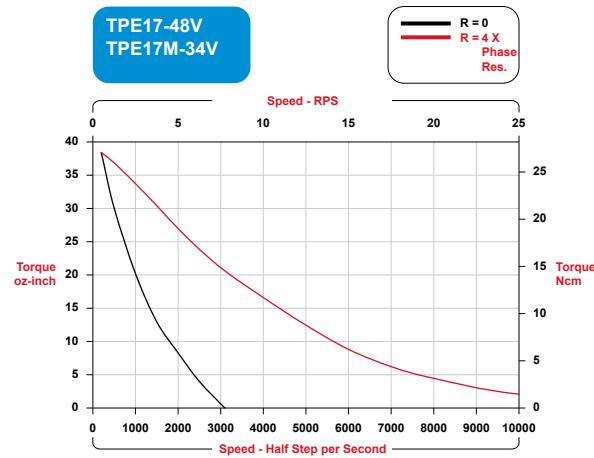
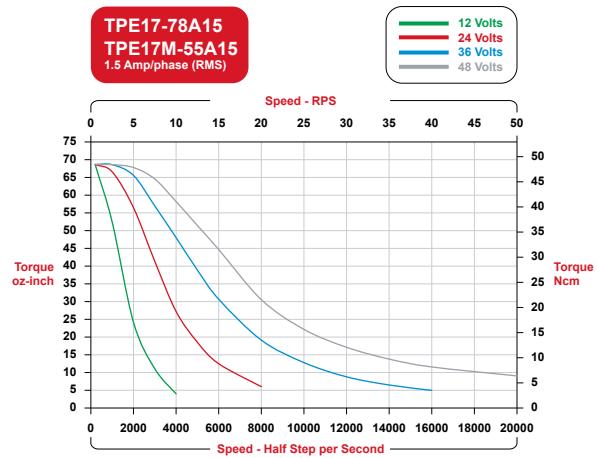
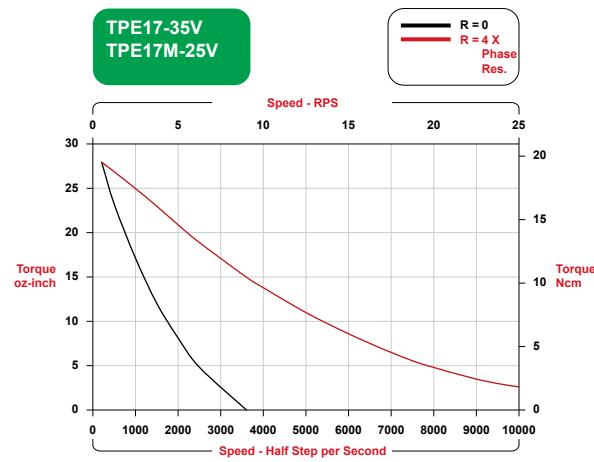


TPE17 & TPE17M Speed - Torque Curves

Bipolar



Unipolar



TPE23 & TPE23M : ElectroCraft TorquePower™ Enhanced | Stepper Motor

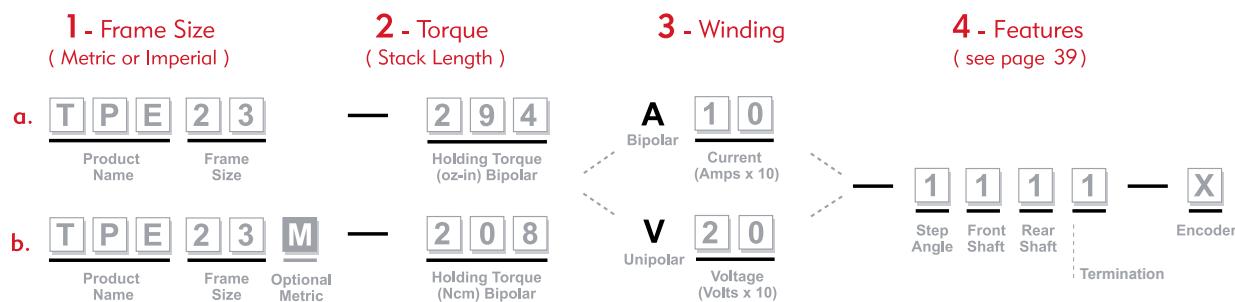
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------|-------------------------------|---------------------|
| Nema 23 | 294 (208) | 50 |



Compact. Powerful.

The ElectroCraft Torque Power™ Enhanced Nema 23 is a high performance stepper motor incorporating creative design and manufacturing techniques to offer improved holding torque. Motors are available in both bipolar and unipolar windings with a variety of shaft configurations and encoder options to meet the needs of any application.

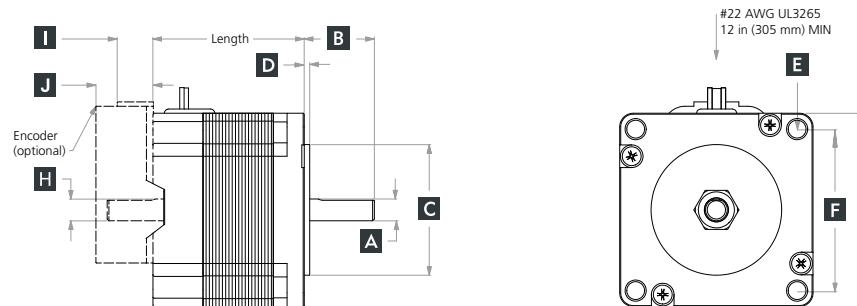
To build your own motor, choose the:

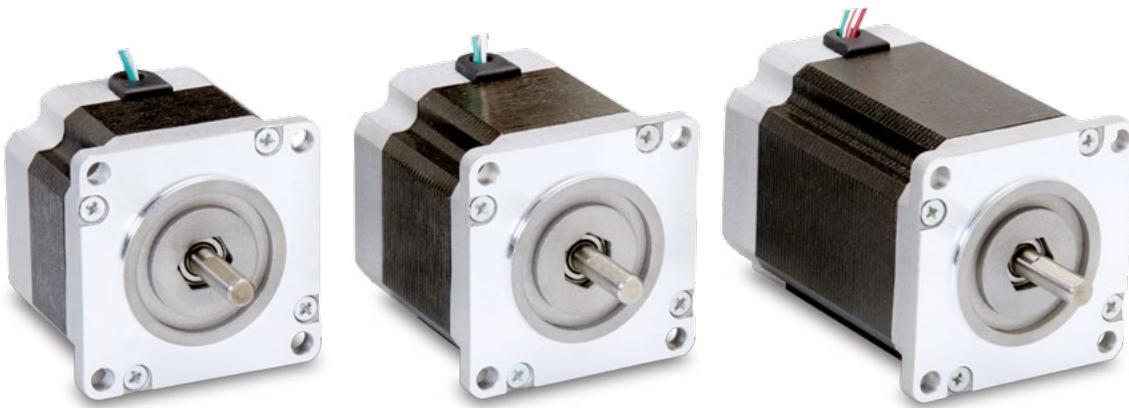


Step 1:

TPE23 & TPE23M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|--------------------|----------------------|--------------------|----------------------|--------------|---------------------------------|--------------------------|---------------------------------|---------------------|--------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPE23-100 | TPE23-77 | 1.75 in \pm 0.03 | 0.2500 in | 0.81 in \pm 0.03 | 1.500 in \pm 0.002 | 0.06 in | [4] 0.205 in \pm 0.01 Through | 1.854 in | 2.22 in | 0.2500 in 0.2495 in | 0.53 in \pm 0.04 | 0.66 in |
| TPE23-166 | TPE23-126 | 2.21 in \pm 0.03 | 0.2495 in | | | | | | | | | |
| TPE23-294 | TPE23-226 | 3.08 in \pm 0.03 | | | | | | | | | | |
| TPE23M-71 | TPE23M-54 | 44.5 mm \pm 0.8 | 7.998 mm | 20.5 mm \pm 0.8 | 38.1 mm \pm 0.05 | 1.5 mm | [4] 5.2 mm \pm 0.25 Through | 47.1 mm | 56.4 mm | 4.998 mm 4.986 mm | 13.5 mm \pm 1.0 | 16.8 mm |
| TPE23M-117 | TPE23M-89 | 56.0 mm \pm 0.8 | 7.976 mm | | | | | | | | | |
| TPE23M-208 | TPE23M-160 | 78.5 mm \pm 0.8 | | | | | | | | | | |





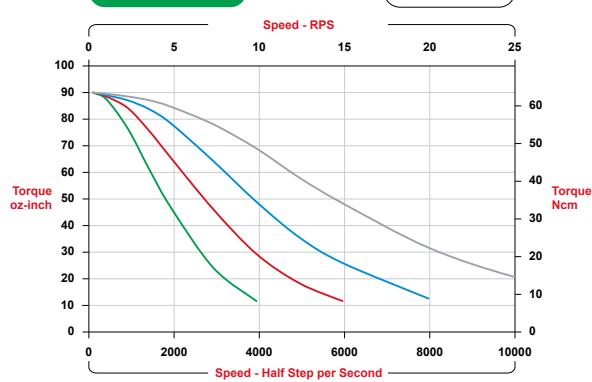
| Step 2: | | TPE23 & TPE23M Torque and Mechanical Data | | | | | |
|--------------------------------------|----------------|---|----------------|----------------|----------------|----------------|--|
| Stack Size Models | | Bipolar | | | Unipolar | | |
| Imperial | 100A | 166A | 294A | 77V | 126V | 226V | |
| Metric | 71A | 117A | 208A | 54V | 89V | 160V | |
| Holding Torque oz-in (Ncm) | 100 (71) | 166 (117) | 294 (208) | 77 (54) | 126 (89) | 226 (160) | |
| Step Angle °/step | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | |
| Rotor Inertia oz-in-sec² (kg-cm²) | 0.0020 (0.141) | 0.0035 (0.247) | 0.0061 (0.431) | 0.0020 (0.141) | 0.0035 (0.247) | 0.0061 (0.431) | |
| Weight oz (g) | 17 (482) | 24 (680) | 37 (1049) | 17 (482) | 24 (680) | 37 (1049) | |

| Step 3: | | Available Windings | | | | | | | |
|------------------------------|--------|--------------------|--------|--------|--------|--------|--------|--------|---------|
| Bipolar | | | | | | | | | |
| Imperial | 100A10 | 100A20 | 100A30 | 166A10 | 166A20 | 166A30 | 294A10 | 294A20 | 294A30 |
| Metric | 71A10 | 71A20 | 71A30 | 117A10 | 117A20 | 117A30 | 208A10 | 208A20 | 208A30 |
| Current Bipolar (A/Phase) | 1.00 | 2.00 | 3.00 | 1.00 | 2.00 | 3.00 | 1.00 | 2.00 | 3.00 |
| Phase Resistance (ohm) | 5.90 | 1.50 | 0.70 | 7.80 | 1.90 | 0.92 | 10.60 | 2.70 | 1.20 |
| Phase Inductance (mH) | 19.20 | 4.80 | 2.10 | 37.00 | 9.20 | 4.10 | 57.00 | 14.20 | 6.40 |
| Unipolar | | | | | | | | | |
| Imperial | 77V21 | 77V30 | 77V59 | 126V28 | 126V38 | 126V78 | 226V36 | 226V54 | 226V106 |
| Metric | 54V21 | 54V30 | 54V59 | 89V28 | 89V38 | 89V78 | 160V36 | 160V54 | 160V106 |
| Unipolar (V/Phase) | 2.10 | 3.00 | 5.90 | 2.80 | 3.80 | 7.80 | 3.60 | 5.40 | 10.60 |
| Unipolar (A/Phase) | 3.00 | 2.00 | 1.00 | 3.00 | 2.00 | 1.00 | 3.00 | 2.00 | 1.00 |
| Phase Resistance (ohm) | 0.70 | 1.50 | 5.90 | 0.92 | 1.90 | 7.80 | 1.20 | 2.70 | 10.60 |
| Phase Inductance (mH) | 1.10 | 2.40 | 9.60 | 2.10 | 4.60 | 18.40 | 3.20 | 7.10 | 28.50 |
| Bipolar (A/Phase) | 2.12 | 1.41 | 0.71 | 2.12 | 1.41 | 0.71 | 2.12 | 1.41 | 0.71 |

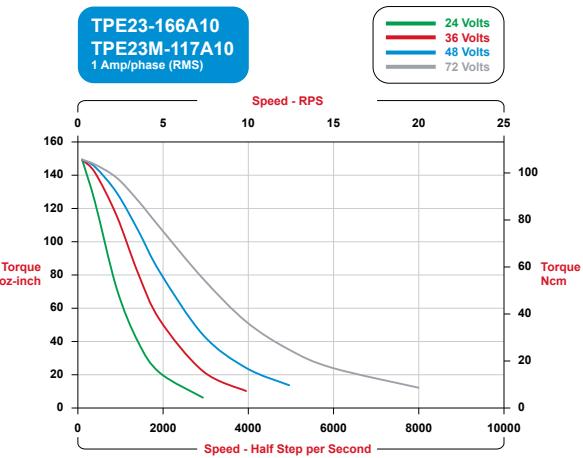
TPE23 & TPE23M Speed - Torque Curves

Bipolar

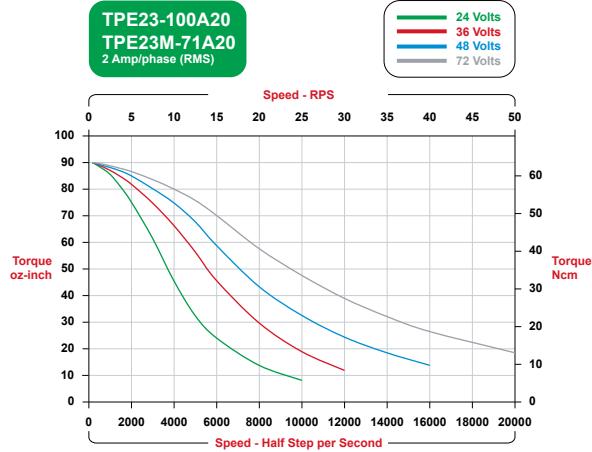
**TPE23-100A10
TPE23M-71A10**
1 Amp/phase (RMS)



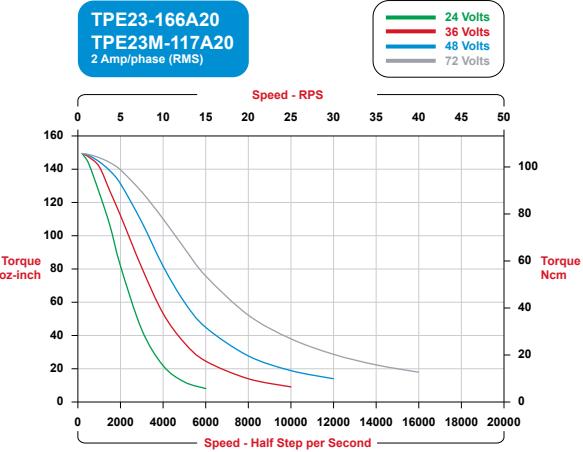
**TPE23-166A10
TPE23M-117A10**
1 Amp/phase (RMS)



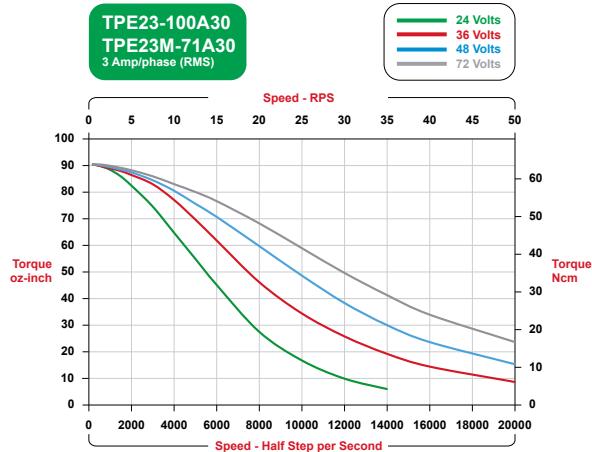
**TPE23-100A20
TPE23M-71A20**
2 Amp/phase (RMS)



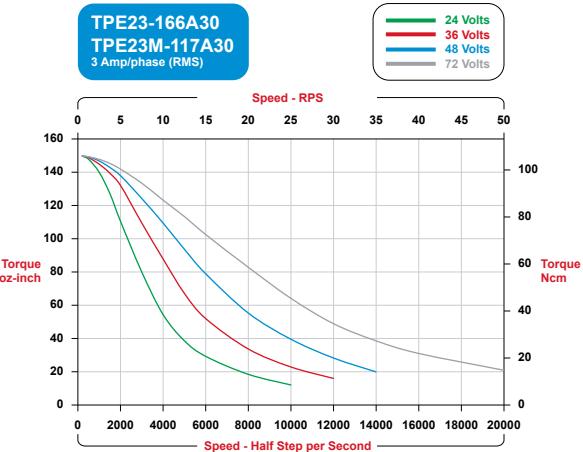
**TPE23-166A20
TPE23M-117A20**
2 Amp/phase (RMS)



**TPE23-100A30
TPE23M-71A30**
3 Amp/phase (RMS)



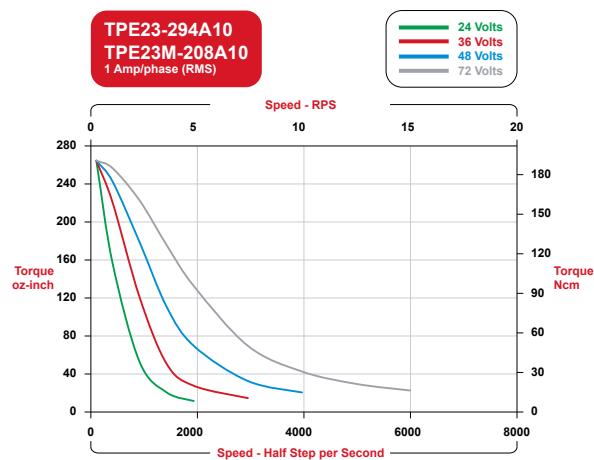
**TPE23-166A30
TPE23M-117A30**
3 Amp/phase (RMS)



TPE23 & TPE23M Speed - Torque Curves

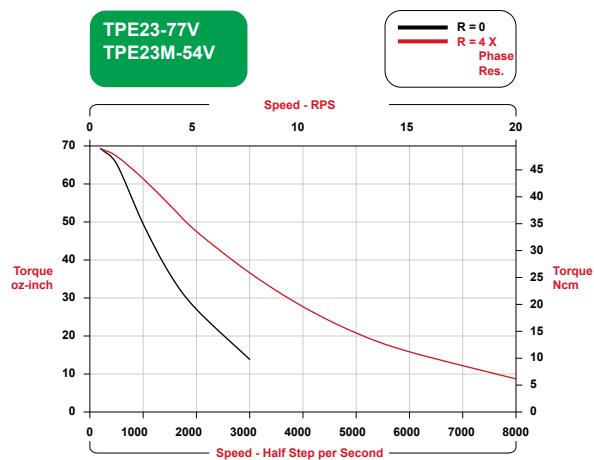
Bipolar

TPE23-294A10
TPE23M-208A10
1 Amp/phase (RMS)

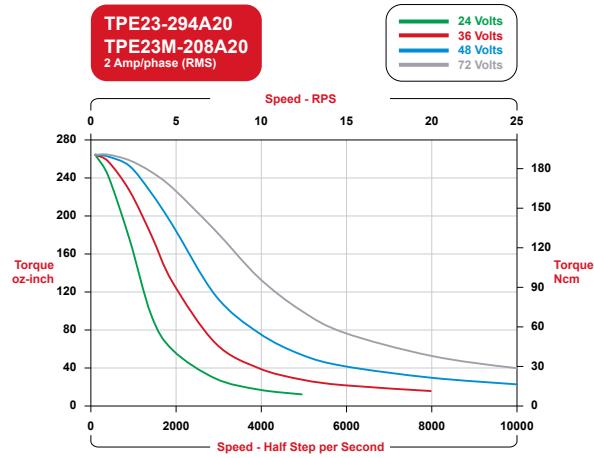


Unipolar

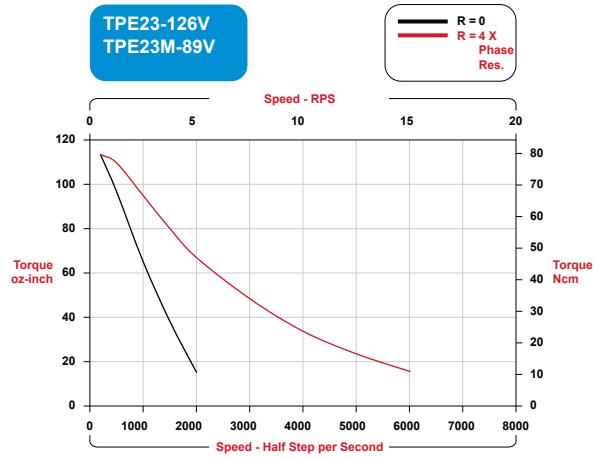
TPE23-77V
TPE23M-54V



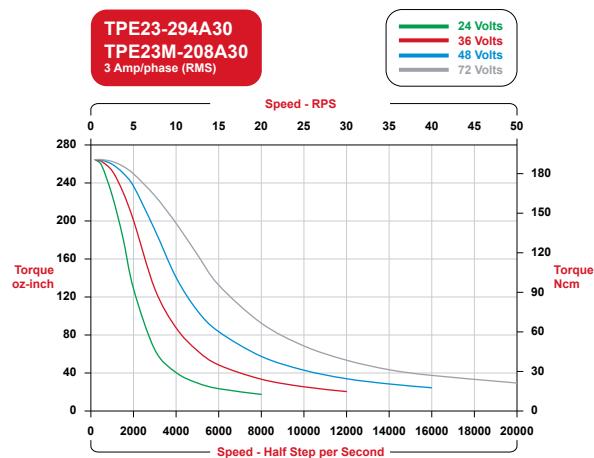
TPE23-294A20
TPE23M-208A20
2 Amp/phase (RMS)



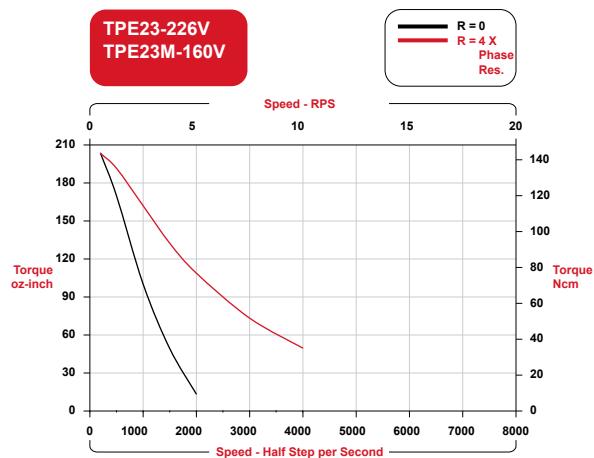
TPE23-126V
TPE23M-89V



TPE23-294A30
TPE23M-208A30
3 Amp/phase (RMS)



TPE23-226V
TPE23M-160V



TPP11M : ElectroCraft TorquePower™ Plus | Stepper Motor

| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 11, 1.8° | 18 (13) | 140 |



Quiet. Durable.

This extremely quiet hybrid stepping motor is made with ball bearings. Only available in metric configuration, sizes in metric units and has a holding torque up to 18 oz-in with a step angle accuracy of $\pm 5\%$.

To build your own motor, choose the:

**1 - Frame Size
(Metric)**

T P P
Product Name
Frame Size
Metric

**2 - Torque
(Stack Length)**

1 0
Holding Torque
(Ncm) Bipolar

3 - Winding

A
Bipolar
1 0
Current
(Amps x 10)
V
Unipolar
1 7
Voltage
(Volts x 10)

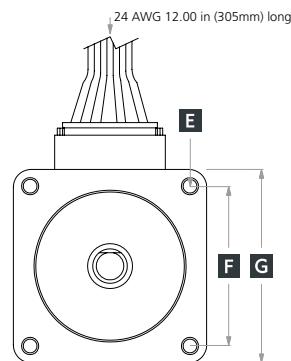
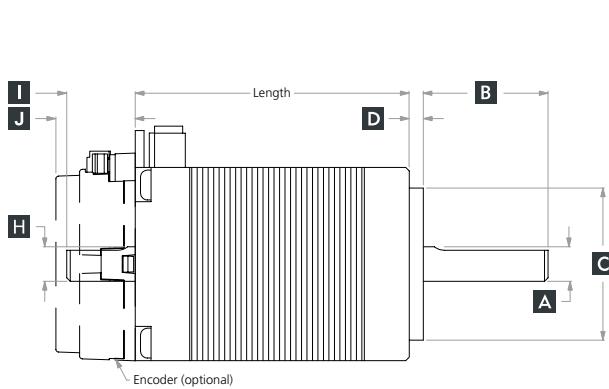
**4 - Features
(see page 39)**

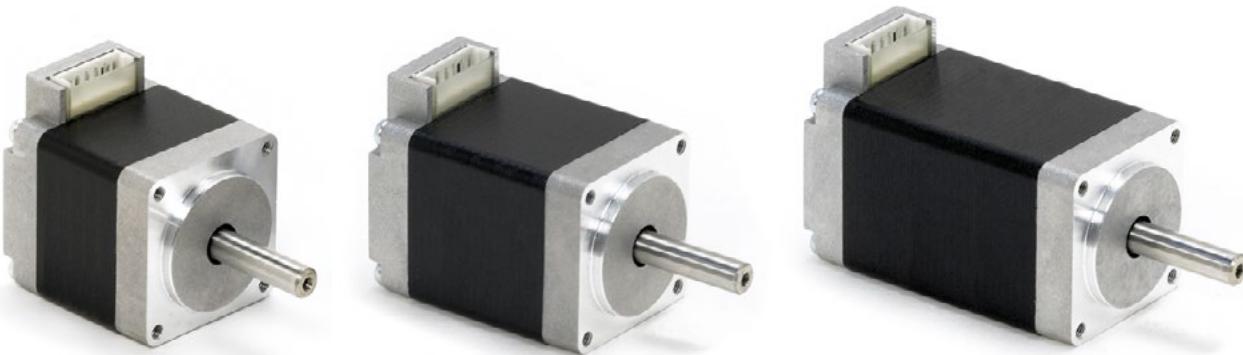
1 1 0 0 X
Step Angle
Front Shaft
Rear Shaft
Termination
Feedback

Step 1:

TPP11M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|--------------------|----------------------|--------------------|----------------|--------------------|-----------------------------------|--------------------------|---------------------------------|----------------------|----------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length (Ref) | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPP11M-7 | TPP11M-5 | 31.5 mm ± 0.08 | 4.999 mm | 20 mm | 22.00 mm | 2.0 mm | (4) M2.5x0.45H 3.5 mm Deep min | 23.0 mm | 28.0 mm | 4.999 mm 4.986 mm | 9.9 mm ± 0.08 | 16.26 mm |
| TPP11M-10 | TPP11M-6 | 39.6 mm ± 0.08 | 4.986 mm | ± 0.08 | 21.97 mm | | | | | | | |
| TPP11M-13 | TPP11M-9 | 50.6 mm ± 0.08 | | | | | | | | | | |





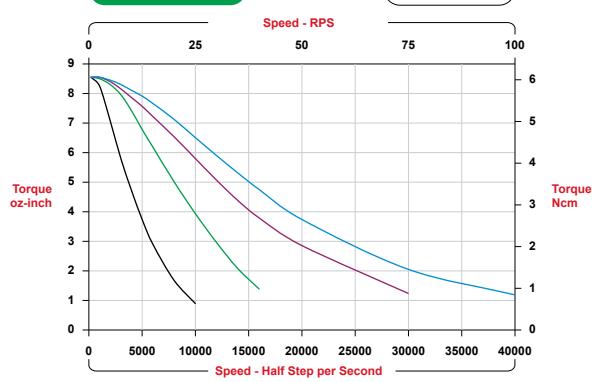
| Step 2: | | TP11M Torque and Mechanical Data | | | | | |
|--|--|----------------------------------|--------------|--------------|-------------|-------------|-------------|
| Stack Size Models | | Bipolar | | | Unipolar | | |
| | | TPP11M - 7A | TPP11M - 10A | TPP11M - 13A | TPP11M - 5V | TPP11M - 6V | TPP11M - 9V |
| Holding Torque oz-in (Ncm) | | 9.5 (6.71) | 13.7 (9.67) | 18 (12.71) | 6.6 (4.7) | 9.6 (6.8) | 13.0 (9.2) |
| Step Angle (°/step) | | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec ²) | | 0.000155 | 0.000208 | 0.000268 | 0.000155 | 0.000208 | 0.000268 |
| Weight oz (g) | | 4.0 (113) | 5.1 (145) | 7.0 (198) | 4.0 (113) | 5.1 (145) | 7.0 (198) |

| Step 3: | | Available Windings | | | | | | | | |
|------------------------------|--|--------------------|------|------|-------|-------|-------|-------|-------|-------|
| | | Bipolar | | | | | | | | |
| Metric | | 7A05 | 7A10 | 7A15 | 10A05 | 10A10 | 10A15 | 13A05 | 13A10 | 13A15 |
| Current Bipolar (A/Phase) | | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 |
| Phase Resistance (ohm) | | 10 | 2.5 | 1.1 | 12.4 | 3.1 | 1.4 | 16.4 | 4.1 | 1.8 |
| Phase Inductance (mH) | | 6.8 | 1.5 | 0.7 | 9.1 | 2.6 | 1 | 9.8 | 2.6 | 1.2 |
| Unipolar | | | | | | | | | | |
| Metric | | 5V14 | 5V27 | 6V17 | 6V33 | 9V22 | 9V44 | | | |
| Unipolar (V/Phase) | | 1.4 | 2.7 | 1.7 | 3.3 | 2.2 | 4.4 | | | |
| Unipolar (A/Phase) | | 1.8 | 0.9 | 1.8 | 0.9 | 1.8 | 0.9 | | | |
| Phase Resistance (ohm) | | 0.7 | 2.8 | 0.9 | 3.4 | 1.2 | 4.6 | | | |
| Phase Inductance (mH) | | 0.23 | 1 | 0.36 | 1.5 | 0.42 | 1.7 | | | |
| Bipolar (A/Phase)* | | 1.3 | 0.7 | 1.3 | 0.7 | 1.3 | 0.7 | | | |

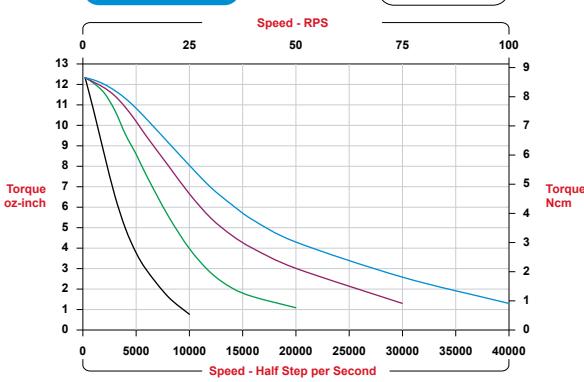
TPP11M Speed - Torque Curves

Bipolar

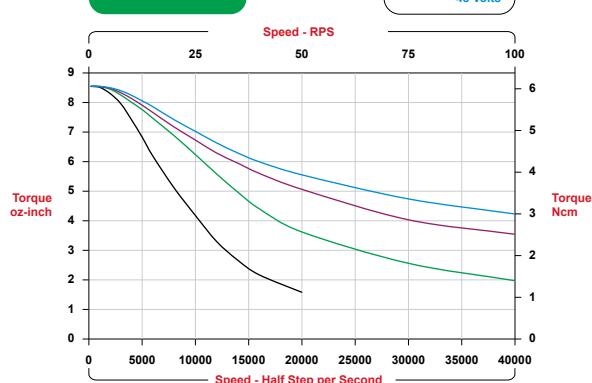
TPP11M-7A05
0.5 Amp/phase (RMS)



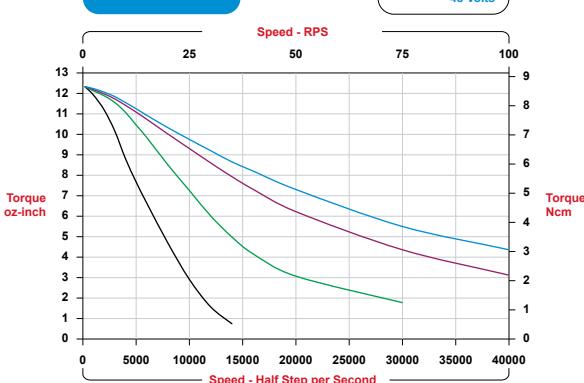
TPP11M-10A05
0.5 Amp/phase (RMS)



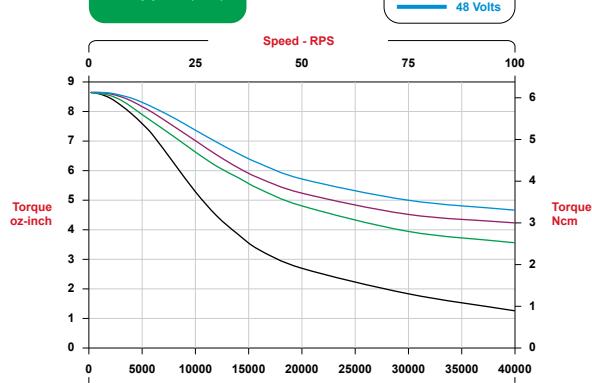
TPP11M-7A10
1 Amp/phase (RMS)



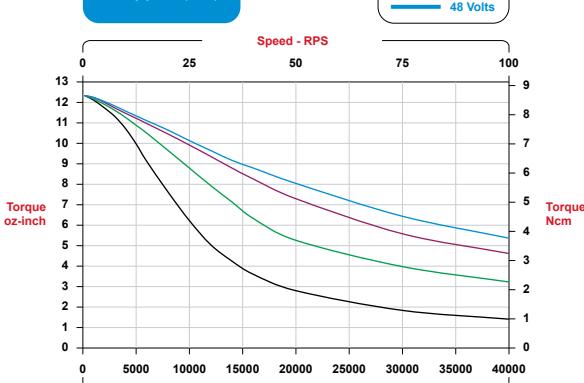
TPP11M-10A10
1 Amp/phase (RMS)

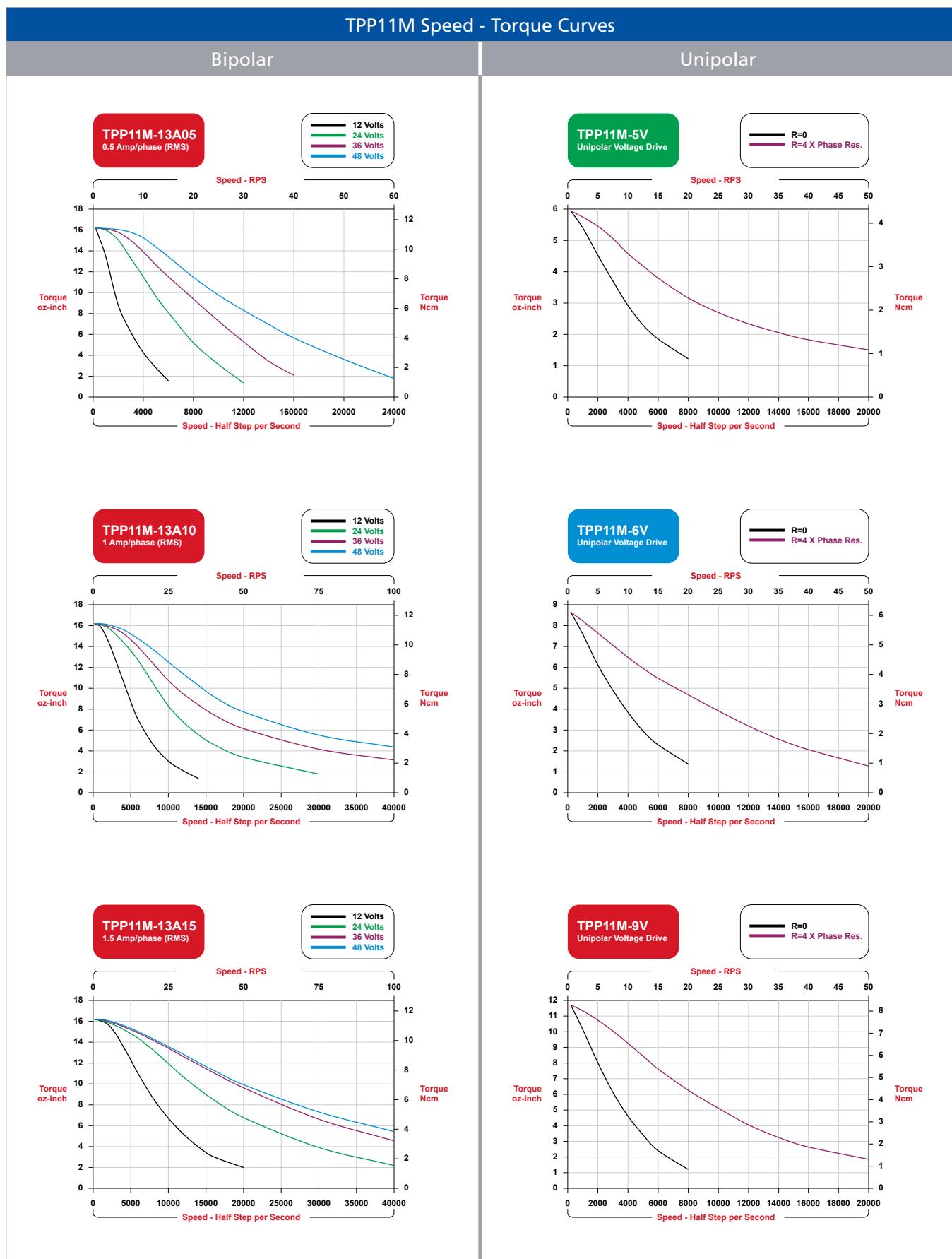


TPP11M-7A15
1.5 Amp/phase (RMS)



TPP11M-10A15
1.5 Amp/phase (RMS)





TPP17 & TPP17M : ElectroCraft TorquePower™ Plus | Stepper Motor

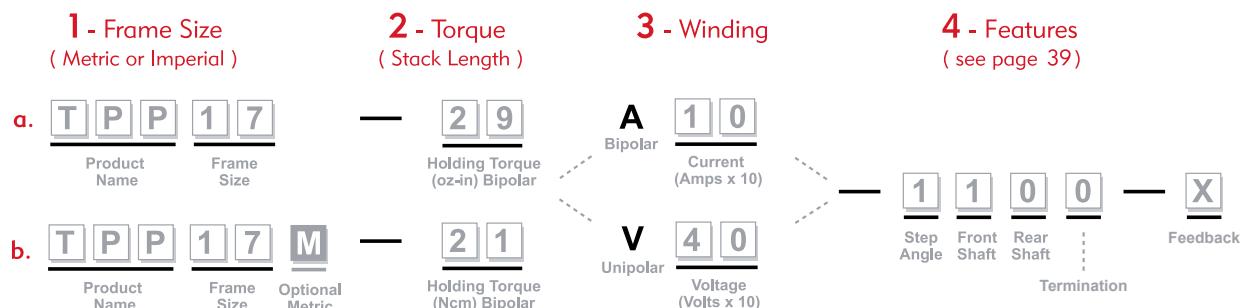
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 17, 1.8° | 58 (41) | 80 |



Precise. Compact.

This 1.8° size 17 hybrid DC stepping motor has permanently lubricated ball bearings. The bi-directional size 17 has holding torque up to 58 oz-in with a step angle accuracy of ±5%

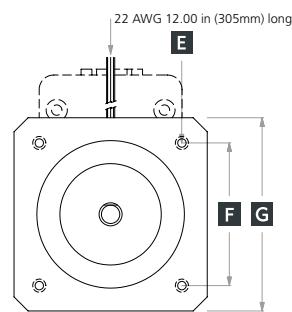
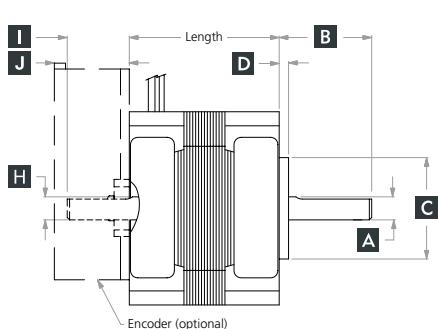
To build your own motor, choose the:



Step 1:

TPP17 & TPP17M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|---------------|----------------------|--------------------|---------------------|--------------|----------------------------------|--------------------------|---------------------------------|---------------------|-------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPP17-29 | TPP17-22 | 1.28 in ±0.03 | | | | | | | | | | |
| TPP17-47 | TPP17-36 | 1.52 in ±0.03 | 0.1968 in 0.1963 in | 0.79 in ±0.03 | 0.8660 in 0.8648 in | 0.08 in | [4] 4-40 UNC-2B 0.17 in Deep Min | 1.22 in | 1.65 in | 0.1968 in 0.1963 in | 0.53 in ±0.04 | 0.70 in |
| TPP17-58 | TPP17-44 | 1.85 in ±0.03 | | | | | | | | | | |
| TPP17M-21 | TPP17M-16 | 32.5 mm ±0.8 | 4.999 mm 4.986 mm | 20 mm ±0.8 | 22.00 mm 21.97 mm | 2.0 mm | (4) M3 x 0.5-6H 4.31 mm Deep min | 30.9 mm | 41.9 mm | 4.999 mm 4.986 mm | 13.5 mm ±1.02 | 17.8 mm |
| TPP17M-33 | TPP17M-25 | 38.6 mm ±0.8 | | | | | | | | | | |
| TPP17M-41 | TPP17M-31 | 47.0 mm ±0.8 | | | | | | | | | | |





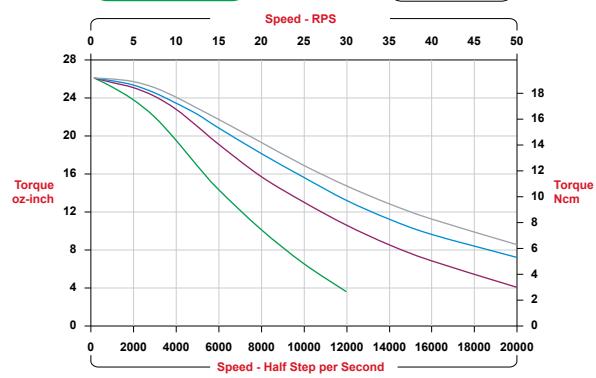
| Step 2: | | TPP17 & TPP17M Torque and Mechanical Data | | | | |
|-------------------------------|-------------|---|-------------|-------------|-------------|-------------|
| Stack Size Models | | Bipolar | | | Unipolar | |
| Imperial | 29A | 47A | 58A | 22V | 36V | 44V |
| Metric | 21A | 33A | 41A | 16V | 25V | 31V |
| Holding Torque oz-in (Ncm) | 29.0 (20.5) | 47.0 (33.2) | 58.0 (41.0) | 22.2 (15.7) | 36.1 (25.5) | 44.4 (31.4) |
| Step Angle (°/step) | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec²) | 0.00053 | 0.00081 | 0.00106 | 0.00053 | 0.00081 | 0.00106 |
| Weight oz (g) | 7.0 (198) | 9 (255) | 11.8 (335) | 7.0 (198) | 9 (255) | 11.8 (335) |

| Step 3: Available Windings | | | | | | | | | |
|------------------------------|-------|-------|-------|--------|-------|-------|--------|--------|-------|
| Bipolar | | | | | | | | | |
| Imperial | 29A10 | 29A15 | 29A20 | 47A10 | 47A15 | 47A20 | 58A10 | 58A15 | 58A20 |
| Metric | 21A10 | 21A15 | 21A20 | 33A10 | 33A15 | 33A20 | 41A10 | 41A15 | 41A20 |
| Current Bipolar (A/Phase) | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 | 1.0 | 1.5 | 2.0 |
| Phase Resistance (ohm) | 3.8 | 1.9 | 0.95 | 4.7 | 2.4 | 1.2 | 5.2 | 2.5 | 1.2 |
| Phase Inductance (mH) | 4.8 | 2.3 | 1.2 | 9.1 | 4.7 | 2.3 | 8.4 | 4.3 | 2.2 |
| Unipolar | | | | | | | | | |
| Imperial | 22V40 | 22V60 | 22V96 | 22V120 | 36V40 | 36V60 | 36V120 | 36V240 | 44V40 |
| Metric | 16V40 | 16V60 | 16V96 | 16V120 | 25V40 | 25V60 | 25V120 | 25V240 | 31V40 |
| Unipolar (V/Phase) | 4.0 | 6.0 | 9.6 | 12.0 | 4.0 | 6.0 | 12.0 | 24.0 | 4.0 |
| Unipolar (A/Phase) | 1.0 | 0.6 | 0.4 | 0.3 | 1.2 | 0.8 | 0.4 | 0.2 | 1.2 |
| Phase Resistance (ohm) | 4.2 | 9.6 | 24 | 38.5 | 3.3 | 7.5 | 30 | 120 | 3.3 |
| Phase Inductance (mH) | 2.5 | 5.8 | 15 | 23 | 3.2 | 7 | 28 | 112 | 2.8 |
| Bipolar (A/Phase)* | 0.7 | 0.4 | 0.3 | 0.2 | 0.9 | 0.6 | 0.3 | 0.1 | 0.9 |
| | | | | | | | | | 0.6 |
| | | | | | | | | | 0.3 |
| | | | | | | | | | 0.1 |

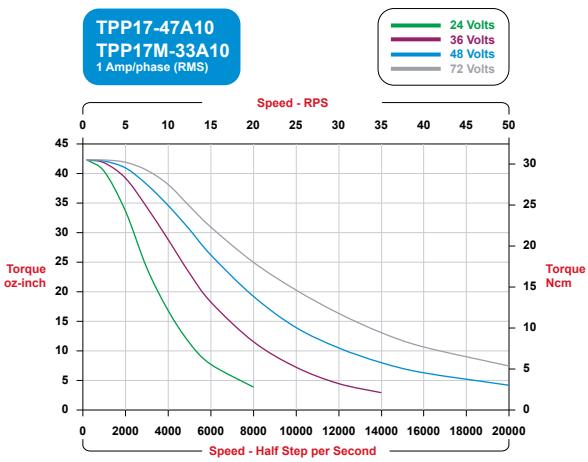
TPP17 & TPP17M Speed - Torque Curves

Bipolar

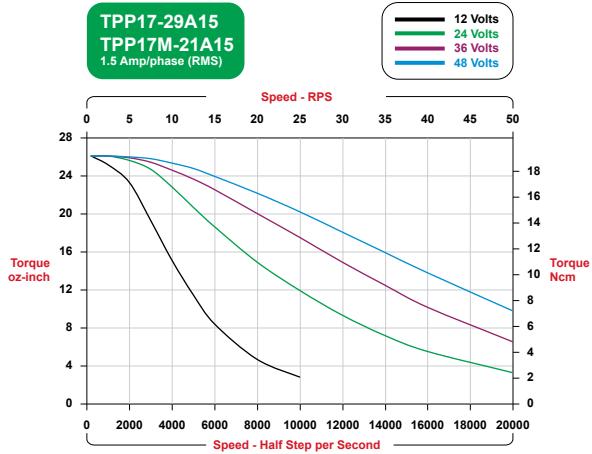
**TPP17-29A10
TPP17M-21A10**
1 Amp/phase (RMS)



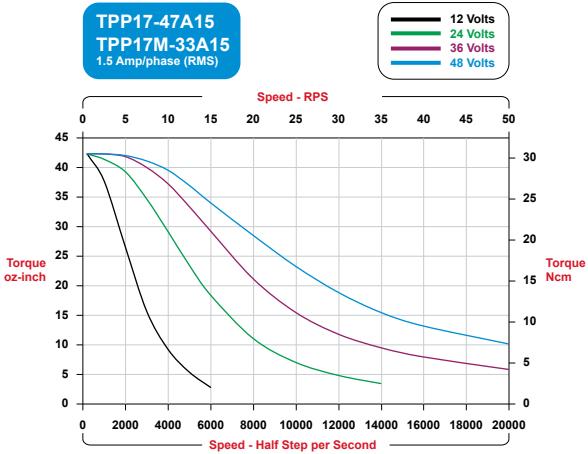
**TPP17-47A10
TPP17M-33A10**
1 Amp/phase (RMS)



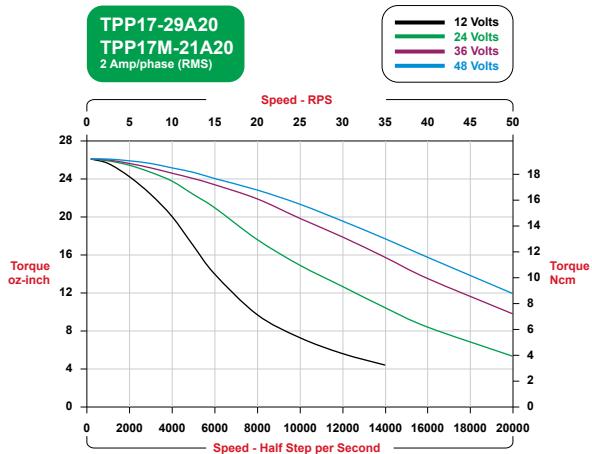
**TPP17-29A15
TPP17M-21A15**
1.5 Amp/phase (RMS)



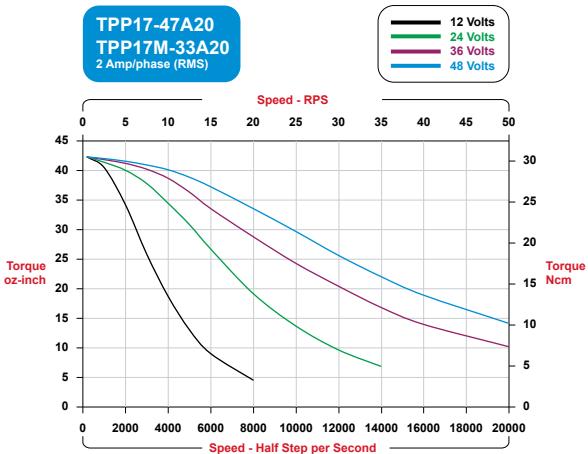
**TPP17-47A15
TPP17M-33A15**
1.5 Amp/phase (RMS)



**TPP17-29A20
TPP17M-21A20**
2 Amp/phase (RMS)

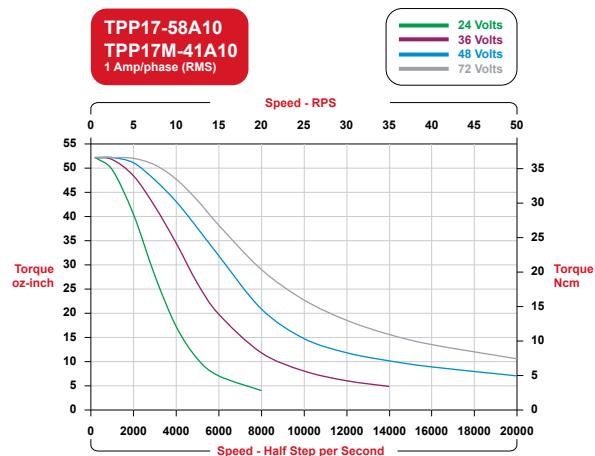


**TPP17-47A20
TPP17M-33A20**
2 Amp/phase (RMS)

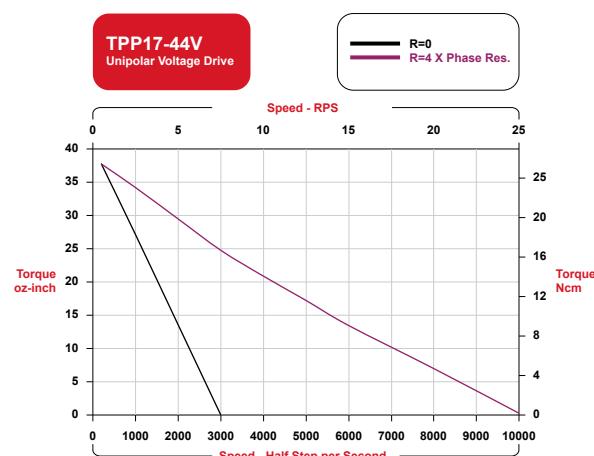
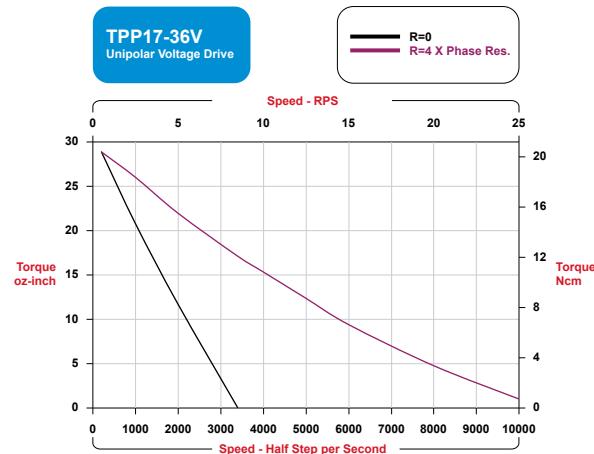
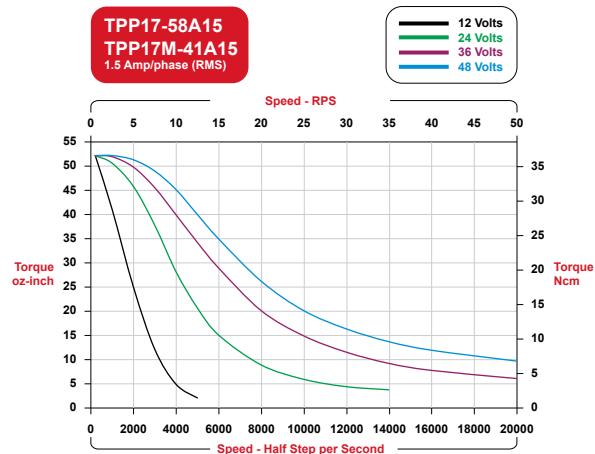
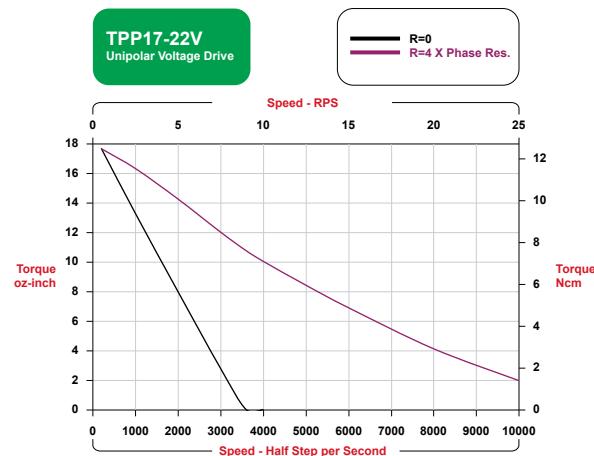


TPP17 & TPP17M Speed - Torque Curves

Bipolar



Unipolar



TPP23 & TPP23M : ElectroCraft TorquePower™ Plus | Stepper Motor

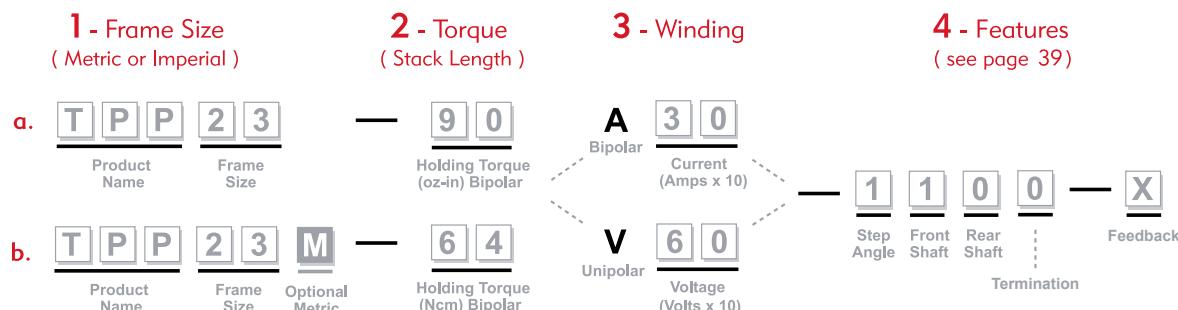
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|-----------------------|-------------------------------|---------------------|
| Nema 23, 0.9° or 1.8° | 240 (169) | 90 |



Powerful. Precise.

This 1.8° degree size 23 hybrid DC stepping motor has permanently lubricated ball bearings. The bi-directional size 23 has holding torque up to 240 oz-in with a step angle accuracy of ±3%.

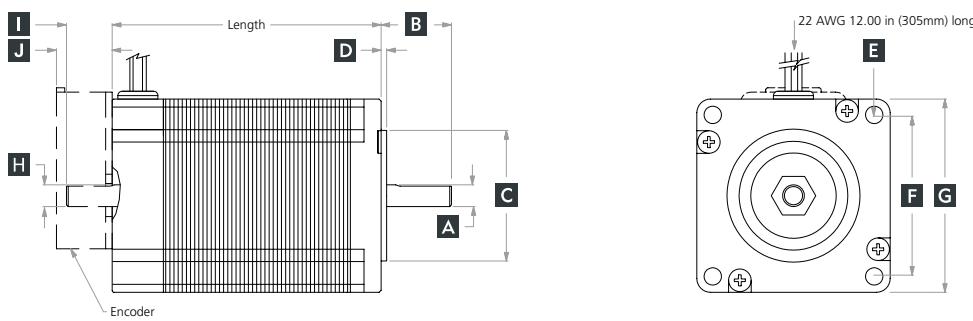
To build your own motor, choose the:

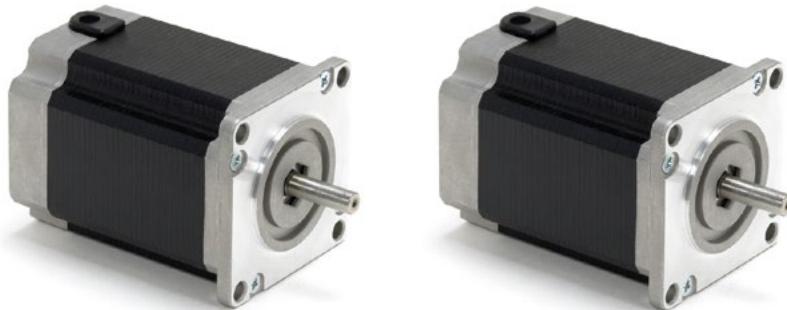


Step 1:

TPP23 & TPP23M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|---------------|------------------------|--------------------|----------------------|--------------------|-------------------------------|--------------------------|---------------------------------|------------------------|-------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length (Ref) | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPP23-90 | TPP23-72 | 1.75 in ±0.03 | | | | | | | | | | |
| TPP23-150 | TPP23-120 | 2.21 in ±0.03 | 0.2500 in 0.2495 in | 0.81 in ±0.03 | 1.502 in 1.498 in | 0.06 in | [4] 0.205 in ±0.01 Through | 1.86 in | 2.22 in | 0.2500 in 0.2495 in | 0.53 in ±0.04 | 0.70 in |
| TPP23-240 | TPP23-190 | 3.09 in ±0.03 | | | | | | | | | | |
| TPP23M-64 | TPP23M-50 | 44.5 mm ±0.8 | | | | | | | | | | |
| TPP23M-106 | TPP23M-84 | 56.1 mm ±0.8 | 7.988 mm 7.976 mm | 20.5 mm ±0.8 | 38.15 mm 38.05 mm | 1.5 mm | (4) 5.21 mm ±0.25 Through | 47.1 mm | 56.4 mm | 4.998 mm 4.986 mm | 13.5 mm ±0.8 | 17.8 mm |
| TPP23M-170 | TPP23M-134 | 78.5 mm ±0.8 | | | | | | | | | | |





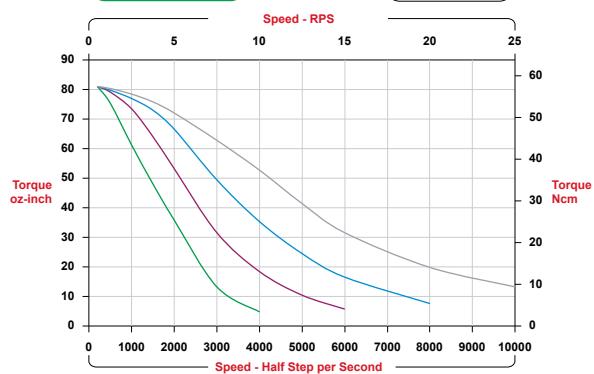
| Step 2: | | TPP23 & TPP23M Torque and Mechanical Data | | | | | | | |
|--|--------------|---|----------------|--------------|--------------|----------------|--|--|--|
| Stack Size Models | | Bipolar | | | Unipolar | | | | |
| Imperial | 90A | 150A | 240A | 72V | 120V | 190V | | | |
| Metric | 64A | 106A | 170A | 50V | 84V | 134V | | | |
| Holding Torque oz-in (Ncm) | 90.0 (63.55) | 150.0 (105.92) | 240.0 (169.46) | 72.0 (50.8) | 120.0 (84.7) | 190.0 (134.17) | | | |
| Step Angle °/step) | 0.9° or 1.8° | 0.9° or 1.8° | 0.9° or 1.8° | 0.9° or 1.8° | 0.9° or 1.8° | 0.9° or 1.8° | | | |
| Rotor Inertia (oz-in-sec ²) | 0.002 | 0.0035 | 0.0061 | 0.002 | 0.0035 | 0.0061 | | | |
| Weight oz (g) | 17 (482) | 24 (680) | 37 (1049) | 17 (482) | 24 (680) | 37 (1049) | | | |

| Step 3: Available Windings | | | | | | | | | | | | | | |
|------------------------------|-------|-------|-------|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|---------|
| Bipolar | | | | | | | | | | | | | | |
| Imperial | 90A10 | 90A20 | 90A30 | 150A10 | 150A20 | 150A30 | 240A10 | 240A20 | 240A30 | | | | | |
| Metric | 64A10 | 64A20 | 64A30 | 106A10 | 106A20 | 106A30 | 170A10 | 170A20 | 170A30 | | | | | |
| Current Bipolar (A/Phase) | 1.0 | 2.0 | 3.0 | 1.0 | 2.0 | 3.0 | 1.0 | 2.0 | 3.0 | | | | | |
| Phase Resistance (ohm) | 5.78 | 1.5 | 0.6 | 7.92 | 1.9 | 0.8 | 9.13 | 2.33 | 1 | | | | | |
| Phase Inductance (mH) | 20.3 | 5.2 | 2 | 35 | 8.6 | 3.5 | 45.4 | 11.5 | 4.8 | | | | | |
| Unipolar | | | | | | | | | | | | | | |
| Imperial | 72V18 | 72V30 | 72V60 | 72V120 | 120V23 | 120V38 | 120V60 | 120V76 | 120V154 | 190V28 | 190V45 | 190V60 | 190V92 | 190V179 |
| Metric | 50V18 | 50V30 | 50V60 | 50V120 | 84V23 | 84V38 | 84V60 | 84V76 | 84V154 | 134V28 | 134V45 | 134V60 | 134V92 | 134V179 |
| Unipolar (V/Phase) | 1.8 | 3.0 | 6.0 | 11.9 | 2.3 | 3.8 | 6.0 | 7.6 | 15.4 | 2.8 | 4.5 | 6.0 | 9.2 | 17.9 |
| Unipolar (A/Phase) | 3.0 | 2.0 | 1.0 | 0.5 | 3.0 | 2.0 | 1.3 | 1.0 | 0.5 | 3.0 | 2.0 | 1.5 | 1.0 | 0.5 |
| Phase Resistance (ohm) | 0.61 | 1.57 | 6 | 23.5 | 0.76 | 1.91 | 4.73 | 7.59 | 30.9 | 0.92 | 2.24 | 4 | 9.23 | 35.7 |
| Phase Inductance (mH) | 1 | 2.6 | 10.8 | 41.4 | 1.6 | 4.2 | 11 | 17.7 | 67.3 | 2.1 | 5.2 | 9.25 | 22.5 | 93.8 |
| Bipolar (A/Phase)* | 2.1 | 1.4 | 0.7 | 0.4 | 2.1 | 1.4 | 0.9 | 0.7 | 0.4 | 2.1 | 1.4 | 1.1 | 0.7 | 0.4 |

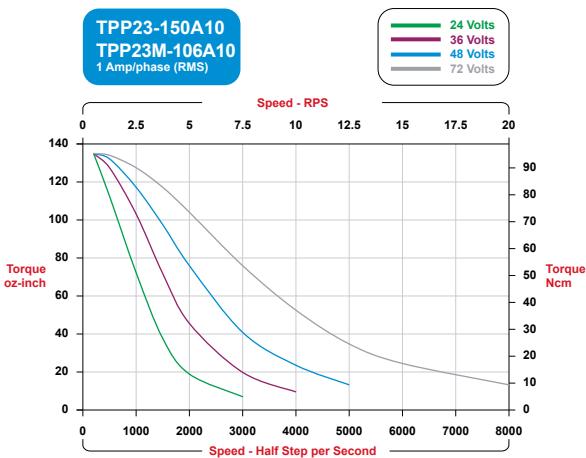
TPP23 & TPP23M Speed - Torque Curves

Bipolar

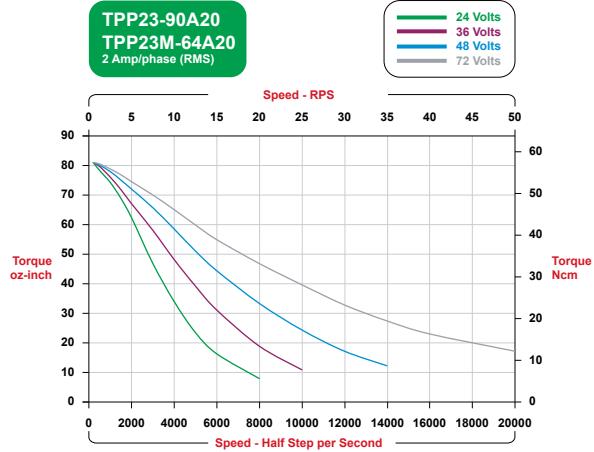
**TPP23-90A10
TPP23M-64A10**
1 Amp/phase (RMS)



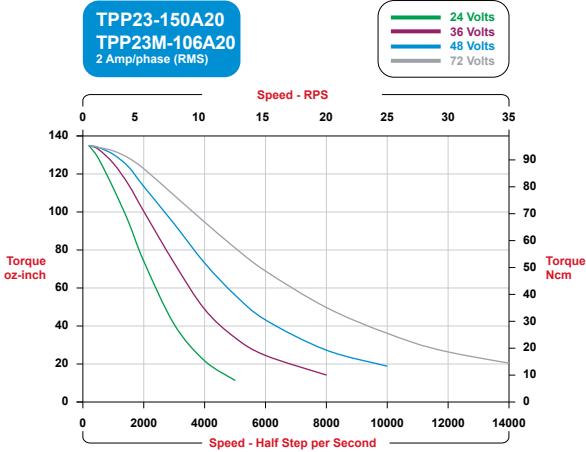
**TPP23-150A10
TPP23M-106A10**
1 Amp/phase (RMS)



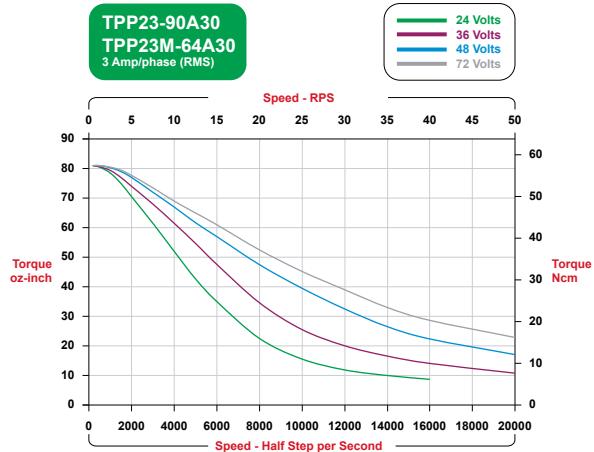
**TPP23-90A20
TPP23M-64A20**
2 Amp/phase (RMS)



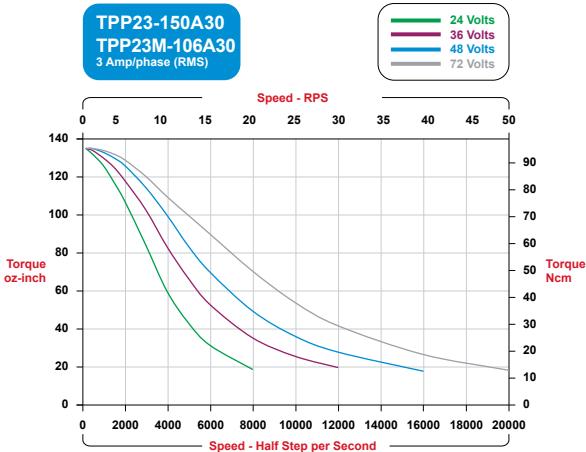
**TPP23-150A20
TPP23M-106A20**
2 Amp/phase (RMS)



**TPP23-90A30
TPP23M-64A30**
3 Amp/phase (RMS)

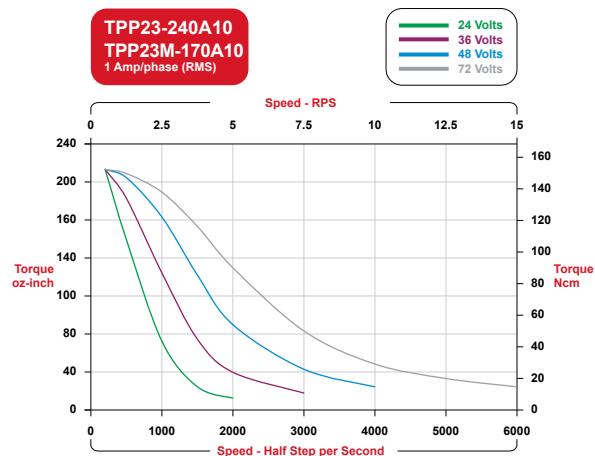


**TPP23-150A30
TPP23M-106A30**
3 Amp/phase (RMS)

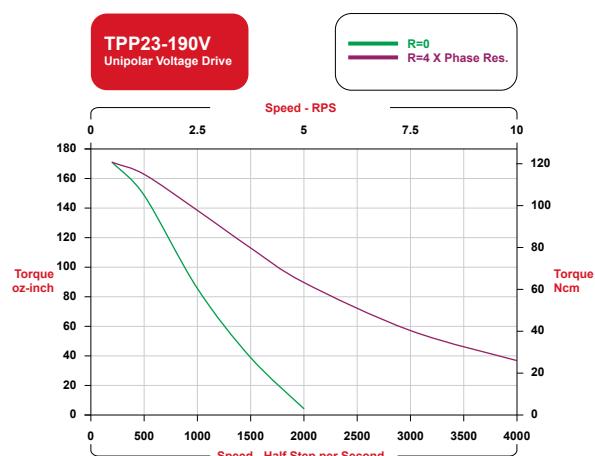
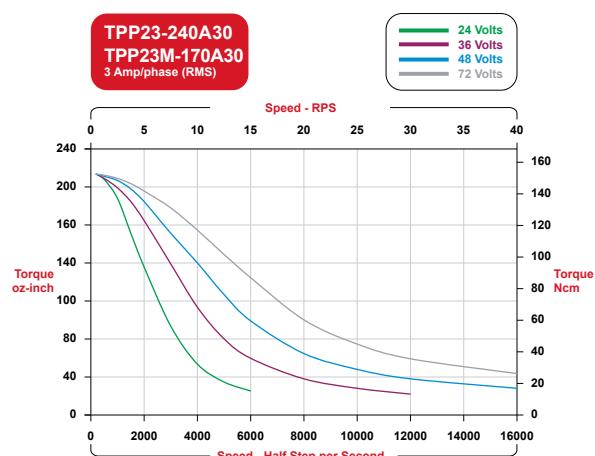
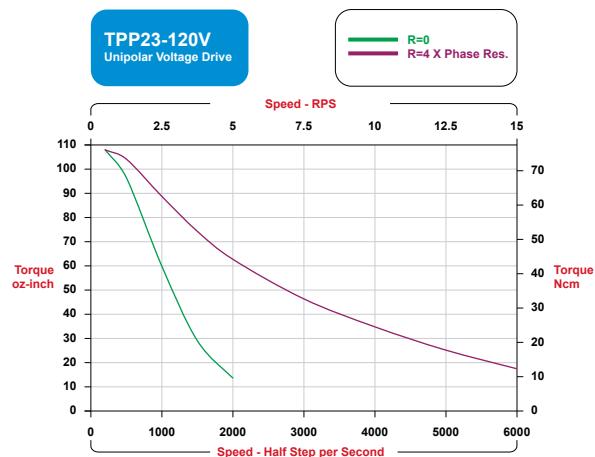
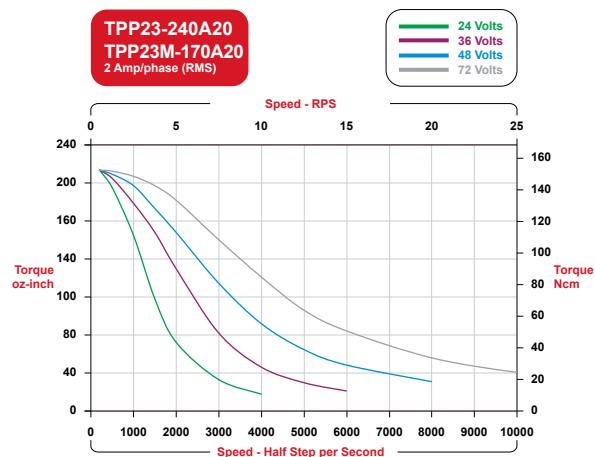
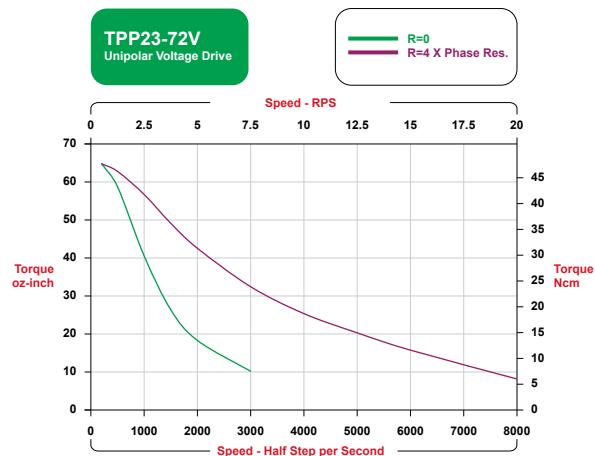


TPP23 & TPP23M Speed - Torque Curves

Bipolar



Unipolar



TPP34 & TPP34M : ElectroCraft TorquePower™ Plus | Stepper Motor

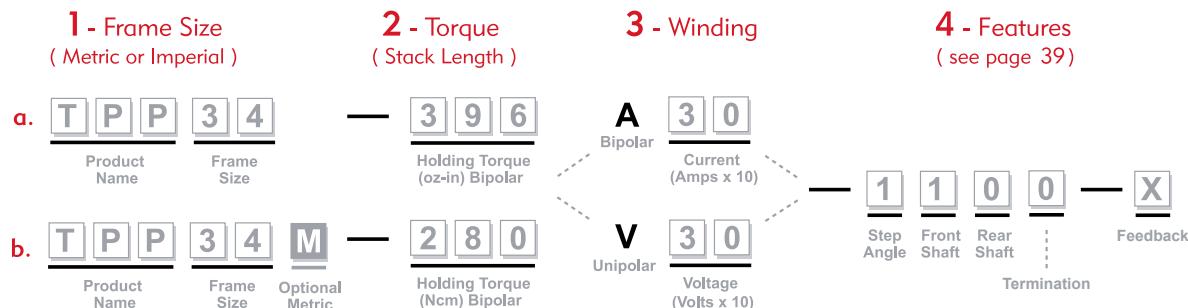
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 34, 1.8° | 1190 (840) | 35 |



Compact. Force.

This bi-directional, 1.8° size 34 hybrid DC stepping motor provides a lot of torque in a relatively small size. The TPP34 has holding torque up to 1190 oz-in with a step angle accuracy of ±3%.

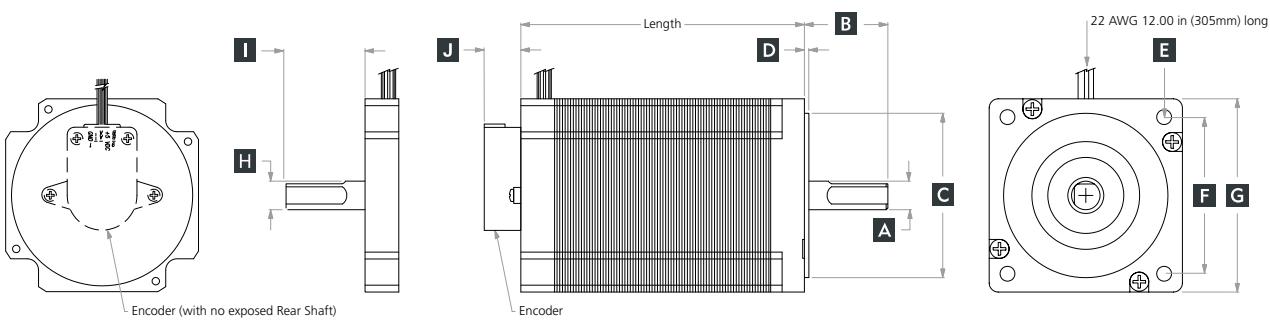
To build your own motor, choose the:

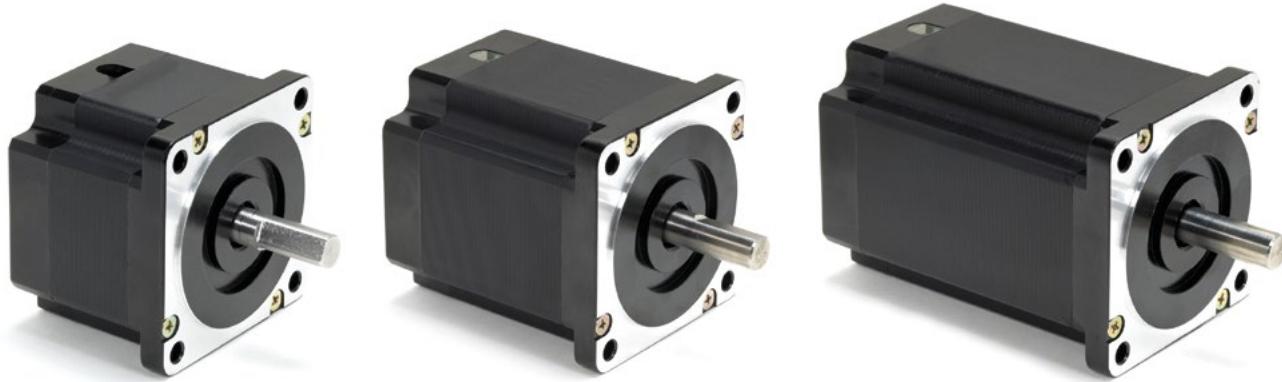


Step 1:

TPP34 & TPP34M Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|---------------|----------------------|--------------------|-------------------|--------------------|----------------------------|--------------------------|---------------------------------|---------------------|-------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length (Ref) | Mount Hole Callout (Ref) | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TPP34-396 | TPP34-305 | 2.60 in ±0.04 | | | | | | | | | | |
| TPP34-793 | TPP34-610 | 3.78 in ±0.04 | 0.5000 in 0.4995 in | 1.46 in ±0.04 | 2.876 in 2.874 in | 0.08 in | [4] 0.260 in ±0.01 Through | 2.74 in | 3.38 in | 0.5000 in 0.4995 in | 1.34 in ±0.04 | 0.70 in |
| TPP34-1190 | TPP34-916 | 4.96 in ±0.04 | | | | | | | | | | |
| TPP34M-280 | TPP34M-215 | 66.0 mm ±1.0 | | | | | | | | | | |
| TPP34M-560 | TPP34M-430 | 96.0 mm ±1.0 | 14.000 mm 13.988 mm | 37 mm ±1.0 | 73.05 mm 73.00 mm | 2.0 mm | (4) 6.60 mm ±0.25 Through | 69.6 mm | 85.8 mm | 14.000 mm 13.988 mm | 34.0 mm ±1.0 | 17.8 mm |
| TPP34M-840 | TPP34M-646 | 126.0 mm ±1.0 | | | | | | | | | | |





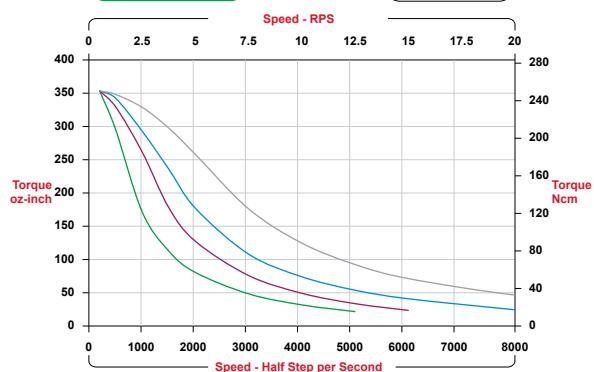
| Step 2: | | TPP34 & TPP34M Torque and Mechanical Data | | | | | |
|--|----------------|---|----------------|-----------------|-------------|-----------|-------------|
| Stack Size Models | | Bipolar | | | Unipolar | | |
| Imperial | 396A | 793A | 1190A | 305V | 610V | 916V | |
| Metric | 280A | 560A | 840A | 215V | 430V | 646V | |
| Holding Torque oz-in (Ncm) | 396.0 (279.62) | | 793.0 (559.94) | 1190.0 (840.26) | 305.0 (215) | 610 (430) | 916.0 (650) |
| Step Angle (°/step) | 1.8° | | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec ²) | 0.0198 | | 0.0382 | 0.0566 | 0.0198 | 0.0382 | 0.0566 |
| Weight oz (g) | 62 (1758) | | 99 (2807) | 141 (3997) | 62 (1758) | 99 (2807) | 141 (3997) |

| Step 3: Available Windings | | | | | | | | | |
|------------------------------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| Bipolar | | | | | | | | | |
| Imperial | 396A20 | 396A30 | 396A50 | 793A20 | 793A30 | 793A50 | 1190A20 | 1190A30 | 1190A50 |
| Metric | 280A20 | 280A30 | 280A50 | 560A20 | 560A30 | 560A50 | 840A20 | 840A30 | 840A50 |
| Current Bipolar (A/Phase) | 2.0 | 3.0 | 5.0 | 2.0 | 3.0 | 5.0 | 2.0 | 3.0 | 5.0 |
| Phase Resistance (ohm) | 2.30 | 1 | 0.4 | 3.93 | 1.56 | 0.62 | 4.33 | 1.72 | 0.68 |
| Phase Inductance (mH) | 21.9 | 8.67 | 3.44 | 34.3 | 13.6 | 5.39 | 44.3 | 17.6 | 6.98 |
| Unipolar | | | | | | | | | |
| Imperial | 305V23 | 305V30 | 305V50 | 610V35 | 610V47 | 610V79 | 916V39 | 916V52 | 916V87 |
| Metric | 215V23 | 215V30 | 215V50 | 430V35 | 430V47 | 430V79 | 646V39 | 646V52 | 646V87 |
| Unipolar (V/Phase) | 2.3 | 3.0 | 5.0 | 3.5 | 4.7 | 7.9 | 3.9 | 5.2 | 8.7 |
| Unipolar (A/Phase) | 4.5 | 3.0 | 2.0 | 4.5 | 3.0 | 2.0 | 4.5 | 3.0 | 2.0 |
| Phase Resistance (ohm) | 0.5 | 1 | 2.52 | 0.78 | 1.56 | 3.93 | 0.86 | 1.72 | 4.33 |
| Phase Inductance (mH) | 2.17 | 4.34 | 10.9 | 3.4 | 6.8 | 17.1 | 4.4 | 8.6 | 22.2 |
| Bipolar (A/Phase)* | 3.2 | 2.1 | 1.4 | 3.2 | 2.1 | 1.4 | 3.2 | 2.1 | 1.4 |

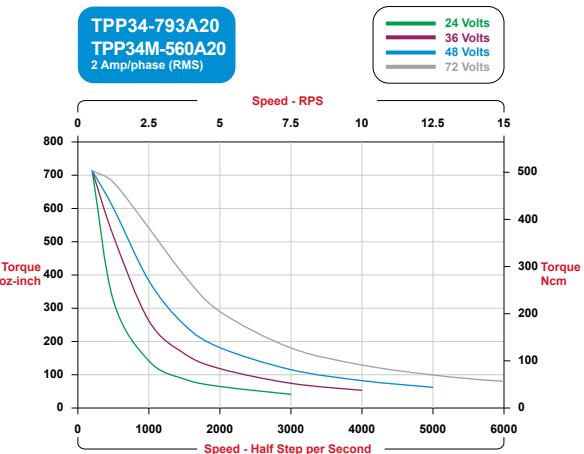
TPP34 & TPP34M Speed - Torque Curves

Bipolar

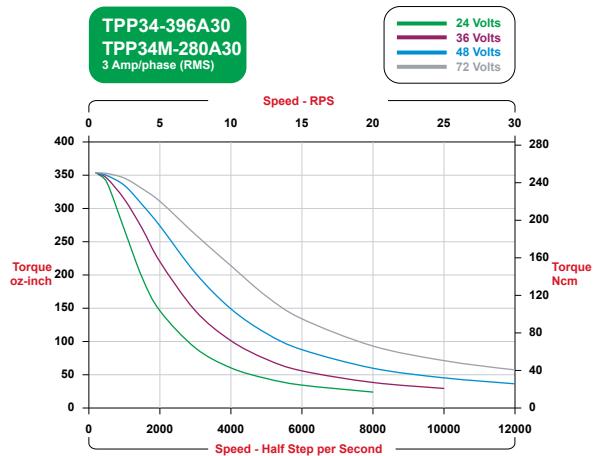
**TPP34-396A20
TPP34M-280A20**
2 Amp/phase (RMS)



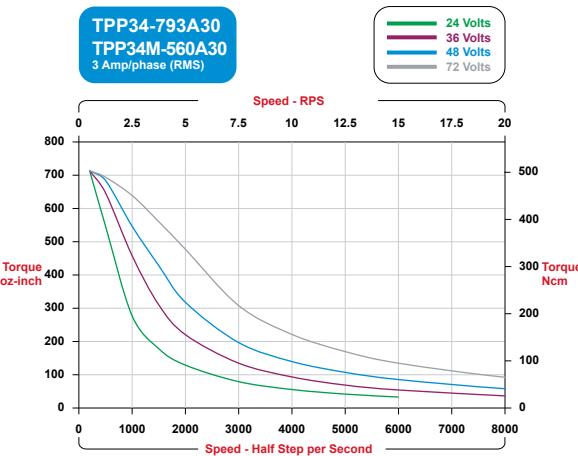
**TPP34-793A20
TPP34M-560A20**
2 Amp/phase (RMS)



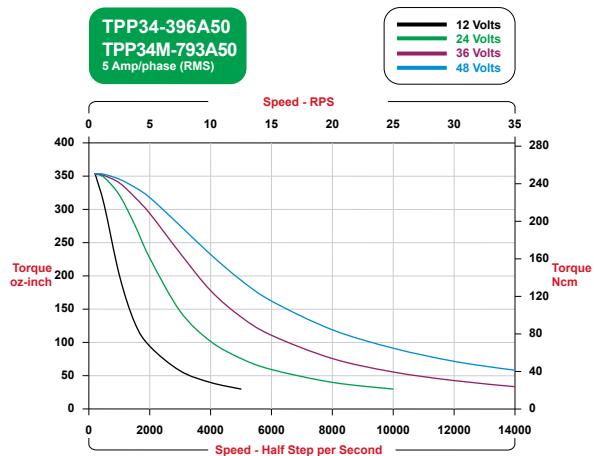
**TPP34-396A30
TPP34M-280A30**
3 Amp/phase (RMS)



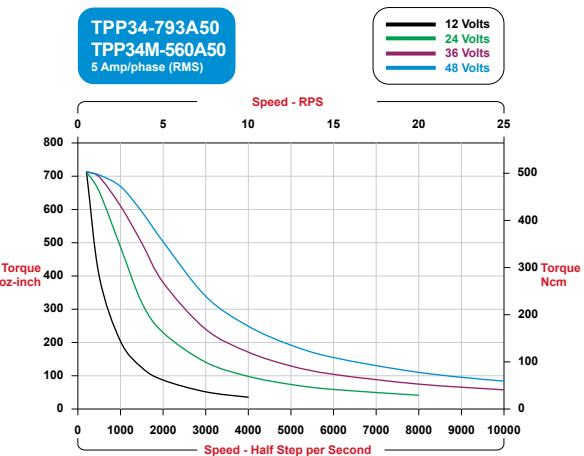
**TPP34-793A30
TPP34M-560A30**
3 Amp/phase (RMS)



**TPP34-396A50
TPP34M-793A50**
5 Amp/phase (RMS)

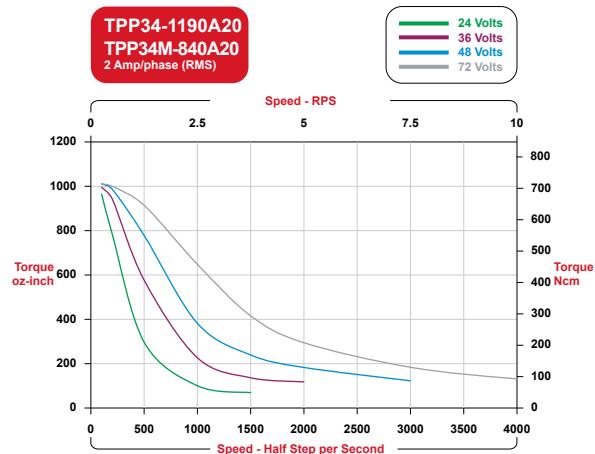


**TPP34-793A50
TPP34M-560A50**
5 Amp/phase (RMS)

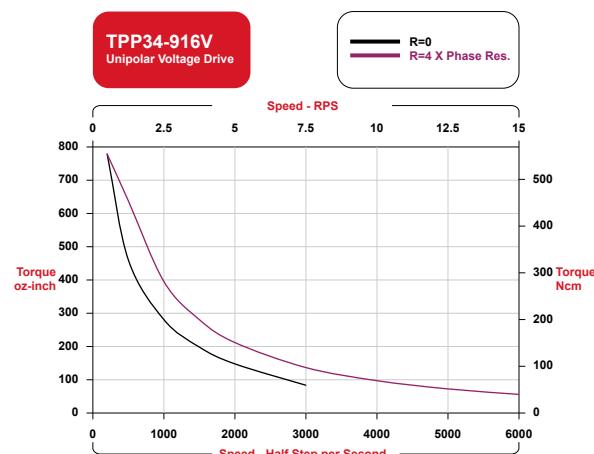
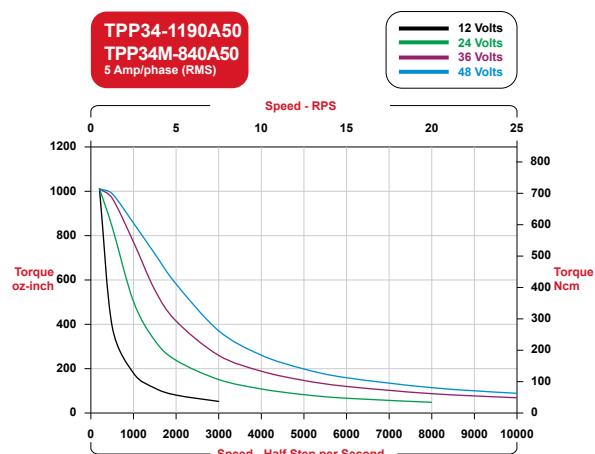
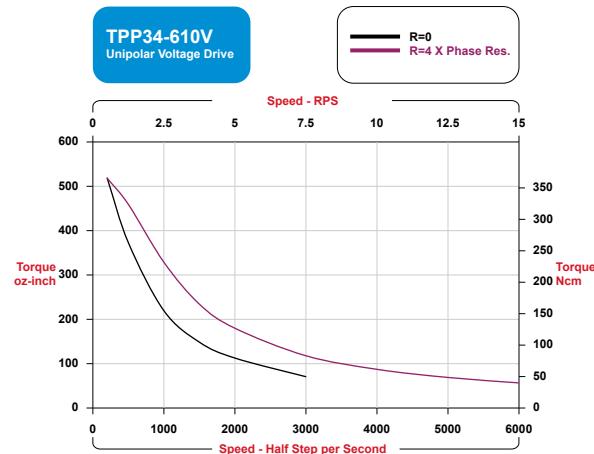
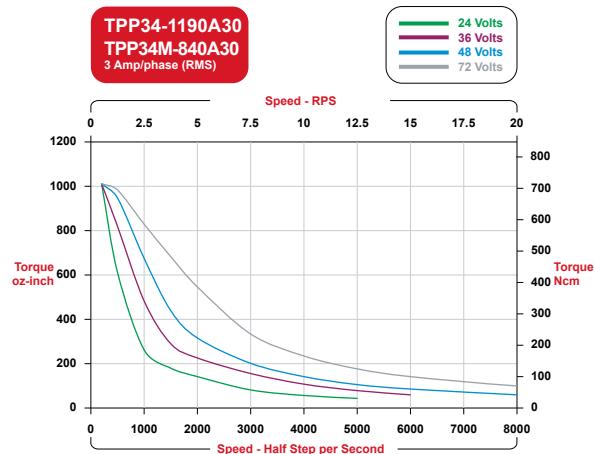
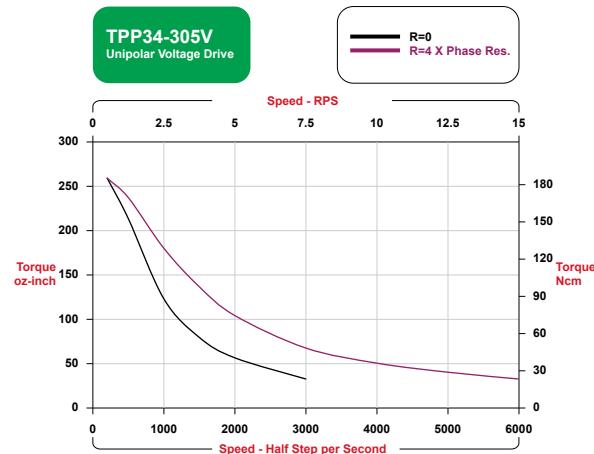


TPP34 & TPP34M Speed - Torque Curves

Bipolar

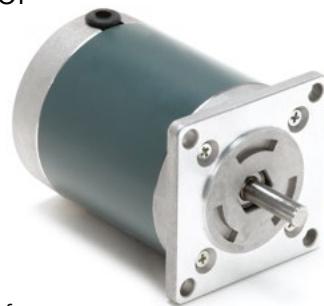


Unipolar



TP23 : ElectroCraft TorquePower™ | Stepper Motor

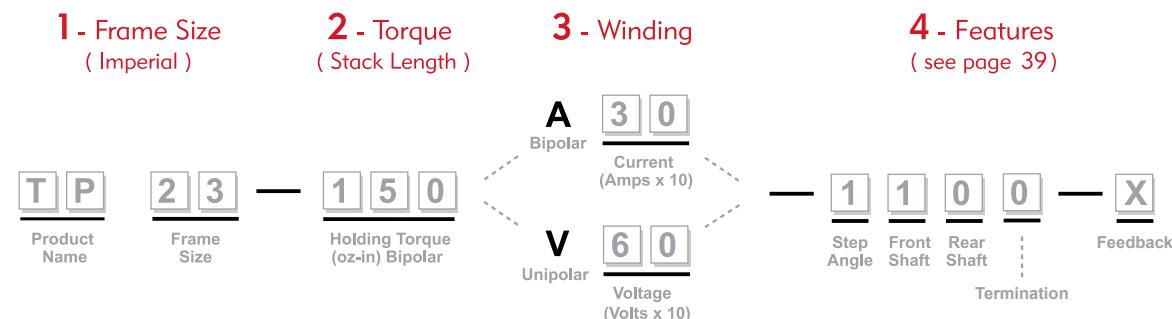
| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 23, 1.8° | 210 (148) | 85 |



Forceful. Extra-sturdy.

This 1.8° size 23 hybrid DC stepping motor is built with an extra-sturdy casing for when you need small, powerful torque with a little more durability. The motor is totally enclosed with permanently lubricated ball bearings. The bi-directional size 23 has a step angle accuracy of ±3%.

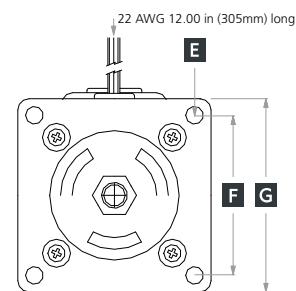
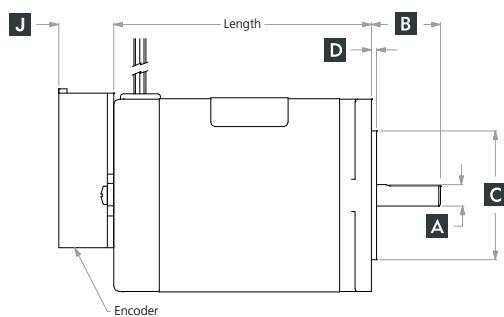
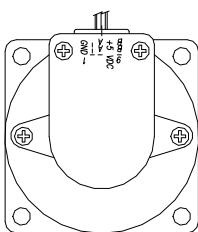
To build your own motor, choose the:



Step 1:

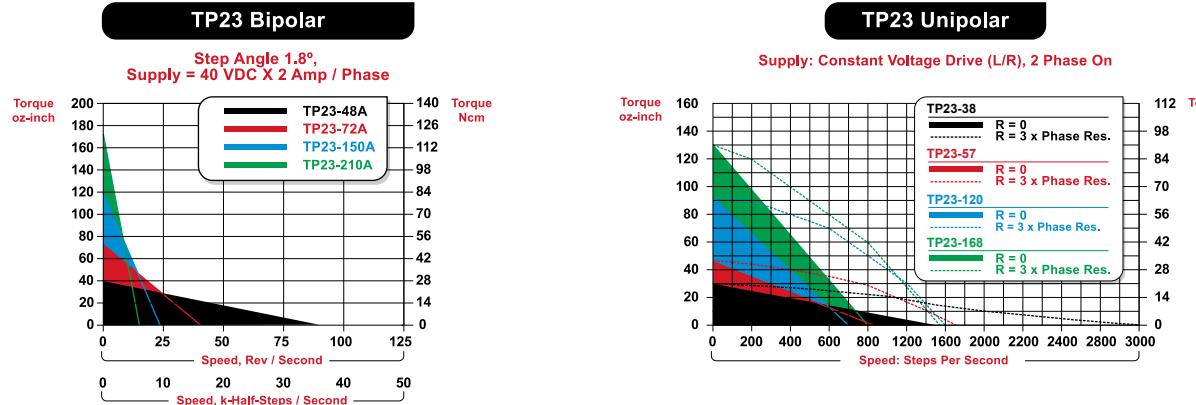
TP23 Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|--------------|------------------------|--------------------|----------------------|--------------------|-------------------------------|--------------------------|---------------------------------|------------------------|-------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length (Ref) | Mount Hole Callout | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TP23-48 | TP23-38 | 1.60 in ±.03 | | | | | | | | | | |
| TP23-72 | TP23-57 | 2.00 in ±.03 | 0.2500 in 0.2495 in | 0.81 in ±.03 | 1.502 in 1.498 in | 0.06 in | [4] 0.205 in ±.010 Through | 1.86 in | 2.25 in | 0.2500 in 0.2495 in | 0.75 in ±.040 | 0.70 in |
| TP23-150 | TP23-120 | 3.00 in ±.03 | | | | | | | | | | |
| TP23-210 | TP23-168 | 4.00 in ±.03 | | | | | | | | | | |



Step 2:

TP23 Torque and Mechanical Data



| Stack Size Models | Bipolar | | | | Unipolar | | | |
|---|--------------|--------------|----------------|----------------|-------------|--------------|--------------|---------------|
| | 48A | 72A | 150A | 210A | 38V | 57V | 120V | 168V |
| Holding Torque oz-in (Ncm) | 48.0 (33.89) | 72.0 (50.84) | 150.0 (105.92) | 210.0 (148.28) | 38.5 (27.2) | 57.5 (40.66) | 120.0 (84.7) | 168.0 (118.6) |
| Step Angle (°/step) | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec ²) | 0.00081 | 0.00166 | 0.00331 | 0.00497 | 0.00081 | 0.00166 | 0.00331 | 0.00497 |
| Weight oz (g) | 14 (397) | 19 (539) | 32 (907) | 47 (1332) | 14 (397) | 19 (539) | 32 (907) | 47 (1332) |

Step 3:

Available Windings

Bipolar

| | | | | | | | | | | | | | | | |
|---------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|
| Imperial | 48A10 | 48A20 | 48A30 | 48A40 | 72A10 | 72A20 | 72A30 | 72A40 | 150A10 | 150A20 | 150A30 | 150A40 | 210A20 | 210A30 | 210A40 |
| Current Bipolar (A/Phase) | 1.0 | 2.0 | 3.0 | 4.0 | 1.0 | 2.0 | 3.0 | 4.0 | 1.0 | 2.0 | 3.0 | 4.0 | 2.0 | 3.0 | 4.0 |
| Phase Resistance (ohm) | 5.9 | 1.5 | 0.66 | 0.37 | 5.6 | 1.4 | 0.62 | 0.35 | 7.6 | 1.9 | 0.84 | 0.48 | 2.65 | 1.18 | 0.66 |
| Phase Inductance (mH) | 16.9 | 4.2 | 1.9 | 1.11 | 25.6 | 6.4 | 2.8 | 1.6 | 35.2 | 8.8 | 3.9 | 2.2 | 13.2 | 5.88 | 3.33 |

Unipolar

| | | | | | | | | | | | | | | | |
|------------------------|-------|-------|--------|--------|-------|-------|--------|--------|--------|--------|---------|---------|--------|--------|---------|
| Imperial | 38V40 | 38V60 | 38V120 | 38V240 | 57V51 | 57V60 | 57V120 | 57V240 | 120V54 | 120V60 | 120V120 | 120V240 | 168V34 | 168V60 | 168V120 |
| Unipolar (V/Phase) | 4.0 | 6.0 | 12.0 | 24.0 | 5.1 | 6.0 | 12.0 | 24.0 | 5.4 | 6.0 | 12.0 | 24.0 | 3.4 | 6.0 | 12.0 |
| Unipolar (A/Phase) | 1.5 | 1.2 | 0.6 | 0.3 | 1.0 | 1.0 | 0.5 | 0.3 | 1.5 | 1.3 | 0.7 | 0.4 | 2.8 | 1.8 | 0.8 |
| Phase Resistance (ohm) | 2.6 | 5 | 20 | 80 | 5.1 | 6.2 | 25 | 96 | 3.5 | 4.8 | 18.2 | 66 | 1.2 | 3.4 | 16 |
| Phase Inductance (mH) | 3.2 | 5.4 | 21.6 | 81.2 | 9.7 | 10.6 | 41.19 | 131.4 | 7.8 | 11.4 | 41.2 | 143.3 | 2.9 | 8.4 | 39 |
| Bipolar (A/Phase)* | 1.1 | 0.9 | 0.4 | 0.2 | 0.7 | 0.7 | 0.3 | 0.2 | 1.1 | 0.9 | 0.5 | 0.3 | 2.0 | 1.3 | 0.5 |

TP34 : ElectroCraft TorquePower™ | Stepper Motor

| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 34, 1.8° | 620 (438) | 55 |



Forceful. Extra-sturdy.

This 1.8° size 34 hybrid DC stepping motor is built with an extra-sturdy casing for when you need medium-sized, powerful torque with a little more durability. The motor is totally enclosed with permanently lubricated ball bearings. The bi-directional size 34 has a step angle accuracy of ±3%.

To build your own motor, choose the:

1 - Frame Size
(Imperial)

T
P

Product Name

3
4

Frame Size

2 - Torque
(Stack Length)

4
2
0

Holding Torque
(oz-in) Bipolar

3 - Winding

A
Bipolar
3
0

Current (Amps x 10)

V
Unipolar
6
0

Voltage (Volts x 10)

4 - Features
(see page 39)

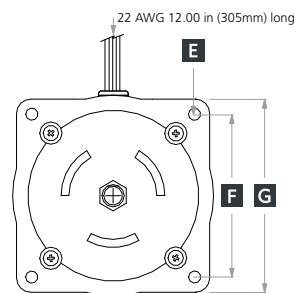
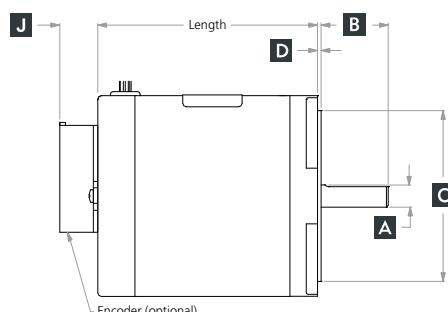
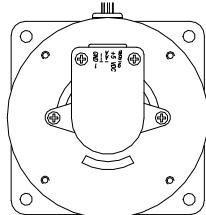
1
1
0
0
X

Step Angle
Front Shaft
Rear Shaft
Termination
Feedback

Step 1:

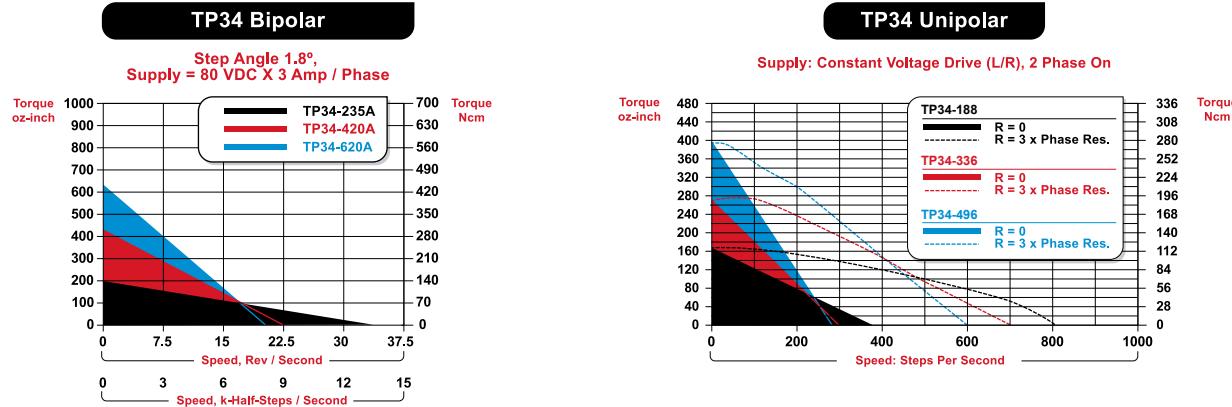
TP34 Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|--------------|------------------------|--------------------|----------------------|--------------------|------------------------------|--------------------------|---------------------------------|------------------------|-------------------|----------------------|
| | | | Front Shaft Diameter | Front Shaft Length | Pilot Diameter | Pilot Length (Ref) | Mount Hole Callout | Mount Hole Spacing (Ref) | Flange External Dimension (Ref) | Rear Shaft Diameter | Rear Shaft Length | Encoder Length (max) |
| TP34-235 | TP34-188 | 2.45 in ±.03 | | | | | | | | | | |
| TP34-420 | TP34-336 | 3.70 in ±.03 | 0.3750 in 0.3745 in | 1.19 in ±.03 | 2.877 in 2.873 in | 0.06 in | [4] 0.22 in ±.010 Through | 2.74 in | 3.25 in | 0.3750 in 0.3745 in | 1.19 in ±.04 | 0.70 in |
| TP34-620 | TP34-496 | 5.08 in ±.03 | | | | | | | | | | |



Step 2:

TP34 Torque and Mechanical Data



| Stack Size Models | Bipolar | | | Unipolar | | |
|--|----------------|----------------|----------------|-------------|-------------|-------------|
| | 235A | 420A | 620A | 188V | 336V | 496V |
| Holding Torque oz-in (Ncm) | 235.0 (165.93) | 420.0 (296.56) | 620.0 (437.78) | 188.0 (133) | 336.0 (237) | 496.0 (350) |
| Step Angle (°/step) | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec ²) | 0.0091 | 0.017 | 0.0265 | 0.0091 | 0.017 | 0.0265 |
| Weight oz (g) | 48 (1361) | 80 (2268) | 121 (3430) | 48 (1361) | 80 (2268) | 121 (3430) |

Step 3:

Available Windings

Bipolar

| | | | | | | | | | | | | |
|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Imperial | 235A20 | 235A30 | 235A40 | 235A60 | 420A20 | 420A30 | 420A40 | 420A60 | 620A20 | 620A30 | 620A40 | 620A60 |
| Current Bipolar (A/Phase) | 2.0 | 3.0 | 4.0 | 6.0 | 2.0 | 3.0 | 4.0 | 6.0 | 2.0 | 3.0 | 4.0 | 6.0 |
| Phase Resistance (ohm) | 2.2 | 0.96 | 0.55 | 0.24 | 3 | 1.33 | 0.75 | 0.33 | 3.8 | 1.7 | 0.96 | 0.43 |
| Phase Inductance (mH) | 20.4 | 9.07 | 5.1 | 2.27 | 33.2 | 14.8 | 8.3 | 3.7 | 54.5 | 24.2 | 13.6 | 6.1 |

Unipolar

| | | | | | | | | | | | | | |
|---------------------------|--------|--------|---------|---------|--------|--------|--------|---------|---------|--------|--------|---------|---------|
| Imperial | 188V26 | 188V53 | 188V120 | 188V240 | 336V25 | 336V30 | 336V60 | 336V120 | 336V240 | 496V22 | 496V43 | 496V120 | 496V240 |
| Unipolar (V/Phase) | 2.6 | 5.3 | 12.0 | 24.0 | 2.5 | 3.0 | 6.0 | 12.0 | 24.0 | 2.2 | 4.3 | 12.0 | 24.0 |
| Unipolar (A/Phase) | 3.1 | 1.6 | 0.7 | 0.3 | 4.6 | 4.0 | 2.0 | 1.0 | 0.6 | 7.1 | 3.6 | 1.2 | 0.6 |
| Phase Resistance (ohm) | 0.85 | 3.3 | 18 | 72 | 0.55 | 0.75 | 3 | 11.5 | 44 | 0.31 | 1.2 | 10.3 | 41 |
| Phase Inductance (mH) | 4.15 | 17.5 | 80 | 315 | 2.75 | 3.6 | 16.45 | 64.2 | 237 | 1.81 | 7.65 | 60 | 249 |
| Bipolar (A/Phase)* | 2.2 | 1.1 | 0.5 | 0.2 | 3.2 | 2.8 | 1.4 | 0.7 | 0.4 | 5.0 | 2.5 | 0.8 | 0.4 |

TP42 : ElectroCraft TorquePower™ | Stepper Motor

| Size | Holding Torque oz-in (Ncm) | Speeds up to RPS |
|---------------|-------------------------------|---------------------|
| Nema 42, 1.8° | 2100 (1480) | 24 |



Protected. Force.

If you need a corrosion-resistant motor with powerful force, this 1.8° size 42 hybrid DC stepping motor could be for you. It is totally enclosed with permanently lubricated ball bearings. The bi-directional size 42 has holding torque up to 2100 oz-in with a step angle accuracy of ±3% non-cumulative.

To build your own motor, choose the:

1 - Frame Size
(Imperial)

T P
Product Name

4 2
Frame Size

2 - Torque
(Stack Length)

8 1 0
Holding Torque
(oz-in) Bipolar

3 - Winding

A 2 0
Bipolar
Current (Amps x 10)
V 2 3
Unipolar
Voltage (Volts x 10)

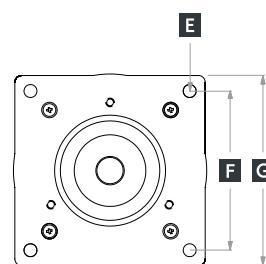
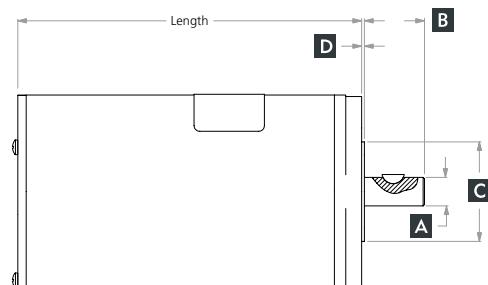
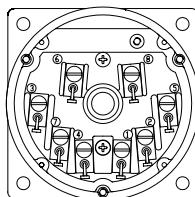
4 - Features
(see page 39)

1 1 0 0 X
Step Angle Front Shaft Rear Shaft Termination
Feedback

Step 1:

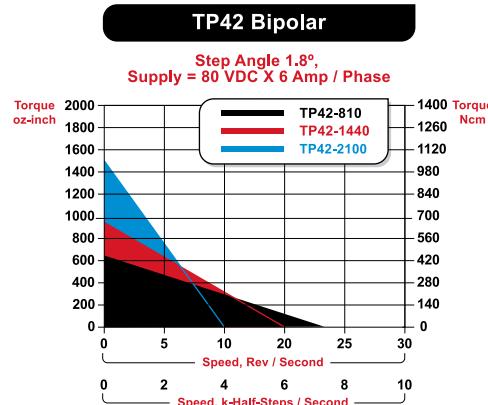
TP42 Frame Size Drawing Key

| Bipolar Model | Unipolar Model | MAX Length | A | B | C | D | E | F | G | H | I | J |
|---------------|----------------|---------------|------------------------|------------------|----------------------|---------|------------------------------|---------|---------|------------------------|------------------|-----|
| TP42-810 | TP42-650 | 5.39 in ±0.04 | | | | | | | | | | |
| TP42-1440 | TP42-1150 | 7.56 in ±0.04 | 0.6250 in 0.6245 in | 1.38 in ±0.03 | 2.188 in 2.184 in | 0.06 in | [4] 0.28 in ±.010 Through | 3.50 in | 4.19 in | 0.5000 in 0.4995 in | 1.25 in ±0.04 | TBD |
| TP42-2100 | TP42-1650 | 9.90 in ±0.04 | | | | | | | | | | |



Step 2:

TP42 Torque and Mechanical Data



| Stack Size Models | Bipolar | | | Unipolar | | |
|----------------------------|----------------|------------------|------------------|----------------|-----------------|------------------|
| | 810A | 1440A | 2100A | 650V | 1150V | 1650V |
| Holding Torque oz-in (Ncm) | 810.0 (571.94) | 1440.0 (1016.78) | 2100.0 (1482.81) | 650.0 (458.96) | 1150.0 (812.01) | 1650.0 (1165.07) |
| Step Angle (°/step) | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° | 1.8° |
| Rotor Inertia (oz-in-sec²) | 0.055 | 0.114 | 0.172 | 0.055 | 0.114 | 0.172 |
| Weight oz (g) | 216 (6123) | 320 (9072) | 424 (12020) | 216 (6123) | 320 (9072) | 424 (12020) |

Step 3:

Available Windings

Bipolar

| Imperial | 810A20 | 810A30 | 810A50 | 1440A20 | 1440A30 | 1440A50 | 2100A20 | 2100A30 | 2100A50 |
|---------------------------|--------|--------|--------|---------|---------|---------|---------|---------|---------|
| Current Bipolar (A/Phase) | 2.0 | 3.0 | 5.0 | 2.0 | 3.0 | 5.0 | 2.0 | 3.0 | 5.0 |
| Phase Resistance (ohm) | 3.5 | 1.6 | 0.6 | 5.5 | 2.4 | 0.9 | 6.25 | 3.04 | 1.0 |
| Phase Inductance (mH) | 63.8 | 28.3 | 10.2 | 186 | 82.8 | 29.8 | 140 | 64 | 22.2 |

Unipolar

| Imperial | 650V23 | 650V41 | 650V79 | 650V98 | 1150V37 | 1150V46 | 1150V58 | 1150V74 | 1650V24 | 1650V32 | 1650V39 | 1650V45 |
|------------------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
| Unipolar (V/Phase) | 2.3 | 4.1 | 7.9 | 9.8 | 3.7 | 4.6 | 5.8 | 7.4 | 2.4 | 3.2 | 3.9 | 4.5 |
| Unipolar (A/Phase) | 6.1 | 3.5 | 1.8 | 1.4 | 6.1 | 4.7 | 3.8 | 3.1 | 10.4 | 8.4 | 6.8 | 5.2 |
| Phase Resistance (ohm) | 0.37 | 1.17 | 4.47 | 7 | 0.6 | 0.97 | 1.53 | 2.4 | 0.23 | 0.38 | 0.57 | 0.86 |
| Phase Inductance (mH) | 3.5 | 10.5 | 40.1 | 63.8 | 7 | 11.3 | 17.4 | 26.9 | 2.6 | 4 | 6.9 | 10.6 |
| Bipolar (A/Phase)* | 4.3 | 2.5 | 1.3 | 1.0 | 4.3 | 3.4 | 2.7 | 2.2 | 7.3 | 6.0 | 4.8 | 3.7 |

SA45 : ElectroCraft CompletePower™ | Motion Control

| Power Supply Voltage | Nominal Current | Phases | Operation Mode | | Special Functions | | |
|----------------------|-----------------|--------|----------------|----------------|-----------------------|------------------|---------------------------|
| | | | Fullstep | Micro stepping | Integrated Oscillator | Current Fallback | Anti-Resonance Anti-Noise |
| 11 - 48 | 5 / 10 | 2 | ● | ● | ● | ● | ● |



For Stepper Motors. Up to 480W.

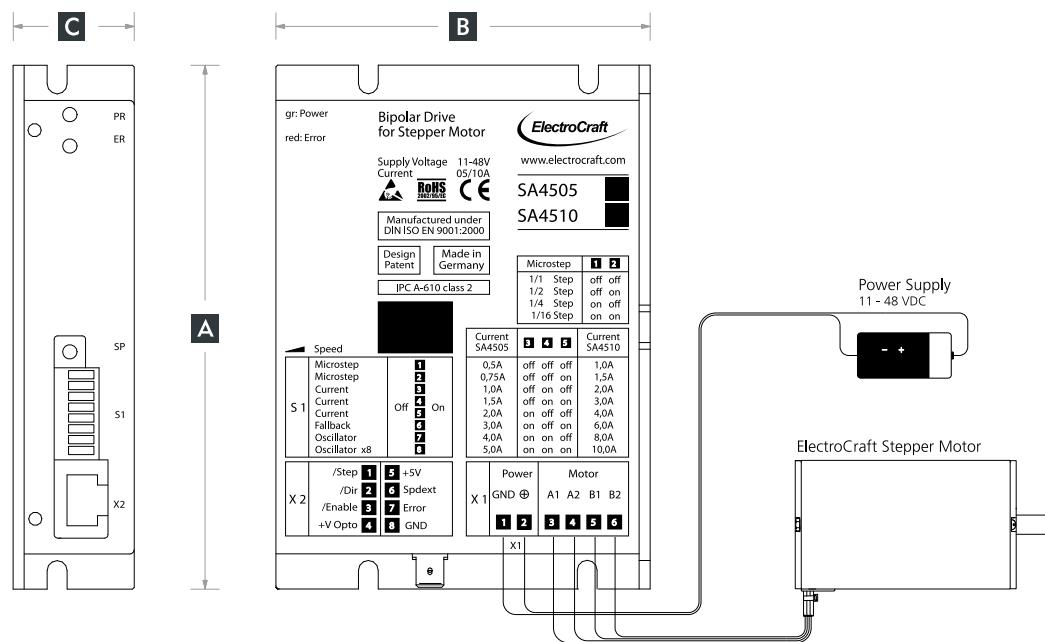
This bipolar stepper drive provides microstepping to 1/16 built into a fully enclosed rugged aluminum case. It can be DIN-rail mounted or panel mounted for fast integration. The mode of operation is set by simple DIP switches. Features include an internal oscillator that allows operation of the drive at a internal speed set point or with an external analog speed reference that can scale this set point. Both the 5 A and 10 A versions of this drive can be powered by the same range of voltage supplies. This drive is protected against over-current and overtemperature and incorporates the state of the art dual full bridge MOSFET driver for maximum efficiency. Connectivity is tool-free with RJ45-CAT5 plugs for the control inputs and push-type terminals for power.

Drive Model Example

S Drive Technology
A Revision
4 # Quadrants
5 Voltage 10x VDC
10 Nominal Amps

SA45 Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------|----------------|---------------|----------------|---------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| SA4505 | 4.69 (119.0) | 3.35 (85.0) | 1.08 (28) | 7.05 (200) |
| SA4510 | | | | 7.76 (220) |



| SA45 Specifications | | | | | | | | |
|--------------------------------------|----------------------------|------------------------|---|---------------------------------------|----------------|--|--|--|
| Model Number | Power Supply Voltage (VDC) | Nominal Current (Amps) | Max. Power with Heatsink (Watts) | Frequency of power output stage (kHz) | Efficiency (%) | | | |
| SA4505 | 11 - 48 | 5 | 240 | 50 | 95 | | | |
| SA4510 | 11 - 48 | 10 | 480 | 50 | 95 | | | |
| Control Inputs | | | | | | | | |
| Enable | | | Optical, $R_i = 1 \text{ kOhm}$; max. 20 mA | | | | | |
| Direction | | | Optical, $R_i = 1 \text{ kOhm}$; max. 20 mA | | | | | |
| Step | | | Optical, $R_i = 1 \text{ kOhm}$; max. 20 mA; 250 kHz | | | | | |
| Speed ext. | | | +1 to +5 VDC; $R_i = 100 \text{ kOhm}$ | | | | | |
| Switches | | | | | | | | |
| Microstep | | | 1/1; 1/2; 1/4; 1/16 | | | | | |
| Current | | | 0,5 A to 5 A / 1 A to 10 A | | | | | |
| Fallback | | | on / off | | | | | |
| Oscillator | | | on / off | | | | | |
| Oscillator x8 | | | on / off | | | | | |
| Outputs | | | | | | | | |
| Auxiliary voltage source +5V | | | +5 VDC / 50 mA | | | | | |
| Fault | | | Optical, max. 20 mA | | | | | |
| Display | | | | | | | | |
| LEDs | | | green= Power / red = Error | | | | | |
| Function of Potentiometers | | | | | | | | |
| Speed | | | Range: 4 Hz - 500kHz / 40 Hz - 4800 Hz | | | | | |
| Ambient conditions | | | | | | | | |
| Operation temperature (°C) | | | -10 to +45 | | | | | |
| Storage temperature (°C) | | | -40 to +85 | | | | | |
| Humidity Range Not Condensing (%rel) | | | 20 to 80 % rel. | | | | | |
| Mode of Operation | | | | | | | | |
| Fullstep; Microstep: 1/2, 1/4, 1/16 | | | | | | | | |

| Available Accessories for SA45 (details see page 56) | | | | | | |
|---|---|---|---|--|---|---|
| IA210x | CAxxx | HA3008 | HA3018 | HA3028 | MA0025 | WA2509 |
|  |  |  |  |  |  |  |



Precision positioning allows microscopic inspection and analysis



Programmable Servo Drive

Compact drive solution for rotary or linear brushless, stepper or PMDC brush motors.

The ElectroCraft PRO Series Programmable Servo Drives are based on a new design concept offering a cost effective, compact and modular solution for the control of rotary or linear brushless, stepper or PMDC brush motors of powers up to 385W, with 48V nominal voltage.

Designed to support both low and high-volume applications, the ElectroCraft PRO Series drive integrates advanced motor control and motion control functionality in a single plug-in module or stand-alone drive. The PRO Series Drives offer a flexible and modular solution in two form factors: PCB Mount (PE models) or built into a stand-alone package with pluggable connectors (SA models). With the comprehensive and flexible motion instruction set, the PRO Series Drives are intelligent drives that are programmable for many applications and levels of experience.



The drive can operate:

- As a single-axis motion controller, autonomously running the program residing in its non-volatile memory.
- As an intelligent slave executing motion sequences triggered by input lines.
- As a part of a multi-axis, distributed motion control solution in either stand-alone or slave configurations.
- As an intelligent slave executing motion sequences triggered by commands received via RS-232 or CAN bus communication.

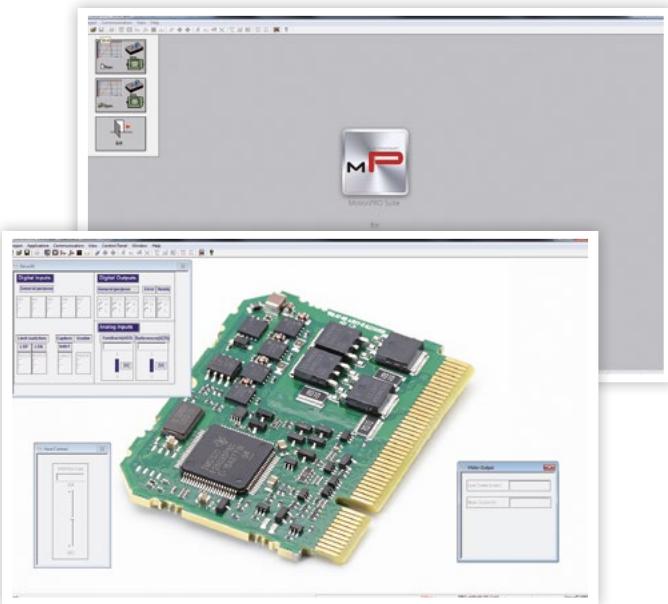
Coordinated motion helps advance medical diagnostics

MotionPRO Suite User Interface

Easy configuration, tuning and programming



The configuration, tuning and programming of the PRO-A04V36 drive is easy with ElectroCraft's powerful MotionPRO Suite user interface.



Flexibility – Control schemes supported by the PRO-A04V36x Drive

| Motor Types (rotary or linear) | Torque Control | Speed Control | Position Control |
|-----------------------------------|----------------|---------------|------------------|
| Brushless | ✓ | ✓ | ✓ |
| Stepper | ✓ | ✓ | ✓ |
| PMDC Brush | ✓ | ✓ | ✓ |

Motor – sensor configurations

| Motor Types | Brushless | Stepper (2-phase) | PMDC Brush |
|------------------------|-----------|-------------------|------------|
| Incr. Encoder | ✓ | ✓ | ✓ |
| Incr. Encoder + Hall | ✓ | | |
| Analog Sin/Cos encoder | ✓ | | |
| Linear Halls | ✓ | | |
| Tacho | | | ✓ |
| Open-loop (no sensor) | | ✓ | |

NOTE: SSI, EnDAT, BiSS encoders and Resolver feedback is possible with an additional feedback extension module

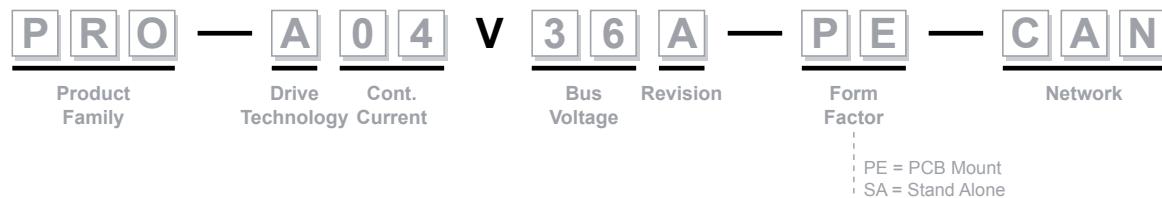
Features

- | | | |
|--|---|--|
| <ul style="list-style-type: none"> • Fully digital servo drive suitable for the control of rotary or linear brushless, stepper or PMDC brush motors • Very compact design • Standard PCIe 4x mating connectors (PE Versions) • Sinusoidal or trapezoidal (Hall-based) control of brushless motors • Open or closed-loop control of 2-phase stepper motors • Various modes of operation, including: torque, speed or position control; position or speed profiles, external analogue reference or sent via communication bus • Comprehensive motion instruction set for the definition and execution of motion sequences | <ul style="list-style-type: none"> • CAN-Bus 2.0B up to 1 Mbit/s (CANopen (CiA 301v4.2 and 402v3.0) protocols • Single power supply: 11-48V; optional logic supply: 9-36V • Digital and analogue I/Os: <ul style="list-style-type: none"> - 8 Digital inputs: 5-36V, NPN [Enable, 2 Limit switches, plus 5 general purpose] - 5 Digital outputs: 5-36V, 0.5A, 5 NPN open-collector [Ready, Error, plus 3 general purpose] - 2 Analogue inputs: 12-bit, 0-5V [Reference, Feedback or general-purpose] • Standalone operation with stored motion sequences • RS-232 serial communication | <ul style="list-style-type: none"> • Switching Frequency up to 100kHz • Operating ambient temperature: 0-40°C • Feedback devices supported: <ul style="list-style-type: none"> - Incremental quad encoder (single-ended, open collector and differential) - Analogue sine/cosine incremental encoder (differential 1Vpp) - Digital and linear Hall sensors - Support for absolute feedback (SSI, BiSS, EnDAT and resolver via additional extension module) • Hardware protections: short-circuit (between motor phases and from motor phases to GND), over-voltage, under-voltage and I^2t |
|--|---|--|

PRO-A04V36: PRO Series | Programmable Servo Drive

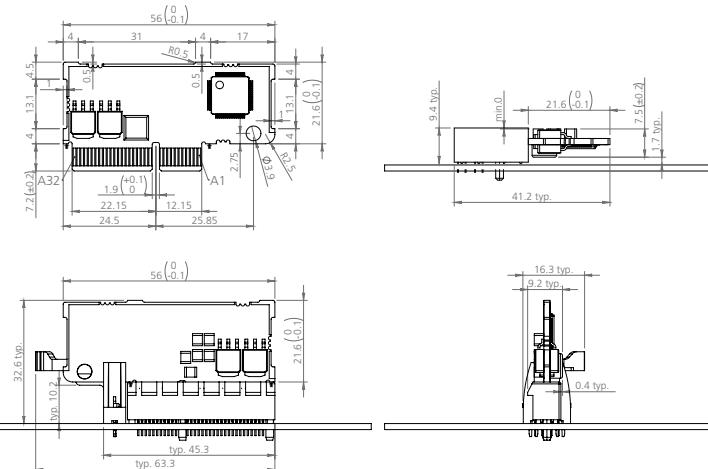


Drive Model Example



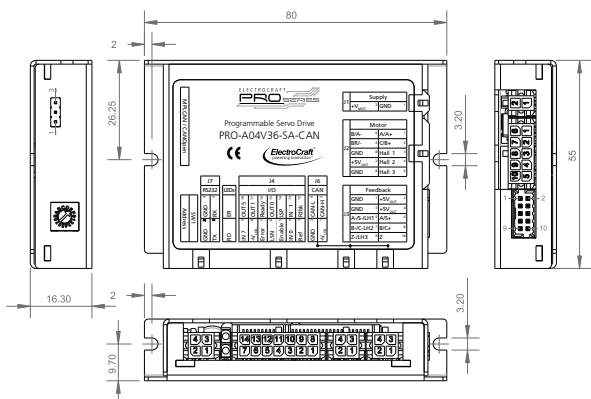
PCB Mount PRO-A04V36x-PE-CAN Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|---------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A04V36A-PE-CAN | 2.2 (56) | 1.1 (28.8) | 0.3 (7.9) | 0.35 (10) |



Stand-alone PRO-A04V36x-SA-CAN Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|---------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A04V36A-SA-CAN | 3.15 (80) | 2.17 (55) | 0.64 (16.3) | 2.5 (70) |



| Electrical Specifications | | | |
|--|--------------|---------|------|
| Maximum DC Supply Voltage: motor & logic | | 36 | volt |
| Maximum continuous current | Peak of sine | 4 | amp |
| | RMS | 2.8 | amp |
| Peak current (2.4 sec. max.) | Peak of sine | 10 | amp |
| | RMS | 7.1 | amp |
| Nominal switching frequency | | 20 – 60 | kHz |

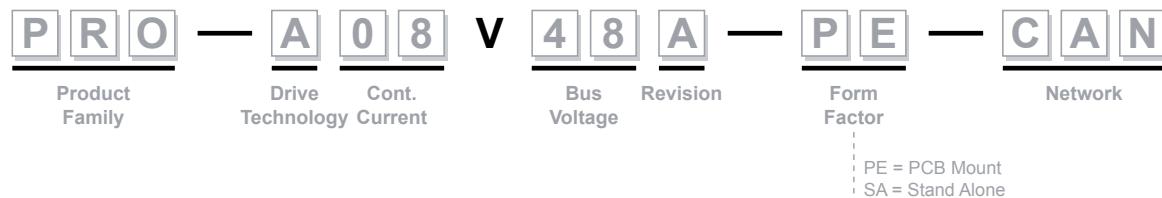
| Input | | | | | |
|-----------------------------------|--|------|---------|------|----------|
| Logic Supply Input ($+V_{LOG}$) | | Min. | Typ. | Max. | Units |
| Supply Voltage | Nominal values | 7 | | 36 | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 4.9 | | 40 | V_{DC} |
| | Absolute maximum values, continuous | -0.7 | | 42 | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | | +45 | V |
| Supply Current | $+V_{LOG} = 7V$ | | 125 | 300 | mA |
| | $+V_{LOG} = 12V$ | | 80 | 200 | |
| | $+V_{LOG} = 24V$ | | 50 | 125 | |
| | $+V_{LOG} = 40V$ | | 40 | 100 | |
| Motor Supply Input ($+V_{MOT}$) | | Min. | Typ. | Max. | Units |
| Supply Voltage | Nominal values | 9 | | 36 | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 8.5 | | 40 | V_{DC} |
| | Absolute maximum values, continuous | -0.7 | | 42 | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | | +45 | V |
| Supply Current | Idle | | 1 | 5 | mA |
| | Operating | -10 | ± 4 | +10 | A |
| | Absolute maximum value, short-circuit condition (duration \leq 10ms) | | | 15 | A |

| Output | | | | | |
|---|--|-----------|-----------|-----------|---------|
| Motor Outputs (A/A+, B/A-, C/B+, BR/B-) | | Min. | Typ. | Max. | Units |
| Nominal output current, continuous | DC brushed, steppers and BLDC motors with Hall-based trapezoidal control | | | 4 | A |
| | Brushless motors with sinusoidal control (Peak of Sine Value) | | | 4 | |
| | Brushless motors with sinusoidal control (sinusoidal effective RMS value) | | | 2.82 | |
| Motor output current, peak | maximum 2.5s | -10 | | +10 | A |
| Short-circuit protection threshold | measurement range | | ± 13 | ± 15 | A |
| Short-circuit protection delay | | 5 | 10 | | μs |
| On-state voltage drop | Nominal output current; including typical mating connector contact resistance | | ± 0.3 | ± 0.5 | V |
| Off-state leakage current | | | ± 0.5 | ± 1 | mA |
| Motor inductance (phase to phase) | Recommended value, for current ripple max. $\pm 5\%$ of full range; $+V_{MOT} = 36 V$ | F_{PWM} | | | μH |
| | | 20 kHz | 250 | | |
| | | 40 kHz | 120 | | |
| | | 60 kHz | 90 | | |

PRO-A08V48: PRO Series | Programmable Servo Drive

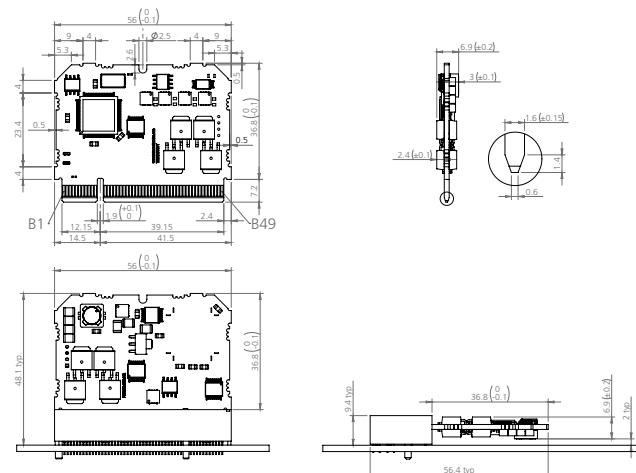


Drive Model Example



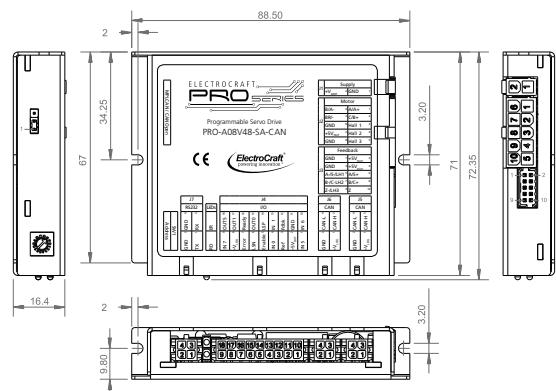
PCB Mount PRO-A08V48x-PE-CAN Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|---------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A08V48A-PE-CAN | 2.2 (56) | 1.73 (48.1) | 0.27 (8.9) | 0.56 (16) |



Stand-alone PRO-A08V48x-SA-CAN Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|---------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A08V48A-SA-CAN | 3.49 (95) | 2.85 (79) | 0.65 (19.5) | 3.9 (110) |

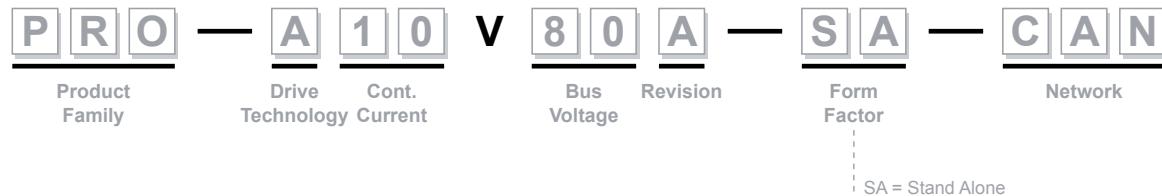


| Electrical Specifications | | | | |
|---|--|-----------|-----------|-----------|
| Maximum DC Supply Voltage | Motor | 48 | volts | |
| | Logic | 36 | volts | |
| Maximum continuous current | Peak of sine | 8 | amps | |
| | RMS | 5.7 | amps | |
| Peak current (2.4 sec. max.) | Peak of sine | 20 | amps | |
| | RMS | 14.1 | amps | |
| Nominal switching frequency | | 20 – 60 | kHz | |
| Input | | | | |
| Logic Supply Input ($+V_{LOG}$) | | | Min. | Typ. |
| Supply Voltage | Nominal values | 9 | | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 8 | | V_{DC} |
| | Absolute maximum values, continuous | -0.6 | | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | | V |
| Supply Current | $+V_{LOG} = 7V$ | | 125 | 320 |
| | $+V_{LOG} = 12V$ | | 80 | 220 |
| | $+V_{LOG} = 24V$ | | 50 | 145 |
| | $+V_{LOG} = 40V$ | | 40 | 120 |
| Motor Supply Input ($+V_{MOT}$) | | | Max. | Units |
| Supply Voltage | Nominal values | 11 | 48 | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 9 | 52 | V_{DC} |
| | Absolute maximum values, continuous | -0.6 | 54 | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | +57 | V |
| Supply Current | Idle | | 1 | mA |
| | Operating | -20 | ± 8 | A |
| | Absolute maximum value, short-circuit condition (duration \leq 10ms) | | 26 | A |
| Output | | | | |
| Motor Outputs (A/A+, B/A-, C/B+, BR/B-) | | | Min. | Typ. |
| Nominal output current, continuous | DC brushed, steppers and BLDC motors with Hall-based trapezoidal control | | | 8 |
| | Brushless motors with sinusoidal control (Peak of Sine Value) | | | 8 |
| | Brushless motors with sinusoidal control (sinusoidal effective RMS value) | | | 5.66 |
| Motor output current, peak | maximum 2.5s | -20 | | +20 |
| Short-circuit protection threshold | measurement range | | ± 26 | ± 30 |
| Short-circuit protection delay | | 5 | 10 | μs |
| On-state voltage drop | Nominal output current; including typical mating connector contact resistance | | ± 0.3 | ± 0.5 |
| Off-state leakage current | | | ± 0.5 | ± 1 |
| Motor inductance (phase to phase) | Recommended value, for current ripple max. $\pm 5\%$ of full range; $+V_{MOT} = 36 V$ | F_{PWM} | | |
| | | 20 kHz | 250 | |
| | | 40 kHz | 120 | |
| | | 60 kHz | 90 | |
| | | | | μH |

PRO-A10V80: PRO Series | Programmable Servo Drive



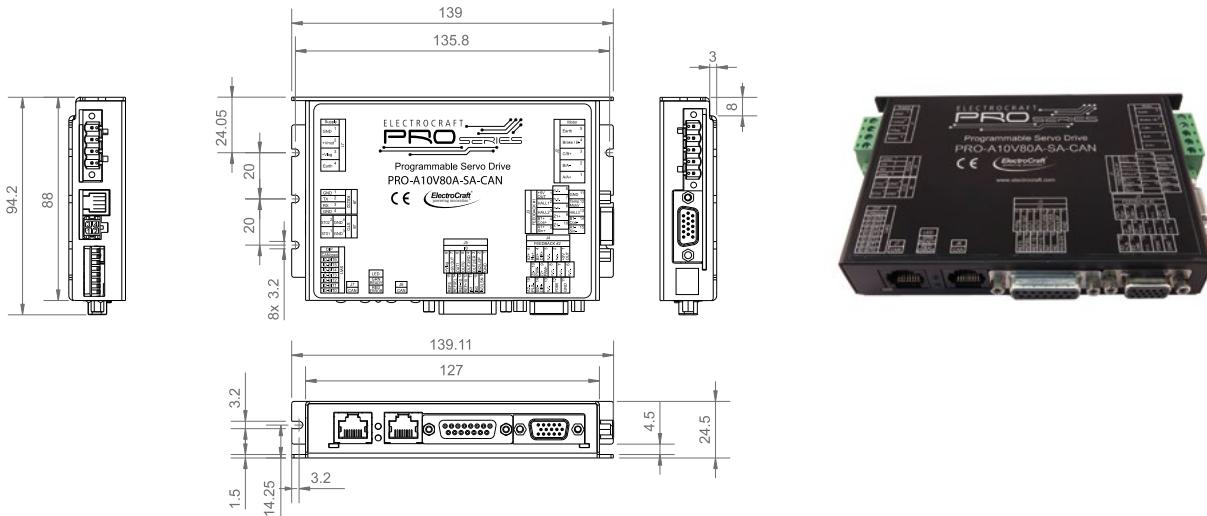
Drive Model Example



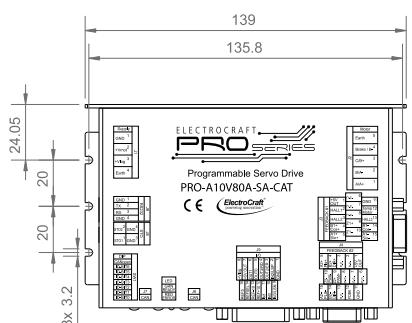
Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|------------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A10V80A-SA-CAN | 5.47 (139) | 3.7 (94.2) | 0.96 (24.5) | 8.5 (240) |

PRO-A10V80A-SA-CAN



PRO-A10V80A-SA-CAT

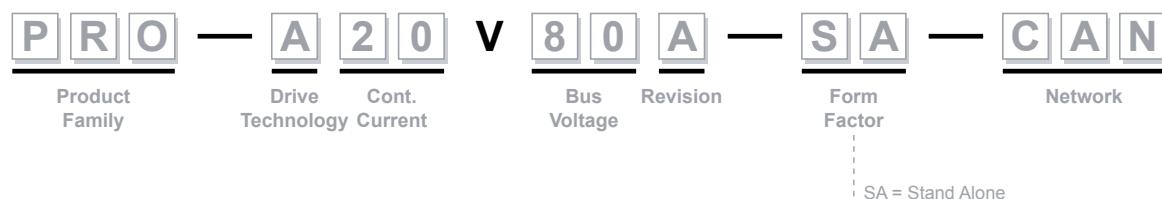


| Electrical Specifications | | | | |
|---|--|-----------|-----------|--------------|
| Maximum DC Supply Voltage | Motor | 80 | volts | |
| | Logic | 36 | volts | |
| Maximum continuous current | Peak of sine | 10 | amps | |
| | RMS | 7.07 | amps | |
| Peak current (2.4 sec. max.) | Peak of sine | 20 | amps | |
| | RMS | 7.1 | amps | |
| Nominal switching frequency | | 14.1 | | kHz |
| Input | | | | |
| Logic Supply Input ($+V_{LOG}$) | | | Min. | Typ. |
| Supply Voltage | Nominal values | 9 | | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 8 | | V_{DC} |
| | Absolute maximum values, continuous | -0.6 | | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | | +45 V |
| Supply Current | $+V_{LOG} = 7V$ | | 300 | |
| | $+V_{LOG} = 12V$ | | 250 | |
| | $+V_{LOG} = 24V$ | | 150 | |
| | $+V_{LOG} = 40V$ | | 100 | |
| Motor Supply Input ($+V_{MOT}$) | | | Max. | Units |
| Supply Voltage | Nominal values | 12 | 80 | V_{DC} |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 11 | 95 | V_{DC} |
| | Absolute maximum values, continuous | -0.6 | 94 | V_{DC} |
| | Absolute maximum values, surge (duration \leq 10ms) | -1 | 95 | V |
| Supply Current | Idle | | 1 | mA |
| | Operating | -40 | ± 10 | A |
| | Absolute maximum value, short-circuit condition (duration \leq 10ms) | | | 22.5 A |
| Output | | | | |
| Motor Outputs (A/A+, B/A-, C/B+, BR/B-) | | | Min. | Typ. |
| Nominal output current, continuous | DC brushed, steppers and BLDC motors with Hall-based trapezoidal control | | | 10 |
| | Brushless motors with sinusoidal control (Peak of Sine Value) | | | 10 |
| | Brushless motors with sinusoidal control (sinusoidal effective RMS value) | | | 7.07 |
| Motor output current, peak | Maximum 10s (3.6s) | -20 | | +20 A |
| Short-circuit protection threshold | Measurement range | | | ± 22.5 A |
| Short-circuit protection delay | | 5 | 10 | μs |
| On-state voltage drop | Nominal output current; including typical mating connector contact resistance | | ± 0.3 | ± 0.5 V |
| Off-state leakage current | | | ± 0.5 | ± 1 mA |
| Motor inductance (phase to phase) | Recommended value, for current ripple max. $\pm 5\%$ of full range; $+V_{MOT} = 36 V$ | F_{PWM} | | |
| | | 20 kHz | 330 | |
| | | 40 kHz | 150 | |
| | | 60 kHz | 120 | |
| | | | | μH |

PRO-A20V80: PRO Series | Programmable Servo Drive



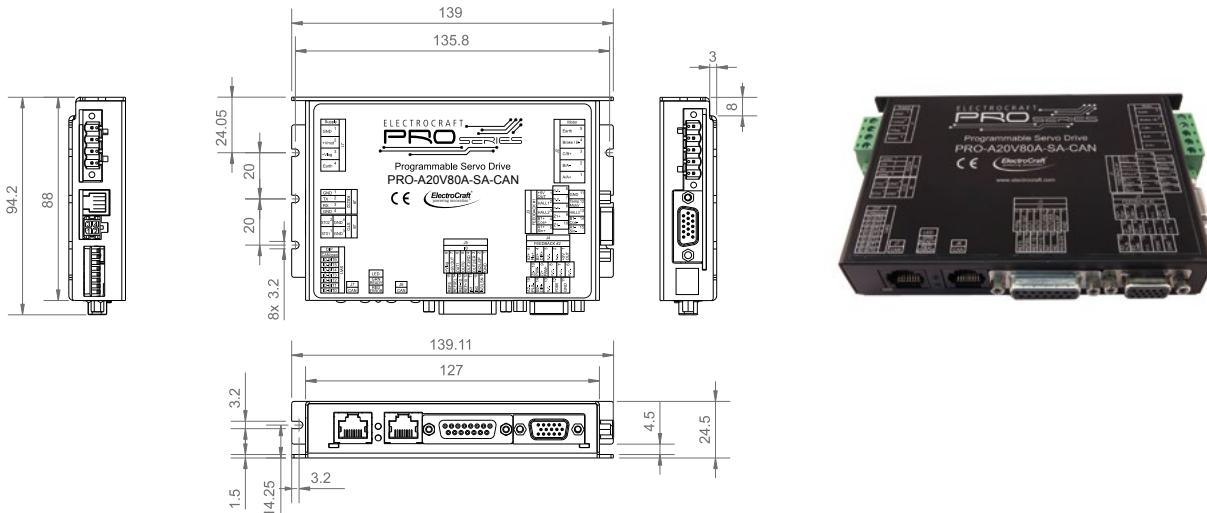
Drive Model Example



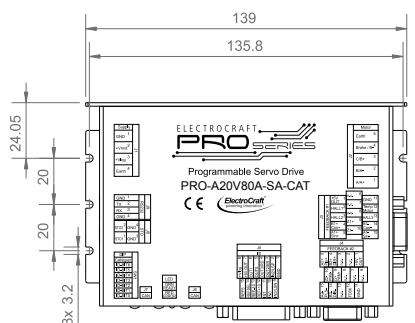
Outline Drawing

| Model | A | B | C | Weight oz (g) |
|--------------------|----------------|---------------|----------------|------------------|
| | Length in (mm) | Width in (mm) | Height in (mm) | |
| PRO-A10V80A-SA-CAN | 5.47 (139) | 3.7 (94.2) | 0.96 (24.5) | 8.5 (240) |

PRO-A20V80A-SA-CAN



PRO-A20V80A-SA-CAT



| Electrical Specifications | | | | |
|---|--|--------------|------|-----------|
| Maximum DC Supply Voltage | | Motor | 80 | volt |
| | | Logic | 36 | volt |
| Maximum continuous current | | Peak of sine | 20 | amp |
| | | RMS | 14.1 | amp |
| Peak current (2.4 sec. max.) | | Peak of sine | 40 | amp |
| | | RMS | 7.1 | amp |
| Nominal switching frequency | | | 28.2 | kHz |
| Input | | | | |
| Logic Supply Input ($+V_{LOG}$) | | | Min. | Typ. |
| Supply Voltage | Nominal values | | 9 | 36 |
| | Absolute maximum values, drive operating but outside guaranteed parameters | | 8 | 40 |
| | Absolute maximum values, continuous | | -0.6 | 42 |
| | Absolute maximum values, surge (duration \leq 10ms) | | -1 | +45 |
| Supply Current | $+V_{LOG} = 7V$ | | | 300 |
| | $+V_{LOG} = 12V$ | | | 250 |
| | $+V_{LOG} = 24V$ | | | 150 |
| | $+V_{LOG} = 40V$ | | | 100 |
| Motor Supply Input ($+V_{MOT}$) | | | Min. | Typ. |
| Supply Voltage | Nominal values | | 12 | 80 |
| | Absolute maximum values, drive operating but outside guaranteed parameters | | 11 | 95 |
| | Absolute maximum values, continuous | | -0.6 | 94 |
| | Absolute maximum values, surge (duration \leq 10ms) | | -1 | 95 |
| Supply Current | Idle | | | 1 |
| | Operating | | -40 | ± 20 |
| | Absolute maximum value, short-circuit condition (duration \leq 10ms) | | | 45 |
| Output | | | | |
| Motor Outputs (A/A+, B/A-, C/B+, BR/B-) | | | Min. | Typ. |
| Nominal output current, continuous | DC brushed, steppers and BLDC motors with Hall-based trapezoidal control | | | 20 |
| | Brushless motors with sinusoidal control (Peak of Sine Value) | | | 20 |
| | Brushless motors with sinusoidal control (sinusoidal effective RMS value) | | | 14.2 |
| Motor output current, peak | Maximum 10s (3.6s) | | -40 | +40 |
| Short-circuit protection threshold | Measurement range | | | ± 45 |
| Short-circuit protection delay | | | 5 | 10 |
| On-state voltage drop | Nominal output current; including typical mating connector contact resistance | | | ± 0.3 |
| Off-state leakage current | | | | ± 0.5 |
| Motor inductance (phase to phase) | Recommended value, for current ripple max. $\pm 5\%$ of full range; $+V_{MOT} = 36 V$ | F_{PWM} | | |
| | | 20 kHz | 330 | |
| | | 40 kHz | 150 | |
| | | 60 kHz | 120 | |



HYBRID MOTOR CONNECTION DIAGRAMS

These diagrams show the unipolar and bipolar switching sequence.

The direction of the rotation is viewed from the lead end.



CW Rotation
(Lead End)



| Step | A | A' | B | B' |
|------|---|----|---|----|
| 1 | - | | - | |
| 2 | - | | | - |
| 3 | | - | | - |
| 4 | | - | - | |

2 Phase On

CCW Rotation
(Lead End)



| | | | | |
|---|---|---|---|---|
| 1 | - | | - | |
| 2 | - | | | - |
| 3 | - | | | - |
| 4 | | | | - |
| 5 | | - | | - |
| 6 | | - | | |
| 7 | | - | - | |
| 8 | | | - | |

Half Step

CW Rotation
(Lead End)



| Step | A | A' | B | B' |
|------|---|----|---|----|
| 1 | + | - | + | - |
| 2 | + | - | - | + |
| 3 | - | + | - | + |
| 4 | - | + | + | - |

2 Phase On

CCW Rotation
(Lead End)



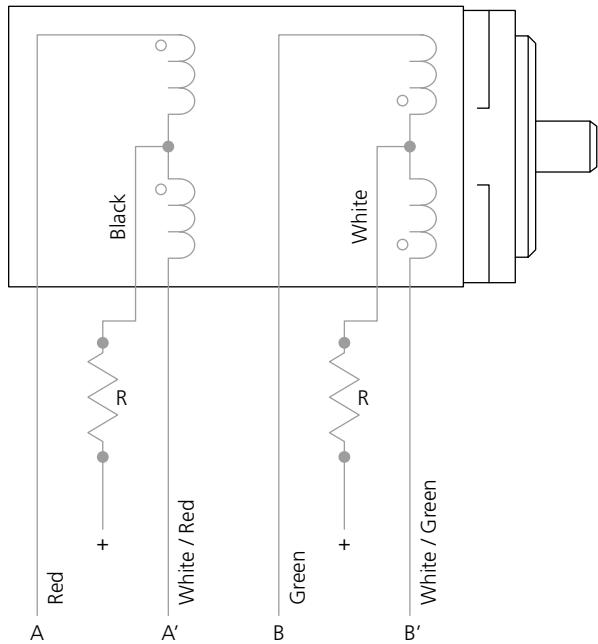
| | | | | |
|---|---|---|---|---|
| 1 | + | - | + | - |
| 2 | + | - | - | - |
| 3 | + | - | - | + |
| 4 | - | - | - | + |
| 5 | - | + | - | + |
| 6 | - | + | - | - |
| 7 | - | + | + | - |
| 8 | - | - | + | - |

Half Step

Unipolar Configuration

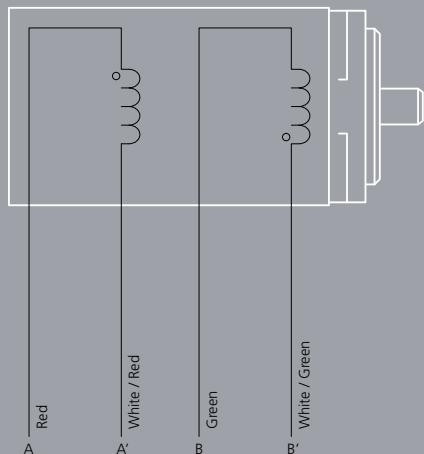
To Fit Your Exact Application

Unipolar (6 Leads)

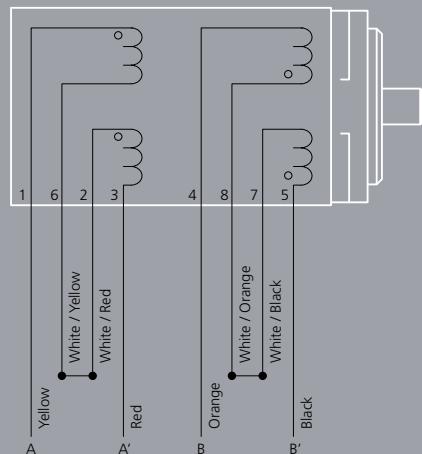


Bipolar Configurations

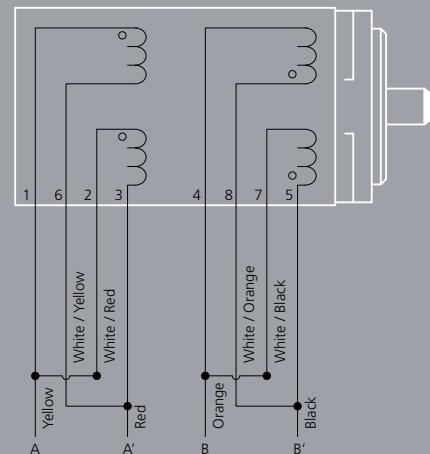
Bipolar (4 Leads)



Bipolar Series (8 Leads)



Bipolar Parallel (8 Leads)





GO FIGURE.

Customize your options ...

To easily find a motor / motion system
that best meets your needs:

Step 1: Select a base technology

Step 2: Select a model type & features

Step 3: Select a performance

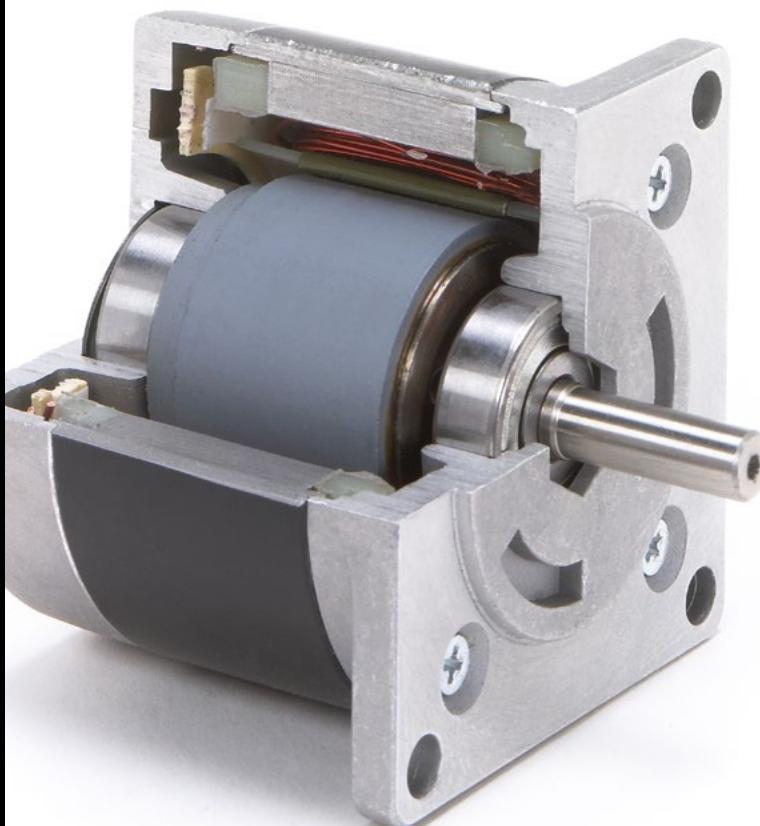
Step 4: Select an electrical winding

Step 5: Select any options & accessories

Easily build your own motor at
www.configureamotor.com

Build Your Own ElectroCraft Motor To Fit Your Exact Application

For the past 60 years, the global team at ElectroCraft has helped engineers like you translate innovative ideas into reality. To build on that legacy, we created this Build-Your-Own ElectroCraft Motor web tool to get you started with our technology.



A web configuration tool from ElectroCraft ... Go Figure!
Your Genius. Our Drive.

System Matrix – Matching Motor and Drive Combinations

| Motor Series | | Drive Models | | | | | |
|--------------|--------|-----------------|------------|------------|------------|------------|-------------|
| Motor P/N | | Bipolar Stepper | PRO Series | | | | |
| Imperial | Metric | SA4505 | SA4510 | PRO-A04V36 | PRO-A08V48 | PRO-A10V80 | PRO-A20V160 |
| TP23-150A10 | | ● | | ● | ● | ● | |
| TP23-150A20 | | ● | | ● | ● | ● | |
| TP23-150A30 | | ● | | ● | ● | ● | |
| TP23-150A40 | | ● | | ● | ● | ● | |
| TP23-210A20 | | ● | | ● | | ● | |
| TP23-210A30 | | ● | | ● | ● | ● | |
| TP23-210A40 | | | ● | ● | ● | ● | |
| TP23-48A10 | | ● | | ● | ● | ● | |
| TP23-48A20 | | ● | | ● | ● | ● | |
| TP23-48A30 | | ● | | ● | ● | ● | |
| TP23-48A40 | | | ● | ● | ● | ● | |
| TP23-72A10 | | | | ● | ● | ● | |
| TP23-72A20 | | | | ● | ● | ● | |
| TP23-72A30 | | | | ● | ● | ● | |
| TP23-72A40 | | | ● | ● | ● | ● | |
| TP34-235A20 | | ● | | ● | ● | ● | |
| TP34-235A30 | | ● | | ● | ● | ● | |
| TP34-235A40 | | | ● | ● | ● | ● | |
| TP34-235A60 | | | ● | | | ● | |
| TP34-420A20 | | ● | | ● | ● | | |
| TP34-420A30 | | ● | | ● | ● | | |
| TP34-420A40 | | | ● | ● | ● | | |
| TP34-420A60 | | | ● | | | ● | |
| TP34-620A20 | | ● | | ● | ● | | |
| TP34-620A30 | | ● | | ● | ● | | |
| TP34-620A40 | | | ● | ● | ● | | |
| TP34-620A60 | | | ● | | | ● | |
| TP42-1440A20 | | ● | | ● | ● | | |
| TP42-1440A30 | | ● | | ● | ● | | |
| TP42-1440A50 | | | ● | ● | ● | ● | ● |
| TP42-2100A20 | | ● | | ● | ● | | |
| TP42-2100A30 | | ● | | ● | ● | | |
| TP42-2100A50 | | | ● | ● | ● | ● | ● |
| TP42-810A20 | | ● | | ● | ● | | |
| TP42-810A30 | | ● | | ● | ● | | |
| TP42-810A50 | | | ● | ● | ● | ● | ● |

| TorquePower Enhanced - TPE | TPE17-45A10 | TPE17M-32A10 | ● | | ● | ● | ● |
|----------------------------|--------------|---------------|---|--|---|---|---|
| | TPE17-45A15 | TPE17M-32A15 | ● | | ● | ● | ● |
| | TPE17-45A20 | TPE17M-32A20 | ● | | ● | ● | ● |
| | TPE17-63A10 | TPE17M-44A10 | ● | | ● | ● | ● |
| | TPE17-63A15 | TPE17M-44A15 | ● | | ● | ● | ● |
| | TPE17-63A20 | TPE17M-44A20 | ● | | ● | ● | ● |
| | TPE17-78A10 | TPE17M-55A10 | ● | | ● | ● | ● |
| | TPE17-78A15 | TPE17M-55A15 | ● | | ● | ● | ● |
| | TPE17-78A20 | TPE17M-55A20 | ● | | ● | ● | ● |
| | TPE23-100A10 | TPE23M-71A10 | ● | | ● | ● | ● |
| | TPE23-100A20 | TPE23M-71A20 | ● | | ● | ● | ● |
| | TPE23-100A30 | TPE23M-71A30 | ● | | | ● | ● |
| | TPE23-166A10 | TPE23M-117A10 | ● | | ● | ● | ● |
| | TPE23-166A20 | TPE23M-117A20 | ● | | ● | ● | ● |
| | TPE23-166A30 | TPE23M-117A30 | ● | | | ● | ● |
| | TPE23-294A10 | TPE23M-208A10 | ● | | ● | ● | ● |
| | TPE23-294A20 | TPE23M-208A20 | ● | | ● | ● | ● |
| | TPE23-294A30 | TPE23M-226A30 | ● | | | ● | ● |



Other Products available from ElectroCraft:

- CompletePower™ | Motion Control
- RapidPower™ | BLDC
- AxialPower™ | Linear Actuator
- DirectPower™ | PMDC
- MobilePower™ | Transmissions
- SolidPower™ Plus | Housed AC
- SurePower™ | C-Frame AC
- PRO Series | Motion Control



CompletePower™ | Drives



With meticulous engineering and advanced electronics, our CompletePower speed controls and servo drives offer reliability and precision servo motion control. From sensitive medical dosing systems to rugged professional power tools, our CompletePower devices can handle a wide variety of applications.

TorquePower™ | Steppers



With non-cumulative position accuracies as low as $\pm 3\%$, the precision of our TorquePower motor is matched only by the dependability of its performance. Bi-directional operation and enclosed, permanently lubricated ball bearings provide long-lasting, smooth operation.

PRO Series | Drives



The PRO Series Programmable Servo Drive provides a new design concept offering a cost effective, compact and modular solution for the control of rotary or linear stepper, brushless or PMDC brush motors of powers up to 385W, with up to 48V nominal voltage and 5.7A (RMS) continuous current.

RapidPower™ | BLDC



Our BLDC motors provide the rapid acceleration and consistent speed needed for applications from centrifuges to x-y positioning systems. The RapidPower product line ensures a steady operation at any speed by utilizing sealed ball bearings and reduced torque ripple from skewed magnetization.

AxialPower™ | Linear Actuator



Based on modified hybrid steppers, PMDC, and BLDC motors, our family of AxialPower linear actuators are built to last. Our unique approach to linear motion with low-friction, polymer rotating nuts and stainless steel leadscrews provides high force and linear precision in the smallest packages available.

DirectPower™ | PMDC



Dynamically balanced armatures and precision ball bearings ensure that the DirectPower line maintains its characteristically smooth performance. This durable, totally enclosed, non-ventilated (TENV) motor is available in a broad product line from lower cost, general purpose options to high performance PMDC servo motors.

MobilePower™ | Transmissions



With a choice of output ratios, our MobilePower line of products helps power battery-operated vehicles from wheelchairs to lift trucks. And, to increase durability and decrease noise levels, the robust all metallic gears are hobbed to a precision AGMA 9-Class.

SolidPower™ Plus | Housed AC



High starting torques and stator windings matched to your application ensure the SolidPower product provides lasting performance. The dynamically balanced, skewed rotor bars and precision-machined fits keep vibration levels at a minimum.

SurePower™ | C-Frame AC



Our AC shaded-pole motor, the SurePower product, can be utilized for a wide range of air-moving applications – perfect for the rigors of refrigeration and commercial food equipment applications.

To build your own motor, choose the:

**1 - Frame Size
(Imperial)**

T P

2 3

**2 - Torque
(Stack Length)**

1 5 0

3 - Winding

A 3 0

Bipolar
Current (Amps x 10)
V 6 0

Unipolar
Voltage (Volts x 10)

**4 - Features
(Select Appropriate Code)**

1 1 0 0 X

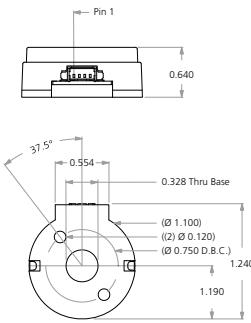
Step Angle
Front Shaft
Rear Shaft
Lead Option
Feedback

Step 4:

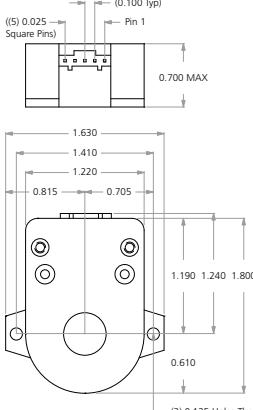
Stepper Motor Features

| Step Angles | | Front Shaft | | Rear Shaft | | Lead Option | | Feedback Options | |
|---|---------|---|----------------|---------------------------|------------------------|------------------------------------|---------|---|--|
| 0 = 0.9° | | 0 = round shaft | | 0 = none | | 0 = flying leads | | X = none | |
| 1 = 1.8° | | 1 = flat shaft | | 1 = standard shaft | | 1 = connector | | B = 400 Line Differential Encoder | |
| Option 0 only available on TP17(M) and TPP23(M) | | 2 = key seat | | | | 2 = integral connector only | | D = 1000 Line Differential Encoder | |
| | | Option 2 only available on shaft diameters 0.3150 inches (8mm) and larger | | | | Option 2 only available on TPP11M | | H = 400 Line Single-Ended Encoder | |
| | | | | | | | | K = 1000 Line Single-Ended Encoder | |
| Motor Size | Encoder | Line Count | Motor Size | Encoder | Line Count | Motor Size | Encoder | Line Count | |
| TPP11M | B | 400 Line Differential | TPP17 TPE17 | B | 400 Line Differential | TPP23 | B | 400 Line Differential | |
| | H | 400 Line Single-Ended | | D | 1000 Line Differential | TP34 | D | 1000 Line Differential | |
| | | | | H | 400 Line Single-Ended | TP42 | H | 400 Line Single-Ended | |
| | | | | K | 1000 Line Single-Ended | TPP23 | | | |
| | | | | | | TPE23 | | | |
| | | | | | | TPP34 | K | 1000 Line Single-Ended | |

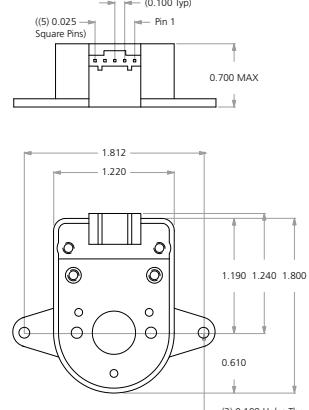
SHOWN AS ASSEMBLED UNIT



SHOWN AS ASSEMBLED UNIT



SHOWN AS ASSEMBLED UNIT



| Pin Number | Parameter | Lead-wire color | Supply Voltage | Pin Number | Parameter | Lead-wire color | Supply Voltage | Pin Number | Parameter | Lead-wire color | Supply Voltage | | |
|----------------------|---|-----------------|----------------|---|--|-----------------|----------------|---|---|-----------------|----------------|--|--|
| Motor size 11 | | | | Motor sizes 17/23/34/42 Single-Ended Encoder | | | | Motor sizes 17/23/34/42 Differential Encoder | | | | | |
| Pin 1 | + 5 VDC | ORG | 5VDC ± 0.5 | Pin 1 | Ground | BRN | 5VDC ± 0.5 | Pin 1 | Ground | NC | 5VDC ± 0.5 | | |
| Pin 2 | CH A | BLU | | Pin 2 | CH Z | PUR | | Pin 2 | Ground | GRN/WHT | | | |
| Pin 3 | Ground | BRN | | Pin 3 | CH A | BLU | | Pin 3 | Ch Z- | WHT/ORG | | | |
| Pin 4 | CH B | YEL | | Pin 4 | + 5 VDC | ORG | | Pin 4 | CH Z+ | ORG/WHT | | | |
| | | | | Pin 5 | CH B | YEL | | Pin 5 | CH A- | WHT/BLU | | | |
| | | | | | | | | Pin 6 | CH A+ | BLU/WHT | | | |
| | | | | | | | | Pin 7 | + 5 VDC | WHT/GRN | | | |
| | | | | | | | | Pin 8 | + 5 VDC | NC | | | |
| | | | | | | | | Pin 9 | CH B- | WHT/BRN | | | |
| | | | | | | | | Pin 10 | CH B+ | BRN/WHT | | | |
| Mating Connector | Connector: Molex 51021-0400 Pins: Molex 50079-8100 | | | Mating Connector | Connector: Molex 14-56-2052 Pins: Connector Includes Pins | | | Mating Connector | Connector: Molex 15-04-5104 Pins: Molex 14-60-0058 | | | | |

| Drive Accessories | | | | | | | | |
|---|---|--------|--------|--------|--------|--|--|--|
| Patch Cable | | | | | | | | |
|  | P/N | 50cm | 100cm | 200cm | 300cm | | | |
| | Red | CA2005 | CA2010 | CA2020 | CA2030 | | | |
| | Yellow | CA4005 | CA4010 | CA4020 | CA4030 | | | |
| | Gray | CA8005 | CA8010 | CA8020 | CA8030 | | | |
| Passive heatsink | | | | | | | | |
|  | Passive heatsink optimized for drives: SA45 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| fanned heatsink | | | | | | | | |
|  | One fan heatsink optimized for drives (fan is 1 x 24 VDC, .8 W): SA45 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| fanned heatsink | | | | | | | | |
|  | Two fan heatsink optimized for drives (fans are 2 x 24 VDC, .8 W): SA45 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Choke module | | | | | | | | |
|  | Choke module optimized for brushless drives. Inductance: IA2100 = 2x50 µH; IA2101 = 2x100 µH Nominal current: 10 A | | | | | | | |
| | | | | | | | | |
| DIN Rail mounting kit | | | | | | | | |
|  | DIN Rail mounting kit for units: SA45 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Break Out Board | | | | | | | | |
|  | Break Out Board for: SA45 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |



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