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STEP MOTOR DRIVES & CONTROLS 51

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Introduction To Step Motors

A STEP MOTOR IS DEFINED AS a device whose normal shaft motion consists of discrete angular movements of essentially uniform magnitude when driven from sequentially switched DC power supply.

A step motor is a digital input-output device. It is particularly well suited to the type of application where control signals appear as digital pulses rather than analog voltages. One digital pulse to a step motor drive or translator causes the motor to increment one precise angle of motion. As the digital pulses increase in frequency, the step movement changes into continuous rotation.

Types Of Step Motors

There are three basic types of step motors in common use:

- Active rotor: permanent magnet (PM)
- Reactive rotor: variable reluctance (VR)
- Combination of VR and PM: Hybrid(HY)

These are brushless electrical machines which rotate in fixed angular increments when connected to a sequentially switched DC current. When alternating current is used, the rotation is essentially continuous.

Permanent magnet: This type of step motor has a permanent magnet rotor. The stator can be similar to that of a conventional 2- or 3-phase induction motor or constructed similar to a stamped motor. The latter is the most popular type of step motor.

a.) Conventional permanent magnet type. Figure 1 shows a diagram of a conventional permanent magnet rotor step motor. A 2-phase winding is illustrated. Figure 1a shows Phase A energized with the "A" terminal positive. The field is at 0˚. With the coil wound as shown, the north seeking pole of the rotor is also at 0˚. The motor steps as shown in Table I.

TABLE I

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Energization phase A A'	phase B B'	Figure
0	0	0	+ —	off off	1a
1	90	90	off off	+ —	1b
2	180	180	— +	off off	1c
3	270	270	off off	— +	1d

The shaft completes one revolution for each complete revolution of the electromagnetic field in this motor.

Figure 2 shows the same motor with both windings energized. The important difference here is that the resultant electromagnetic field is between two poles. In figure 2, the field has moved 45˚ from the field in figure 1. Table II shows the energization sequence and rotor positions.

TABLE II

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Energization phase A A'	phase B B'	Figure
0	45	45	+ —	+ —	2a
1	135	135	— +	+ —	2b
2	225	225	— +	— +	2c
3	315	315	+ —	— +	2d

As in the one-phase-on energizing scheme, the shaft completes one revolution for each complete revolution of the electromagnetic field.

It should be evident that this motor can half step; i.e., step in small step increments. This is possible by combining the energization shown in Figure 1 with that shown in Figure 2. Figure 3 shows the diagrams of a motor with half-step rotor motion. The energizing sequence and rotor positions are shown in Table III.

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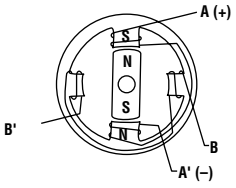
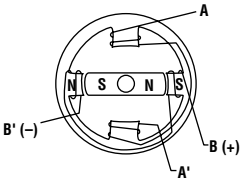
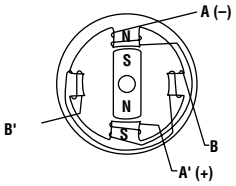
FIGURE 1



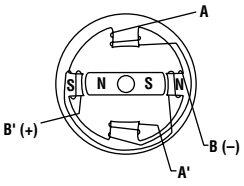
a.) PHASE A ENERGIZED



b.) PHASE B ENERGIZED.



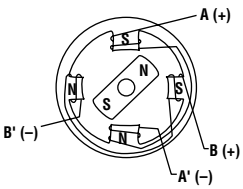
c.) PHASES A ENERGIZED WITH REVERSE POLARITY.



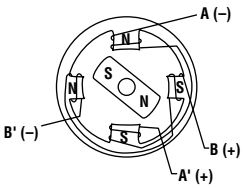
d.) PHASE B ENERGIZED WITH REVERSED POLARITY.

Conventional permanent magnet step motor shown with one phase energized with a bipolar drive. The electromagnetic field rotates in 90° increments. The rotor rotates in 90° increments.

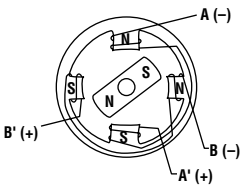
FIGURE 2



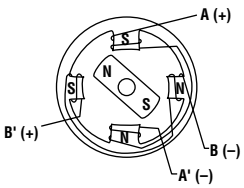
a.) PHASE A & B ENERGIZED



b.) PHASE A ENERGIZED WITH REVERSED POLARITY. PHASE B ENERGIZED.



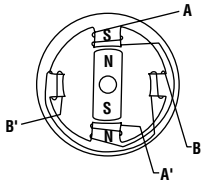
c.) PHASES A & B ENERGIZED WITH REVERSE POLARITY.



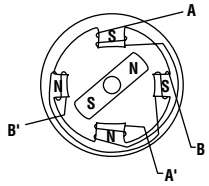
d.) PHASE A ENERGIZED. PHASE B ENERGIZED WITH REVERSED POLARITY.

Permanent magnet step motor shown with two phases energized with a bipolar drive.

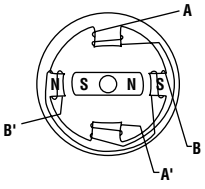
FIGURE 3



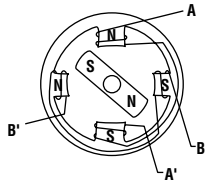
a.) PHASE A ENERGIZED



b.) PHASE A & B ENERGIZED.



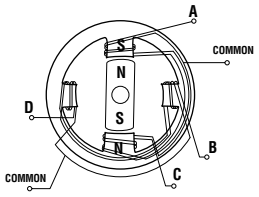
c.) PHASE B ENERGIZED.



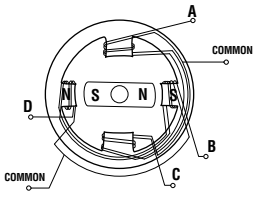
d.) PHASE B ENERGIZED. PHASE A ENERGIZED WITH REVERSED POLARITY.

PM step motor with half step motion.

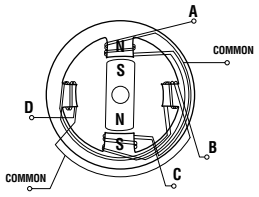
FIGURE 4



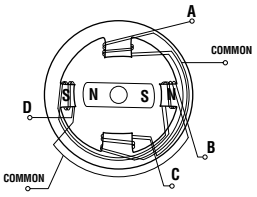
a.) PHASE A ON.



b.) PHASE B ON.



c.) PHASE C ON.



d.) PHASE D ON.

A conventional PM step motor with bifilar winding.

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TABLE III

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Energization phase A A'	phase B B'	Figure
0	0	0	+ —	off off	3a
1	45	45	+ —	+ —	3b
2	90	90	off off	+ —	3c
3	135	135	— +	+ —	3d

As in the previous diagrams, the rotor and shaft move through the same angle as the field. Note that each step resulted in a 45˚ rotation instead of 90˚ in the previous diagram.

A permanent magnet step motor may be wound with a bifilar winding to avoid the necessity of reversing the polarity of the winding. Figure 4 shows the bifilar winding while Table IV shows the energization sequence.

TABLE IV

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Energization phase A C	phase B D	Figure
0	0	0	on off	off off	4a
1	90	90	off off	on off	4b
2	180	180	off on	off off	4c
3	270	270	off off	off on	4d

Bifilar windings are easier to switch using a transistor controller. Fewer switching transistors are required.

b.) Stamped or can stack permanent magnet step motor. The most popular type of permanent magnet step motor is the so called stamped type, claw tooth, sheet metal, tin can or simply low cost motor. This motor is difficult to illustrate clearly because of the way it is constructed. The cutaway in Figure 5 is an attempt to show how this type of PM step motor looks. The motor is shown with both phases energized. The rotor is shown with 12 poles resulting in 24 steps per revolution with a 15˚ step angle. A schematic diagram of a PM step motor of the type illustrated in Figure 5 is shown in Figure 6. This motor has a pair of coils surrounding a permanent magnet rotor. The coils are enclosed in a soft iron housing with teeth on the inside reacting with the rotor. Each coil housing has the same number of teeth as the number of rotor poles. The housings are radially offset from each other by one-half the tooth pitch.

PM step motors are available with the following step angles:

Step Angle Degrees	Steps Per Revolution
1.8	200
3.6	100
3.75	96
7.5	48
9	40
10	36
11.25	32
15	24
18	20
22.5	16
30	12
45	8
90	4

Variable Reluctance Type: This type of step motor has an electromagnetic stator with a magnetically soft iron rotor having teeth and slots similar to the rotor of an inductor alternator. Whereas PM motors are basically 2-phase machines, VR motors require at least 3 phases. Most VR step motors have 3 or 4 phases although 5-phase VR motors are available.

A 3-phase VR motor diagram is shown in Figure 7. The motor shown has 12 stator teeth, 8 rotor teeth, and step angle of 15˚. The energization sequence is shown in Table V.

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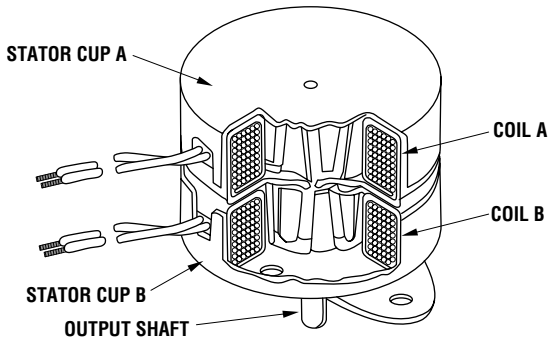
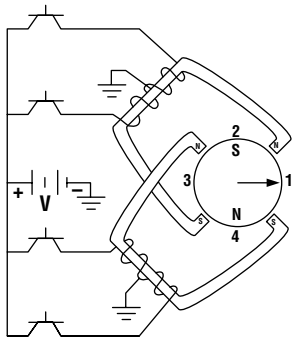
FIGURE 5



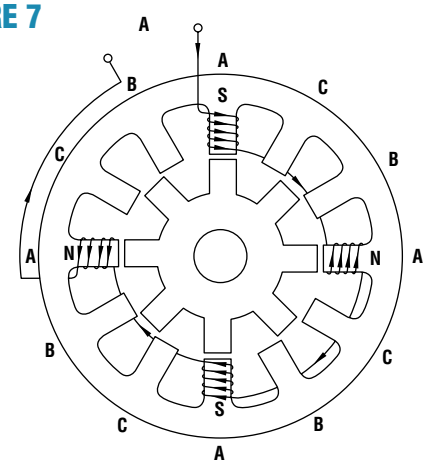
Cut-away view of a PM motor

FIGURE 6



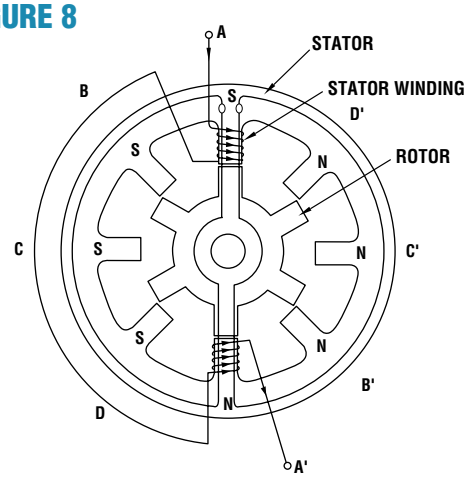
Schematic diagram of a PM motor.

FIGURE 7



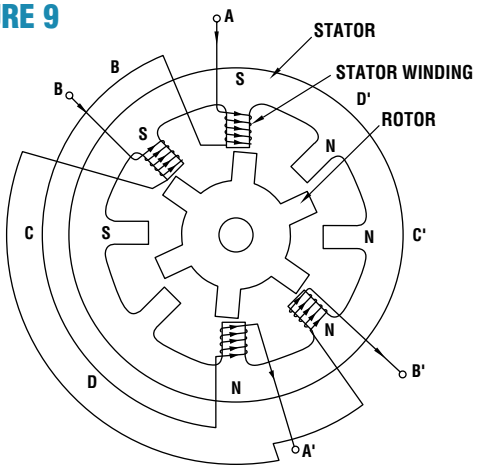
3 phase VR motor.

FIGURE 8



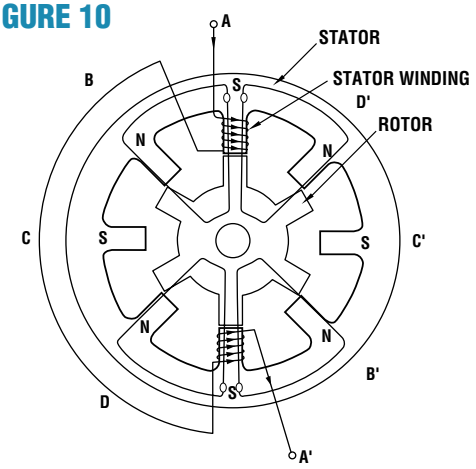
4 phase VR motor with one phase on.

FIGURE 9



4 phase VR motor with two phases on.

FIGURE 10



4 phase VR motor with one phase on. Wound for alternate polarity.

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TABLE V

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Energization Phase A	B	C
0	15	60	on	off	off
1	30	120	off	on	off
2	45	180	off	off	on
3	60	240	on	off	off

In a VR step motor, the field moves at a different rate than the rotor.

Figure 8 shows a diagram of a 4-phase 15˚ step angle motor with one phase energized. The energization diagram is shown in Table VI.

TABLE VI

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Phases A	B	C	D
0	15	-45	on	off	off	off
1	30	-90	off	on	off	off
2	45	-135	off	off	on	off
3	60	+135	off	off	off	on

Note the rotation of the electromagnetic field. The field takes a big jump in rotation between steps 2 and 3. This is characteristic of a motor connected this way. Figure 9 shows this motor with two phases energized at a time. The rotation of the field remains the same. A way to correct this is shown by the diagram in Figure 10. The diagrams in figures 8 and 9 illustrate windings connected 4N and 4S. This indicates the magnetic poles as they are energized. The coil hookup shown in Figure 10 shows a symmetrical hookup called N-S-N-S because of the coil polarity. Note that Phase A coil has two south poles and no north poles for a flux return path. You may rest assured that there will be one. The flux will return through the path of least reluctance, namely through the pole pairs which are nearest to two rotor teeth. This varies with rotor position. The flux induces a voltage in the coils wound on the pole. This induces a current in the winding slowing the rotor. The amount of current is determined by the voltage across the coil. A diode-clamped coil will have more current than a resistor diode or zener diode-clamped winding. Figure 11 illustrates the diagram of a 4-phase VR step motor with N-S-N-S hookup and two phases energized. Note the short flux path between poles.

It is frequently necessary to make the step angle smaller without using gearing. One method is to double the number of rotor and stator teeth. If the motor was constructed as shown in Figure 7, the teeth would be slender and difficult to wind. A better method of doing this is shown in Figure 12. The number of rotor and stator teeth is increased while the number of stator poles is reduced.

Figure 13 shows a diagram of a 5˚ per step variable reluctance step motor. A 1.8˚ per step VR step motor diagram is shown in Figure 14.

Variable reluctance step motors are available in the following step angles:

Step Angle Degrees	Steps Per Revolution
1.8	200
5	72
7.5	48
15	24

Hybrid: This type of motor is frequently referred to as a permanent magnet motor. It uses a combination of permanent magnet and variable reluctance structure. Its construction is similar to that of an induction motor. Figure 15 shows a simplified type of hybrid motor to illustrate its construction. The rotor has two end pieces (yokes) with salient poles equally spaced but radially offset from each other by one-half tooth pitch. A circular permanent magnet separates them. The yokes have essentially uniform flux of opposite polarity. The stator is formed from laminated steel. The motor shown in Figure 15 has 4 coils arranged in two groups of 2 coils in series. One coil pair is called Phase A and the other Phase B. For the motor illustrated, each pole has one tooth. The number of full steps per revolution may be determined from the following formula:

$SPR = N_R \times Ø$

Where: SPR = number of steps per revolution

N_R = total number of rotor teeth (total for both yokes)

Ø = number of motor phases

or: $N_R = SPR/Ø$

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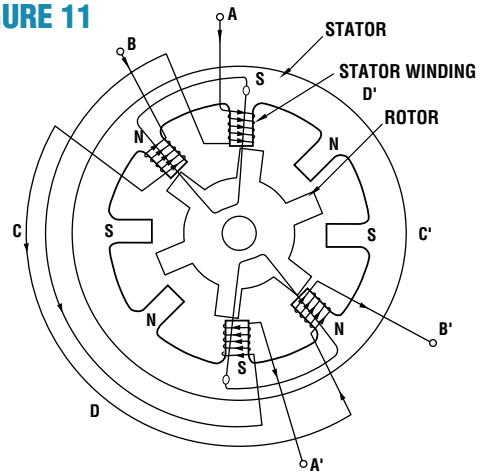
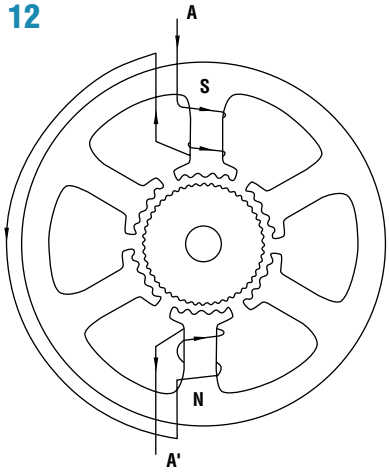
FIGURE 11



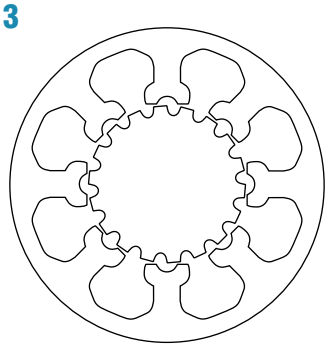
4 phase VR motor with two phases on. Wound for alternate polarity.

FIGURE 12



Stator poles with multiple teeth.

FIGURE 13



5° step angle VR motor.

FIGURE 14

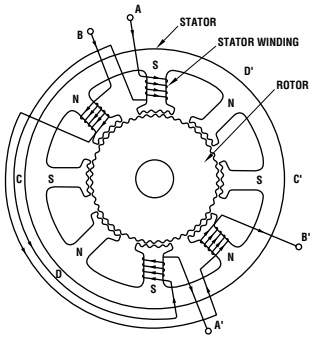
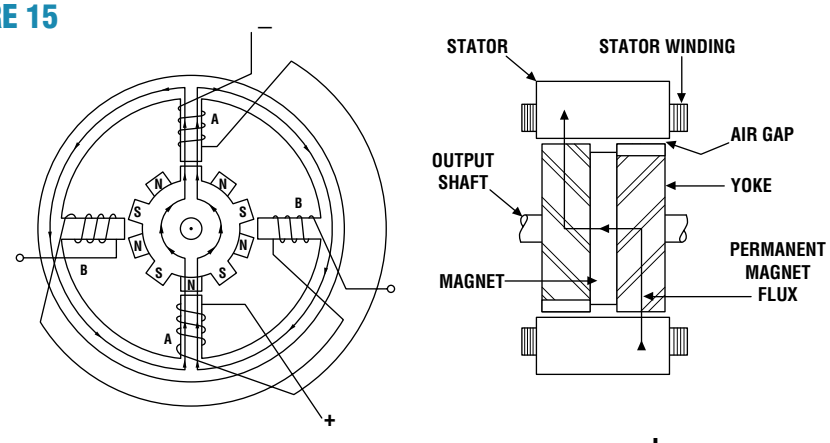


Diagram of 1.8° VR motor.

FIGURE 15



a **b**

a.) Cross section, phase A energized.
b.) Axial view.

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Example: The motor shown in Figure 15 has a 2 Ø winding and a rotor with 5 teeth per yoke for a total of 10 teeth. Calculate the number of steps/rev.

SPR = 10 X 2 = 20 steps/rev.

The step angle may be found from the following formula:

SA = 360/SPR

Where: SA = the step angle in degrees
SPR = steps per revolution

Example: Calculate the step angle for the above motor.

SA = 360/20 = 18°

The step angle may be calculated directly without knowing the number of phases if the number of stator teeth and teeth per pole are known. Figure 15 shows one tooth per pole and a total of 4 teeth on the stator.

Formula: $SA = (1/N_{st} - 1/N_{RP}) \text{ X } 360^{N} \text{ X } N_{STP}$

Where: SA = step angle in degrees
N_{ST} = number of stator teeth
N_{RP} = number of rotor teeth per pole or yoke
N_{STP} = number of stator teeth per pole

Note that motors are frequently built with one or two teeth between each pole left out to facilitate winding the motor and reduce flux leakage between poles. This formula requires that the theoretical number of teeth be used.

Note that here, too, the theoretical number of teeth must be used. It is usually easy to visually determine if a tooth or two has been left out between poles.

Example: The motor in Figure 15 has 5 teeth on each rotor yoke and one tooth per pole with 4 teeth total.

NA = (1/4 - 1/5) x 360 x 1
= (.25 - .20) x 360
= 18˚

Figure 16 shows the shaft rotation with 2-phase-on. The switching sequence, field rotation and output shaft rotation are shown in Table VII.

TABLE VII

Step	Position Rotor & Shaft	(Mechanical Degrees) Electromagnetic Field	Phases A	Phases B	Figure
0	9˚	45˚	+	+	16a
1	27˚	135˚	—	+	16b
2	45˚	215˚	—	—	16c
3	63˚	305˚	+	—	16d

Figure 17 shows a 5˚ hybrid step motor. Note that the rotor has 18 teeth on each yoke for a total of 36 teeth. The commonly available 1.8˚ hybrid diagram is shown in Figure 18.

Hybrid step motors are available in the following step angles:

Step Angle Degrees	Steps Per Revolution
0.45	800
0.72	500
0.9	400
1.8	200
1.875	192
2	180
2.5	144
3.6	100
5	72

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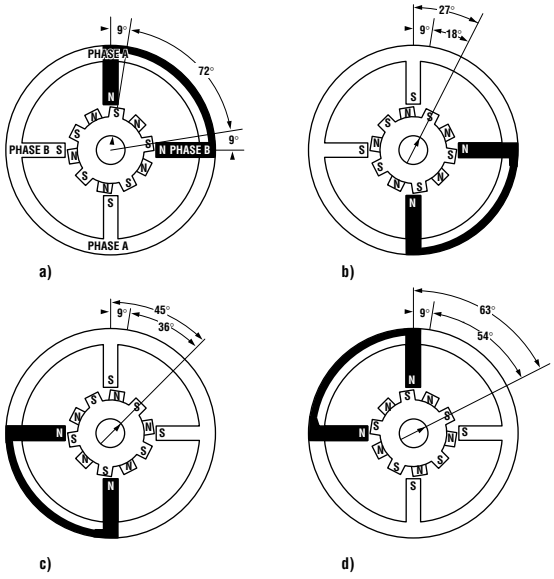
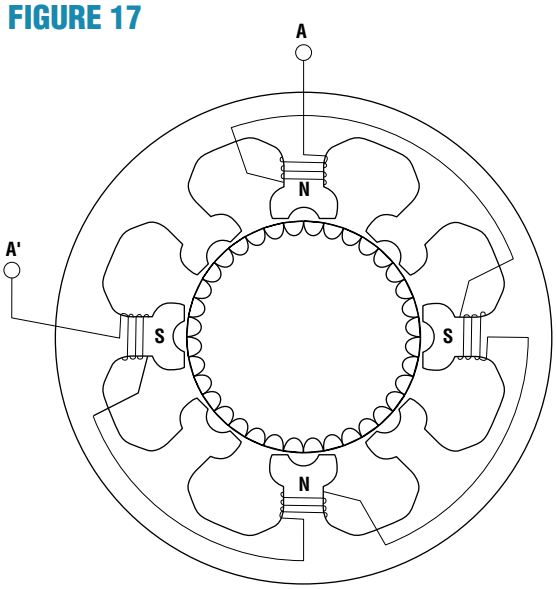
FIGURE 16



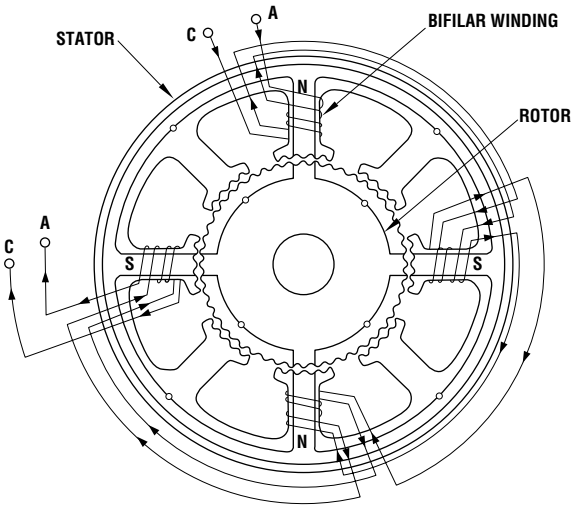
Rotation diagram of 18° Hybrid motor.

FIGURE 17



5° Hybrid motor.

FIGURE 18



1.8° Hybrid motor.

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Conversion Tables

Inertia Conversion Tables

To convert from A to B multiply by entry in table.

A \ B	lb•ft²	lb•ft•s² or slug-ft²	lb•in²	lb•in•s²	oz•in²	oz•in•s²	kg•cm²	kg•cm•s²	g•cm²	g•cm•s²
lb•ft²	1	3.108×10^{-2}	144	.373	2.304×10^{3}	5.968	421.40	0.4297	4.214×10^{5}	429.71
lb•ft•s²	32.174	1	4.633×10^{3}	12	7.413×10^{4}	192	1.356×10^{4}	13.825	1.356×10^{7}	1.383×10^{4}
lb•in²	6.944×10^{-3}	2.158×10^{-4}	1	2.590×10^{-3}	16	4.144×10^{-2}	2.926	2.984×10^{-3}	2.926×10^{3}	2.984
lb•in•s²	2.681	8.333×10^{-2}	386.1	1	6.177×10^{3}	16	1.130×10^{3}	1.152	1.130×10^{6}	1.152×10^{3}
oz•in²	4.34×10^{-4}	1.349×10^{-5}	6.25×10^{-2}	1.619×10^{-4}	1	2.59×10^{-3}	0.183	1.865×10^{-4}	182.901	0.186
oz•in•s²	0.168	5.208×10^{-3}	24.13	6.25×10^{-2}	386.088	1	70.616	7.201×10^{-2}	7.0616×10^{4}	72.008
kg•cm²	2.373×10^{-3}	7.376×10^{-5}	0.3417	8.851×10^{-4}	5.467	1.416×10^{-2}	1	1.0197×10^{-3}	1000	1.0197
kg•cm•s²	2.327	7.233×10^{-2}	335.109	0.8679	5.362×10^{3}	13.887	980.665	1	9.807×10^{5}	1000
g•cm²	2.373×10^{-6}	7.376×10^{-8}	3.417×10^{-4}	8.851×10^{-7}	5.467×10^{-3}	1.416×10^{-5}	10^{-3}	1.0197×10^{-6}	1	1.0197×10^{-3}
g•cm•s²	2.327×10^{-3}	7.233×10^{-5}	0.3351	8.680×10^{-4}	5.362	1.389×10^{-2}	.9807	10^{-3}	980.667	1

Example: Convert a rotor inertia of 90 g•cm² to oz•in•sec²

The multiplier from the table above is 1.416×10^{-5}

The new inertia = $90 \times 1.416 \times 10^{-5} = 1.27 \times 10^{3}$ oz•in•sec²

Torque Conversion Tables

To convert from A to B multiply by entry in table.

A \ B	lb•ft	lb•in	oz•in	dyne•cm	N•m	mN•m	kg•cm	g•cm
lb•ft	1	12	192	1.356×10^{7}	1.356	1.356×10^{3}	13.825	1.3825×10^{4}
lb•in	8.333×10^{-2}	1	16	1.130×10^{6}	0.113	1.13×10^{2}	1.152	1.152×10^{3}
oz•in	5.208×10^{-3}	6.250×10^{-2}	1	7.062×10^{4}	7.062×10^{-3}	7.062	7.201×10^{-2}	72.01
dyne•cm	7.376×10^{-8}	8.851×10^{-7}	1.416×10^{-5}	1	10^{-7}	10^{-4}	1.0197×10^{-6}	1.0197×10^{-3}
N•m	0.7376	8.851	141.62	10^{7}	1	1000	10.197	1.0197×10^{4}
mN•m	7.376×10^{-4}	8.851×10^{-3}	0.1416	10^{4}	10^{-3}	1	1.0197×10^{-2}	10.197
kg•cm	7.233×10^{-2}	0.8679	13.877	9.8066×10^{5}	9.8066×10^{-2}	98.066	1	1000
g•cm	7.233×10^{-5}	8.680×10^{-4}	1.389×10^{-2}	980.67	9.8066×10^{-5}	9.8066×10^{-2}	10^{-3}	1

Example: Convert a torque of 53 oz•in to kg•cm.

The multiplier from the table above is 7.201×10^{-2}

The new value of torque is 53 x 72.01 = 3.816 kg•cm

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Personal Notes

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Glossary

Accuracy (step)
The correctness of the distance a step motor moves during each step. Does not include errors due to hysteresis.

Axial Play
The axial shaft displacement due to a reversal of an axial force on the shaft. (End play)

Bifilar (winding)
Two windings wound (in parallel) on the same pole. This permits magnet polarity reversal with simple switching means.

Bi-level Drive (dual voltage drive)
A driver where two levels of voltage are used to drive a step motor. A high (over drive) voltage is applied to the winding each time it is switched on. The high voltage stays on until the current reaches a predetermined level. The high voltage is turned off after a time period determined experimentally or by sensing winding current. The low voltage maintains the rated or desired current.

Bipolar Drive
A drive which reverses the magnetic polarity of a pole by electronically switching the polarity of the current to the winding (+ or –). Bipolar drives can be used with 4, 6 or 8 lead motors. With 4 and 8 lead motors bipolar drives are usually more efficient than unipolar drives.

Chopper Drive
A step motor drive that uses switching amplifiers to control motor current. Chopper drives are more efficient than L/R or voltage drives.

Controller (step motor)
A system consisting of a DC power supply and power switches plus associated circuits to control the switches in the proper sequence.

Detent Torque
The maximum torque required to slowly rotate a step motor shaft with no power applied to the windings. This applies only to permanent magnet or hybrid motors. The leads are separated from each other.

Driver
An electronic package to convert digital step and direction inputs to currents to drive a step motor.

Duty Cycle
The percentage of ON time vs. OFF time. A device that is always on has a 100% duty cycle. Half on and half off is a 50% duty cycle.

End Play
The axial shaft motion, due to the reversal of an axial force acting on a shaft with axial clearance or low axial preload.

Friction (coulomb)
A resistance to motion between nonlubricated surfaces. This force remains constant with velocity.

Friction (viscous)
A resistance to motion between lubricated surfaces. This force is proportional to the relative velocity between the surfaces.

Holding Torque (static torque)
The maximum restoring torque that is developed by the energized motor when the shaft is slowly rotated by external means. The windings are on but not being switched.

Hybrid Step Motor (HY)
A type of step motor comprising a permanent magnet and variable reluctance stator and rotor structures. It uses a double salient pole construction.

Hysteresis (positional)
The difference between the step positions when moving CW and the step position when moving CCW. A step motor may stop slightly short of the true position thus producing a slight difference in position CW to CCW.

Indexer
An electronic control which converts motion commands from a computer terminal into pulse and direction signals for use by a step motor driver.

Inductance (mutual)
The property that exists between two current-carrying conductors or coils when magnetic lines of flux from one link with those of the other.

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Inductance (self)
The constant by which the time rate of change of the coil current must be multiplied to give the self-induced counter emf.

Instantaneous Start Stop Rate
The maximum switching rate that an unloaded step motor will follow without missing steps when starting from rest.

L/R Drive
A drive that uses external resistance to allow a higher voltage than that of a voltage drive. L/R drives have better performance than voltage drives, but have less performance and efficiency than a chopper drive.

Maximum Reversing Rate
The maximum switching rate at which an unloaded motor will reverse direction of rotation without missing steps.

Maximum Slew Rate
The maximum pulse rate at which a step motor with no load will run and remain in synchronism.

Microstepping
A technique in which motor steps are electronically divided by the drive into smaller steps. The most common microstep resolutions are 10, 25 and 50 steps per full step, but many resolutions, ranging from 2 to 256 microsteps per full step are available.

Oscillator
A device that is used to produce pulses for driving a step motor at a preset speed. Some A.M.P. drives are available with built in oscillators.

Overshoot
The amount the step motor shaft rotates beyond the commanded stopping position. Usually applies to a single step.

Permanent Magnet Step Motor (PM)
A step motor having a permanent magnet rotor and wound stator.

Positional Accuracy
The maximum error in one revolution of a full step in 360˚. Expressed as a percentage of a full step.

Pull-in Rate (response rate)
The maximum switching rate at which an unloaded motor can start without losing step positions.

Pull-in Torque
The maximum torque load at which a step motor will start and run in synchronism with a fixed frequency pulse train without losing step positions.

Pull-out Torque
The maximum torque load that can be applied to a motor running at a fixed stepping rate while maintaining synchronism. Any additional load torque will cause the motor to stall or miss steps.

Pulse Rate
The rate at which successive steps are initiated or the windings switched.

Radial Play
The side to side movement of the shaft due to clearances between the shaft and bearing, bearing to housing, and bearing internal clearance for ball and roller bearings. (Side play)

Response Rate (pull-in rate)
The switching rate an unloaded motor can follow from a standing start without missing steps.

Settling Time
The elapsed time starting the instant the rotor reaches the commanded step position and the oscillations settle to within a specified displacement band about the final position, usually ±3 to ±5 percent.

Stall Torque (holding or static torque)
The maximum restoring torque that is developed by the energized motor when the shaft is slowly rotated by external means. The windings are not switched.

Step Angle
The nominal angle through which the step motor shaft rotates between adjacent step positions.

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Step Rate (speed)
The number of steps a shaft rotates during a specified time interval.

Step-to-step Accuracy
The maximum error that occurs between any adjacent step, expressed as a percentage of one full step.

Switching Amplifier
A device that switches a high voltage on and off to control current. Some amplifiers (PWM types) switch at a constant frequency and adjust duty cycle to control current. Other types have a fixed off time and adjust the frequency.

Switching Sequence (energizing sequence)
The sequence and polarity of voltages applied to the coils of a step motor that result in a specified direction of rotation.

Thermal Resistance
The resistance to the flow of heat between two surfaces of the same body or different bodies. Thermal resistance = Winding temperature/Watts in the winding = ˚C/Watt.

Thermal Time Constant
The time required for the motor winding to reach 63.2% of its final temperature.

Torque Displacement Curve
The holding (restoring) torque plotted as a function of rotor angular displacement with the motor energized.

Torque Gradient (stiffness)
The ratio of the change in holding torque for a particular change in shaft position when the motor is energized.

Unipolar Drive
The motor phase winding current is switched in one direction only. The polarity of the applied voltage to each winding is always the same. Unipolar drives require 6 or 8 lead motors.

Variable Reluctance Step Motor (VR)
A step motor having a wound stator or stators with salient poles working with a soft iron rotor having salient poles on the periphery.

Viscous Damping
A damper which provides a drag or friction torque proportional to speed. At zero speed the drag torque is reduced to zero.

Viscous Inertia Damper
A damper with an inertia coupled to the motor shaft, through a film of viscous fluid, usually silicone oil to minimize viscosity variations due to temperature changes. This damper only responds when the velocity between the damper inertia and motor shaft changes. At steady state speed there is no effect from the damper.

Voltage Drive
A drive operated at the minimum voltage required to safely limit motor current. Motors used with voltage drives produce less torque at higher speeds than when used with L/R or chopper drives.

Wave Drive
Energizing the motor phases one at a time. Driving the motor one phase or winding on at a time.

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Mechanical, Electrical & Environmental Specifications

	SIZE 14	SIZE 16	SIZE 17	SIZE HT17	SIZE 23	SIZE HT23	SIZE 34
SHAFT RUN-OUT (inches)	.0005	.0005	.0005	.0005	.001	.002	.002
RADIAL PLAY (inch/Lbs.)	.0004 max @ 1 Lb.	.0008 max @ 1 Lb.	.001 max @ 4.4 Lbs.	.0008 max @ 1 Lb.	.001 max @ 1 Lb.	.001 max @ 1 Lb.	.001 max @ 1 Lb.
END PLAY (inch/Lbs.)	.0004 max @ 2 Lb.s	.0006 max @ 3 Lbs. .002 min @ 8 Lbs.	.001 max @ 6.6 Lbs.	.003 max @ 2.2 Lbs.	.001 max @ 9 Lbs.	.003 max @ 2.2 Lbs.	.001 max @ 15 Lbs.
PERPENDICULARITY	.003	.003	.003	.003	.003	.003	.003
CONCENTRICITY (inches)	.002	.002	.002	.002	.002	.003	.002
OPERATING TEMPERATURE RANGE	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C	-20°C to 50°C
INSULATION CLASS	130°C Class B	130°C Class B	130°C Class B	130°C Class B	130°C Class B	130°C Class B	130°C Class B
LEAD WIRE GAUGE	26 AWG	26 AWG	26 AWG	26 AWG	26 AWG	22 AWG	18 AWG
MAXIMUM RADIAL LOAD	5	5	5	5	15	15	25
MAXIMUM THRUST LOAD	3	3	3	3	25	25	50

Design Tips

- Series connect lead wires for best torque at low speeds.
- Center tap to end or parallel connect lead wires for best torque at higher speeds.
- Keep motor case temperature below 100˚ C. This can be achieved by lowering the motor current or limiting the duty cycle.
- Allow sufficient time to accelerate load.
- Size motor with 100% safety factor for required torque @ speed.
- Do not disassemble motors. A significant reduction in motor performance will result.
- Do not machine shafts without consulting Applied Motion Products.
- Do not disconnect motor from drive while in operation.
- Do not use holding torque/detent torque of motor as fail safe brake.

Motion Installation Tips

- Mount the motor securely against a surface with good thermal conductivity such as steel or aluminum.
- Properly align the motor with the load using a flexible coupling.
- Protect the motor shaft from excessive thrust, overhung and shock loads.

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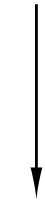
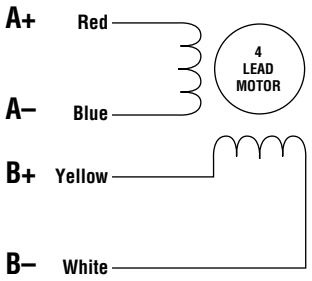
4 Lead Wire Configuration – Bipolar Drive

STEP TABLE				
STEP	RED	BLUE	YELLOW	WHITE
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

CW FACING MOUNTING END



WIRING DIAGRAM



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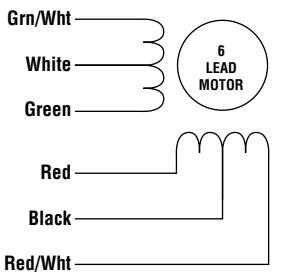
6 Lead Wire Configuration – Unipolar Drive

STEP TABLE				
STEP	RED	RED/WHT	GRN	GRN/WHT
0	ON	OFF	ON	OFF
1	OFF	ON	ON	OFF
2	OFF	ON	OFF	ON
3	ON	OFF	OFF	ON
4	ON	OFF	ON	OFF

CW FACING MOUNTING END

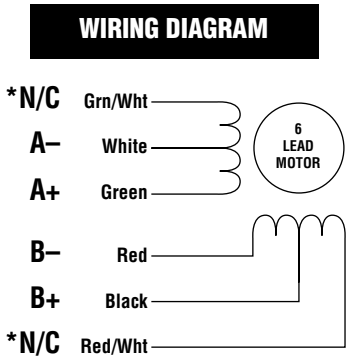


Connect center taps (white & black) to plus (+) voltage. **UNIPOLAR DRIVE ONLY!**

6 Lead Wire Configuration – Bipolar Drive/Center Tap to End

STEP TABLE				
STEP	RED	BLACK	GREEN	WHITE
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

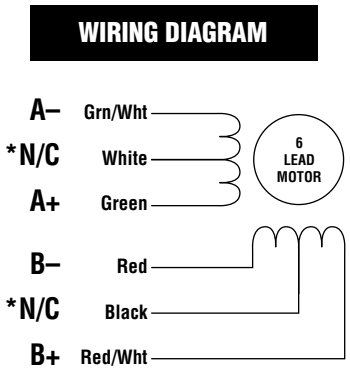
CW FACING MOUNTING END



6 Lead Wire Configuration – Bipolar Drive/End to End

STEP TABLE				
STEP	RED	RED/WHT	GREEN	GRN/WHT
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

CW FACING MOUNTING END



* **NC** denotes lead wires are not connected and are individually taped off.

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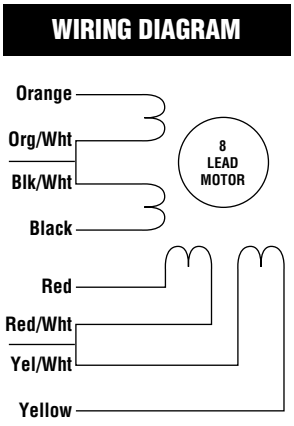
8 Lead Wire Configuration – Unipolar Drive

STEP TABLE				
STEP	ORANGE	BLACK	RED	YELLOW
0	ON	OFF	ON	OFF
1	OFF	ON	ON	OFF
2	OFF	ON	OFF	ON
3	ON	OFF	OFF	ON
4	ON	OFF	ON	OFF

CW FACING MOUNTING END

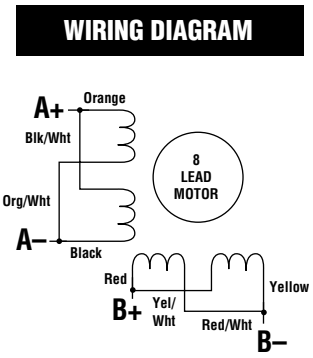


Connect orange/white, black/white, red/white, and yellow/white to plus (+) voltage.
UNIPOLAR DRIVE ONLY!

8 Lead Wire Configuration – Bipolar Drive/Parallel Connected

STEP TABLE				
STEP	A+	A–	B+	B–
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

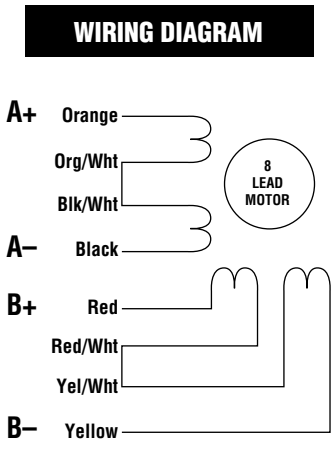
CW FACING MOUNTING END



8 Lead Wire Configuration – Bipolar Drive/Series Connected

STEP TABLE				
STEP	ORANGE	BLACK	RED	YELLOW
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

CW FACING MOUNTING END



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Holding Torque Measurement

Electrical and holding torque ratings shown in the catalog tables are based on the motor being connected using the following drive schemes:

Leads	Drive Scheme	Holding Torque
4	bipolar	bipolar, 2 phase on
6	unipolar	unipolar, 2 phase on
8	unipolar	unipolar, 2 phase on

Rating Conversion

Step motors can be connected using a variety of drive schemes. To determine the rating of a motor using a drive scheme that is different than the standard rating method, multiply the standard rated value by the number indicated in the chart that corresponds to the drive scheme desired.

Desired Value

Known Value Drive Scheme	Rating	Unipolar multiplier	Bipolar series multiplier	Bipolar parallel multiplier
Unipolar	volts	1	1.4	.7
Bipolar Center Tap to End	amps	1	.7	1.4
	mH	1	4	1
Bipolar series	volts	.7	1	.5
	ohms	.5	1	.25
	holding torque	.7	1	1
Bipolar parallel	amps	.7	.5	1
	mH	1	4	1

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Step Motors

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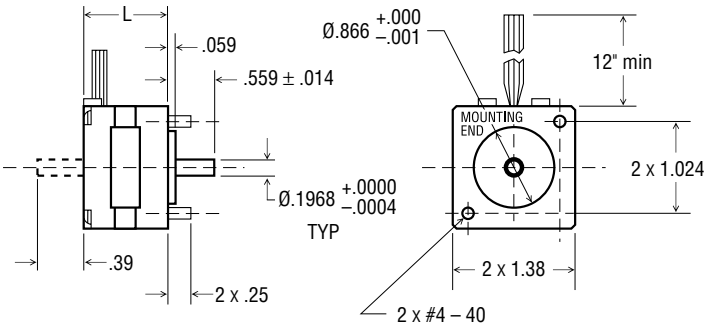
Hybrid Step Motors

SIZE 14



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
5014-820	2	1.00	8.0	4	1.8	3.2	.35	8.5	8.0	.051/9.3	.33
5014-842	2	1.57	26.0	4	1.8	4.8	1.0	4.3	5.5	.109/20	.47

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

• Part numbers listed are for single shaft. To order double shaft add 'D' to the end.

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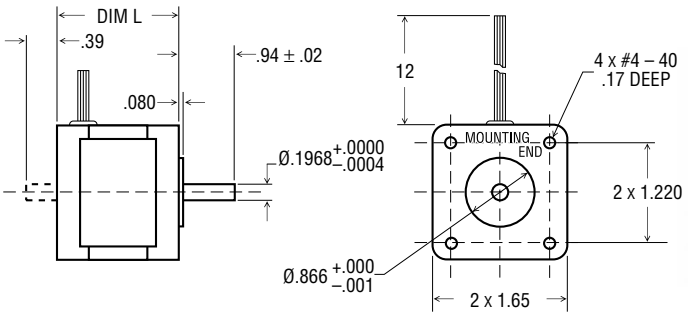
Hybrid Step Motors

SIZE 17



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
5017-006	1	1.34	21.2	6	1.8	5.7	.67	8.4	12.4	.104/19.0	.40
	3		15.0			4.0	.95	4.2	3.1		
5017-007	1		21.2			13.6	.28	48.0	64.0		
	3		15.0			9.6	.40	24.0	16.0		
5017-008	1		14.1			17.0	.11	150.0	180.0		
	3		10.0			12.0	.16	75.0	45.0		
5017-009	1	1.54	31.1			8.5	.57	15.0	26.0	.147/27.0	.52
	3		22.0			6.0	.80	7.5	6.5		
5017-010	1		31.1			17.0	.28	60.0	112.0		
	3		22.0			12.0	.40	30.0	28.0		
5017-011	1		31.1			33.9	.14	240.0	420.0		
	3		22.0			24.0	.20	120.0	105.0		
5017-012	1	1.85	42.4			5.7	.85	6.6	11.2	.191/35.0	.66
	3		30.0			4.0	1.20	3.3	2.8		
5017-013	1		42.4			8.5	.57	15.0	23.2		
	3		30.0			6.0	.80	7.5	5.8		
5017-014	1		42.4			17.0	.28	60.0	104.0		
	3		30.0			12.0	.40	30.0	26.0		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

• Part numbers listed are for single shaft. To order double shaft add 'D' to the end.

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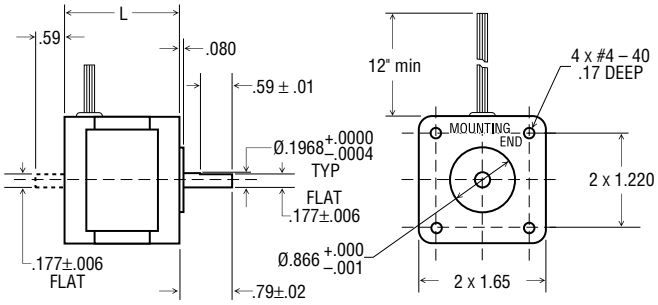
Hybrid Step Motors

SIZE HT 17



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
HT17-068	1	1.3	31.4	8	1.8	5.7	.67	8.4	11.2	.190/35.0	.44
	2		31.4			2.8	1.34	2.1	2.8		
	3		22.2			4.0	0.95	4.2	2.8		
HT17-069	1		31.4			13.6	0.28	48.0	60.0		
	2		31.4			6.8	0.57	12.0	15.0		
	3		22.2			9.6	0.40	24.0	15.0		
HT17-070	1		31.4			17.5	0.22	80.0	88.0		
	2		31.4			8.8	0.44	20.0	22.0		
	3		22.2			12.4	0.31	40.0	22.0		
HT17-071	1	1.54	51.0			5.7	0.85	6.6	14.4	.29/54.0	.57
	2		51.0			2.8	1.70	1.7	3.6		
	3		36.1			4.0	1.20	3.3	3.6		
HT17-072	1		51.0			9.0	0.57	16.0	30.4		
	2		51.0			4.5	1.13	4.0	7.6		
	3		36.1			6.4	0.80	8.0	7.6		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

- Part numbers listed are for single shaft. To order double shaft add 'D' to the end.
- All HT17 motors are optimized for microstepping.

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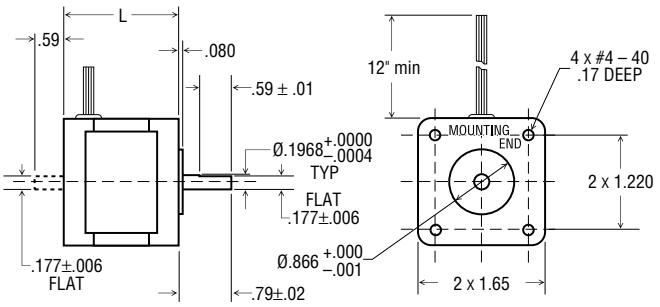
Hybrid Step Motors

SIZE HT 17



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
HT17-073	1	1.54	51.0	8	1.8	17.0	0.28	60.0	120.0	.29/54.0	.57
	2		51.0			8.5	0.57	15.0	30.0		
	3		36.1			12.0	0.40	30.0	30.0		
HT17-074	1		51.0			33.9	0.14	240.0	424.0		
	2		51.0			17.0	0.28	60.0	106.0		
	3		36.1			24.0	0.20	120.0	106.0		
HT17-075	1	1.85	62.8			5.7	0.85	6.6	12.0	.37/68.0	.73
	2		62.8			2.8	1.70	1.7	3.0		
	3		44.4			4.0	1.20	3.3	3.0		
HT17-076	1		62.8			10.2	0.57	18.0	38.0		
	2		62.8			5.1	1.13	4.5	9.5		
	3		44.4			7.2	0.80	9.0	9.5		
HT17-077	1		62.8			17.0	0.28	60.0	116.0		
	2		62.8			8.5	0.57	15.0	29.0		
	3		44.4			12.0	0.40	30.0	29.0		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

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Hybrid Step Motors

SIZE 23

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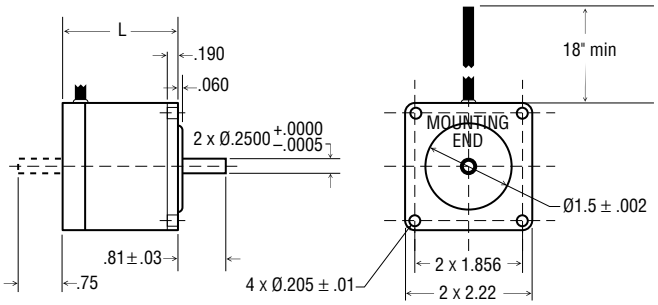

Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
4023-839	1	1.5	49.5	6	1.8	8.5	0.71	12.0	20.0	.311/57	.80
	3		35.0			6.0	1.00	6.0	5.0		
5023-019	1		56.6			18.7	0.31	60.0	112.0		
	3		40.0			13.2	0.44	30.0	28.0		
4023-819	1	2.0	74.9			7.2	0.71	10.2	40.0	.547/100	1.17
	3		53.0			5.1	1.00	5.1	10.0		
4023.820	1		74.9			1.8	2.76	0.7	1.4		
	3		53.0			1.3	3.90	0.33	0.35		
4023-823	1		74.9			15.6	0.31	50.0	152.0		
	3		53.0			11.0	0.44	25.0	38.0		
4023-998	1		74.9			33.9	0.21	160.0	328.0		
	3		53.0			24.0	0.30	80.0	82.0		
5023-100	2		81.0	4		3.2	2.00	1.6	5.0		
* 5023-122	1		74.9	8		4.9	0.99	5.0	17.2		
	2		74.9			2.5	1.98	1.3	4.3		
	3		69.0			3.5	1.40	2.5	4.3		
5023-196	1		53.0	6		18.7	0.42	44.0	128.0		
	3		80.0			13.2	0.60	22.0	32.0		
5023-094	1	2.25	117.0			8.5	0.85	10.0	23.0	.79/144	1.20
	3		83.0			6.0	1.20	5.0	8.0		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

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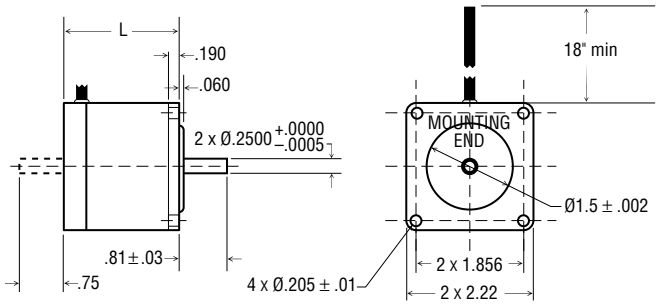
Hybrid Step Motors

SIZE 23



	Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
	5023-499	2	2.25	110.0	4	1.8	3.3	2.00	1.7	5.0	.79/144	1.20
	4023-828	1	3.0	141.0	6		2.7	3.32	0.8	2.0	1.28/234	2.00
		3		100.0			1.9	4.70	0.4	0.5		
	4023-830	1		141.0			6.6	1.27	5.2	20.0		
		3		100.0			4.7	1.80	2.6	5.0		
	5023-024	1		141.1			7.6	1.06	7.2	27.9		
		2		100.0			5.4	1.50	3.6	6.9		
*	5023-123	1		141.0	8		5.9	1.26	4.6	18.8	1.14/210	
		2		141.0			3.0	2.52	1.2	4.7		
		3		100.0			4.2	1.78	2.3	4.7		
	5023-149	1	3.25	198.0			5.1	1.41	3.6	16.0	1.19/219	2.12
		2		198.0			2.5	2.83	0.9	4.0		
		2		198.0			3.6	2.00	1.8	4.0		
	4023-833	1	4.0	212.0	6		3.6	3.25	1.1	3.2	1.76/322	2.80
		3		150.0			2.5	4.60	0.54	0.8		
	4023-835	1		212.0			5.1	2.05	2.48	9.2		
		3		150.0			3.6	2.90	1.24	2.3		
*	5023-124	1		212.0	8		5.7	1.75	3.3	16.8	1.72/315	
		2		212.0			2.8	3.29	0.8	4.2		
		3		150.0			4.0	2.47	1.63	4.2		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

• Part numbers listed are for single shaft. To order double shaft add 'D' to the end.

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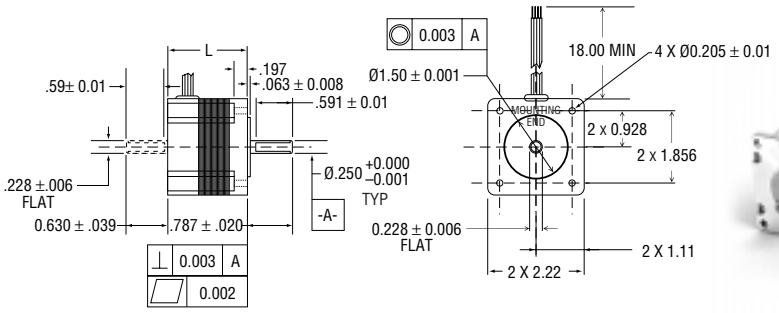
Hybrid Step Motors

SIZE HT 23



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
HT23-393	1	1.54	76.6	8	1.8	7.4	0.71	10.4	21.6	0.66/120	1.0
	2		76.6			3.7	1.41	2.6	5.4		
	3		54.2			5.2	1.00	5.2	5.4		
HT23-394	1		76.6			4.0	1.41	2.8	5.6		
	2		76.6			2.0	2.83	0.7	1.4		
	3		54.2			2.8	2.00	1.4	1.4		
HT23-395	1		76.6			2.7	2.12	1.3	2.4		
	2		76.6			1.3	4.24	0.3	0.6		
	3		54.2			1.9	3.00	0.6	0.6		
HT23-396	1	2.13	177.0			10.2	0.71	14.4	44.0	1.64/300	1.54
	2		177.0			5.1	1.41	3.6	11.0		
	3		125.0			7.2	1.00	7.2	11.0		
HT23-397	1		177.0			5.1	1.41	3.6	10.0		
	2		177.0			2.5	2.83	0.9	2.5		
	3		125.0			3.6	2.00	1.8	2.5		

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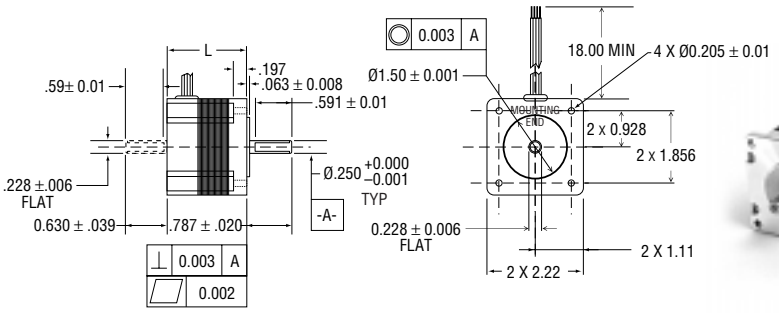
SIZE HT 23



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
HT23-398	1	2.13	177.0	8	1.8	3.3	2.12	1.5	4.8	1.64/300	1.54
	2		177.0			1.6	4.24	0.4	1.2		
	3		125.0			2.3	3.00	0.8	1.2		
HT23-399	1	2.99	264.0			11.6	0.71	16.4	56.0	2.62/480	2.20
	2		264.0			5.8	1.41	4.1	14.0		
	3		187.0			8.2	1.00	8.2	14.0		
HT23-400	1		264.0			6.4	1.41	4.5	14.4		
	2		264.0			3.2	2.83	1.1	3.6		
	3		187.0			4.5	2.00	2.3	3.6		
HT23-401	1		264.0			4.2	2.12	2.0	6.4		
	2		264.0			2.1	4.24	0.5	1.6		
	3		187.0			3.0	3.00	1.0	1.6		

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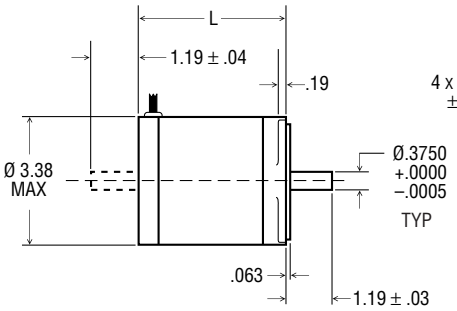
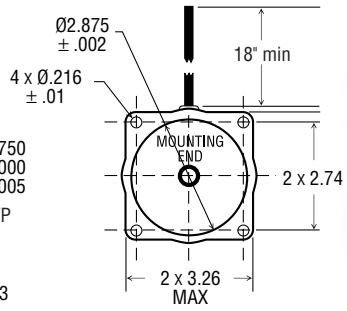
Hybrid Step Motors

SIZE 34





	Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
	4034-322	1	2.5	212.0	6	1.8	8.2	1.13	7.2	46.0	3.66/670	3.00
		3		150.0			5.8	1.60	3.6	11.5		
	4034-324	1		212.0			3.5	2.19	1.6	12.0		
		3		150.0			2.5	3.10	0.8	3.0		
	4034-326	1		212.0			2.5	3.32	0.8	5.0		
		3		150.0			1.8	4.70	0.4	1.3		
*	5034-348	1		212.0	8		3.0	2.42	1.3	10.0		
		2		212.0			1.5	4.84	0.3	2.5		
		3		150.0			2.1	3.42	0.6	2.5		
	4034-329	1	3.7	424.0	6		4.2	2.83	1.5	12.0	6.72/1230	5.40
		3		300.0			3.0	4.00	0.8	3.0		
	4034-331	1		424.0			3.5	3.25	1.1	11.0		
		3		300.0			2.5	4.60	0.6	2.8		
*	5034-349	1		424.0	8		3.5	3.24	1.0	11.6		
		2		424.0			1.8	7.07	0.3	2.9		
		3		300.0			2.5	5.00	0.5	2.9		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

- Part numbers listed are for single shaft. To order double shaft add 'D' to the end.
- All size 34 motors are optimized for microstepping.

* Optimized for use with 160 volt drives.

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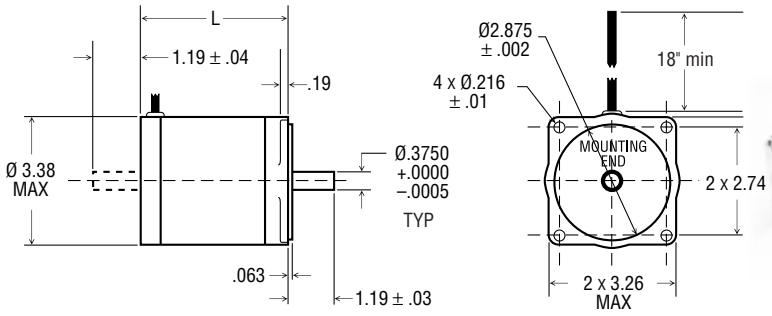
Hybrid Step Motors

SIZE 34



Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
4034-334	1	5.1	636.0	6	1.8	6.1	2.47	2.4	28.0	10.2/1870	7.70
	3		450.0	6		4.3	3.50	1.2	7.0		
4034-336	1		636.0	6		3.7	3.89	1.0	10.0		
	3		450.0	6		2.6	5.50	0.5	2.5		
4034-338	1		636.0	6		3.4	4.95	0.7	6.8		
	3		450.0	6		2.4	7.00	0.4	1.7		
4034-339	1		636.0	6		2.1	7.78	0.3	2.8		
	3		450.0	6		1.5	11.00	0.1	0.7		
* 5034-350	1		636.0	8		3.5	4.17	0.8	10.4		
	2		636.0	8		1.8	8.34	0.2	2.6		
	3		450.0	8		2.5	5.90	0.4	2.6		

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

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Hybrid Step Motors

SIZE HT 34

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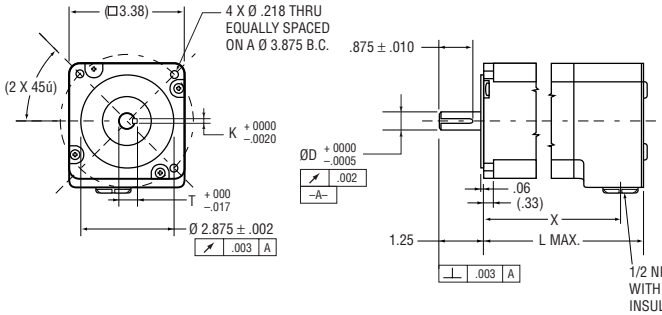


terminal box version shown

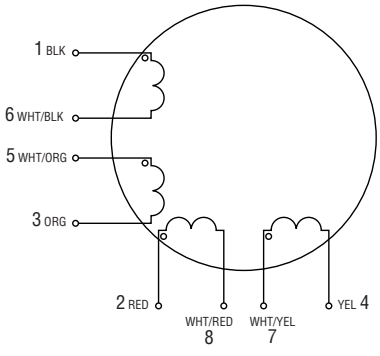
MOTOR	Ø D	K	T	terminal box version X	terminal box version L MAX.	flying leads version L MAX.
HT34-435	.5000	.1250	.555	(3.70)	4.44	3.13
HT34-436	.5000	.1250	.555	(5.22)	5.96	4.65
HT34-437	.6250	.1875	.705	(6.74)	7.48	6.17
HT34-438	.6250	.1875	.705	(8.25)	8.99	7.68

Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Leads	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
HT34-435	1	4.44	650.0	8	1.8	3.1	4.3	0.72	5.8	7.8/1426	5.00
	2	↓	650.0	↓	↓	1.5	8.6	0.18	1.4	↓	↓
	3	↓	460.0	↓	↓	2.1	6.0	0.36	1.4	↓	↓
HT34-436	1	5.96	1200.0	↓	↓	4.2	4.1	1.03	10.3	14.6/2683	8.40
	2	↓	1200.0	↓	↓	2.1	8.1	0.26	2.6	↓	↓
	3	↓	850.0	↓	↓	2.9	5.7	0.52	2.6	↓	↓
HT34-437	1	7.48	1845.0	↓	↓	4.8	4.5	1.06	13.6	21.9/4003	11.90
	2	↓	1845.0	↓	↓	2.3	9.0	0.26	3.4	↓	↓
	3	↓	1305.0	↓	↓	9.6	6.3	1.53	3.4	↓	↓
HT34-438	1	8.99	2140.0	↓	↓	4.6	5.6	0.82	10.6	28.9/5296	15.10
	2	↓	2140.0	↓	↓	2.3	11.3	0.20	2.6	↓	↓
	3	↓	1510.0	↓	↓	3.3	8.0	0.41	2.6	↓	↓

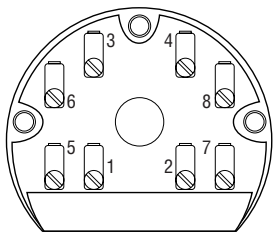
OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

- Part numbers listed are for single shaft. To order double shaft add 'D' to the end. To order with terminal block add "T" to end of number, terminal block motors are not available with double shaft.
- All size HT34 motors are optimized for microstepping and for use with 160 volt drives.

CONNECTION	DRIVER CONNECTION	LEAD COLOR	TERMINAL #
4-LEAD BIPOLAR	A+	BLACK (BLK)	1
SERIES	A–	ORANGE (ORG)	3
	B+	RED	2
	B–	YELLOW (YEL)	4
	NONE	WHT/BLK & WHT/ORG	6 & 5
	NONE	WHT/RED & WHT/YEL	8 & 7
4-LEAD BIPOLAR	A+	BLK & WHT/ORG	1 & 5
PARALLEL	A–	ORG & WHT/BLK	3 & 6
	B+	RED & WHT/YEL	2 & 7
	B–	YEL & WHT/RED	4 & 8



8-LEAD CONFIGURATION



TERMINAL BOARD

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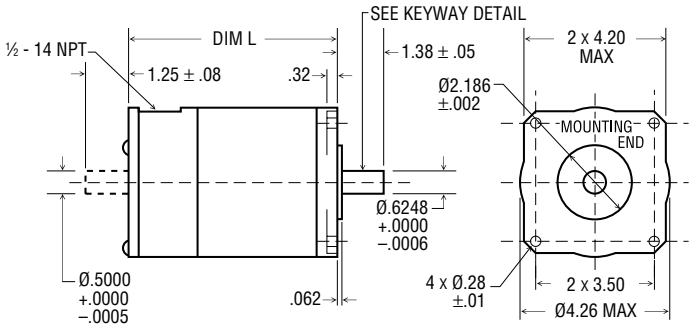
Hybrid Step Motors

SIZE 42

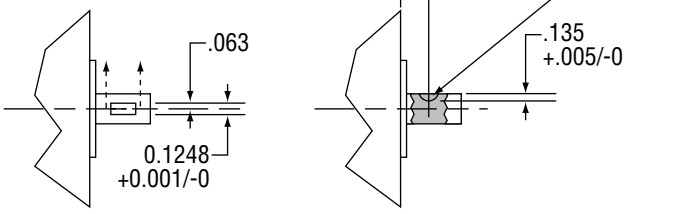


Part #	MOTOR CONNECTION 1 = series 2 = parallel 3 = unipolar	Motor Length (inches)	Minimum Holding Torque (oz-in)	Terminal Block Connections	Step Angle	Volts	Amps	Ohms	mH	Rotor Inertia (oz-in²/G-CM²)	Motor Weight (Lbs.)
5042-022	1	5.1	1591.0	8	1.8	3.8	6.70	0.6	7.6	10.2/1870	7.70
	2		1591.0			1.9	13.40	0.1	1.9		7.70
	3		1125.0			2.7	9.50	0.28	1.9		7.70
5042-023	1		1591.0			6.6	3.32	2.0	35.2		7.70
	2		1591.0			3.3	6.65	0.5	8.8		7.70
	3		1125.0			4.7	4.70	1.00	8.8		7.70

OTHER LENGTHS AND WINDINGS AVAILABLE UPON REQUEST

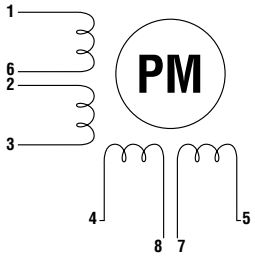
- Part numbers listed are for single shaft. To order double shaft add 'D' to the end.
- All size 42 motors are optimized for microstepping and use with 160 volt drives.

SHAFT KEYWAY DETAIL



#404 WOODRUFF KEYWAY
KEY SUPPLIED WITH MOTOR

TERMINAL #	WINDING WIRE COLOR
1	RED
2	BLUE
3	BLACK
4	WHITE
5	GREEN
6	YELLOW
7	BROWN
8	ORANGE



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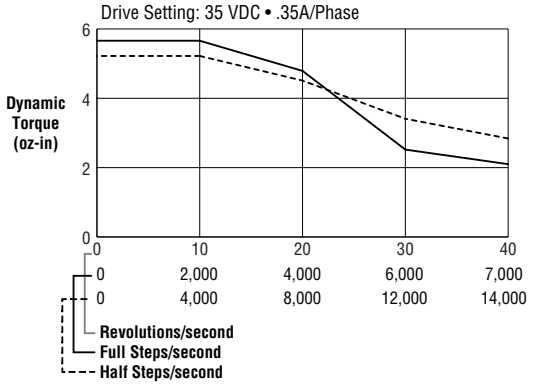
Dynamic Torque Data

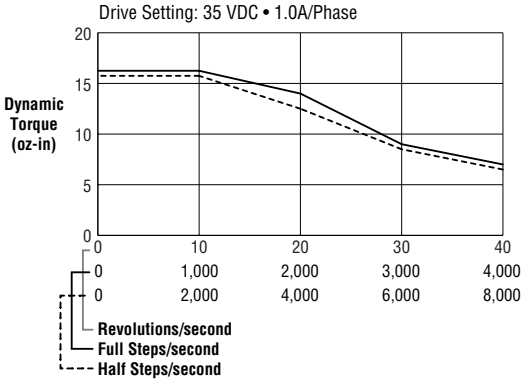
Size 14 Motor

Typical Speed/Torque Performance*

5014-820 MOTOR
Motor Connection: Bipolar
Drive: 2035
Drive Setting: 35 VDC • .35A/Phase



5014-842 MOTOR
Motor Connection: Bipolar
Drive: 2035
Drive Setting: 35 VDC • 1.0A/Phase



*Full steps/sec = Rev/sec x 200. Half steps/sec = Rev/sec x 400.

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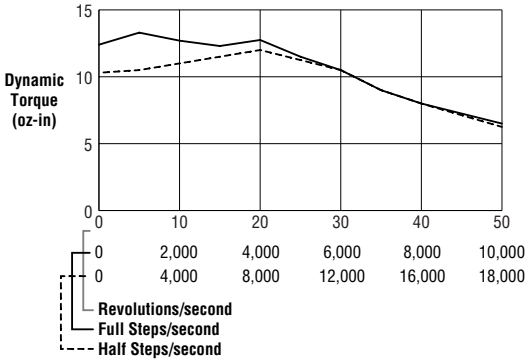
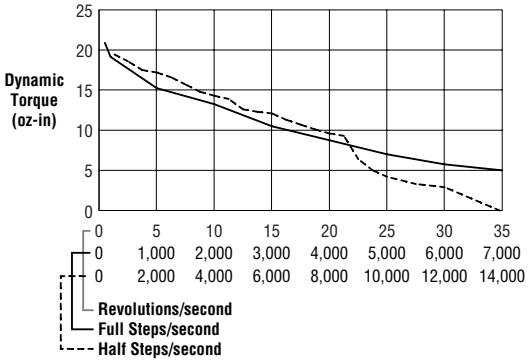
Size 17 Motor

Typical Speed/Torque Performance*

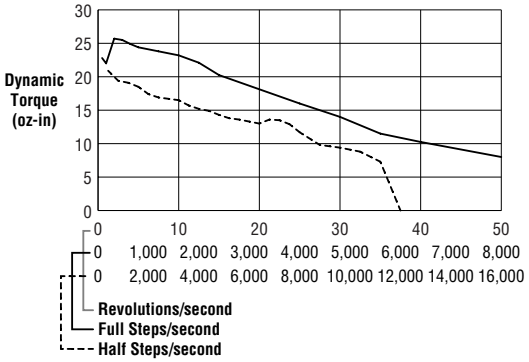
5017-006 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • .95A/Phase



5017-009 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • .8A/Phase



5017-012 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.2A/Phase



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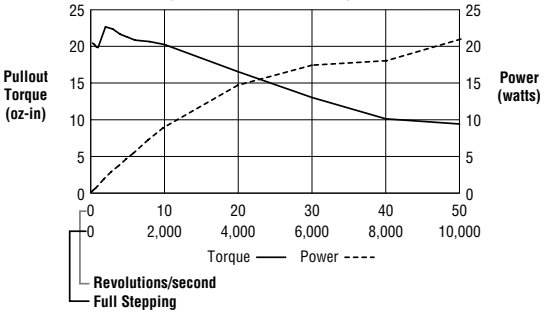
Dynamic Torque Data

Size HT17 Motor

Typical Speed/Torque Performance*

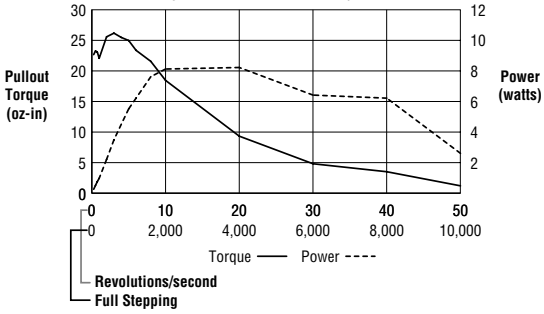
HT17-068 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 1.0A • Full Step



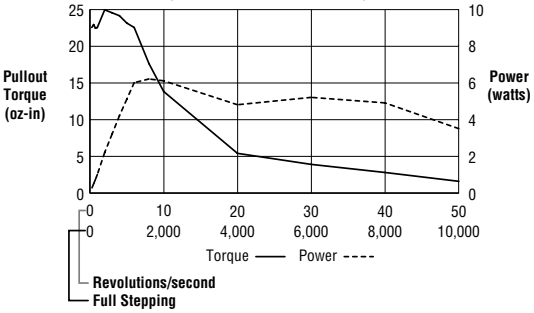
HT17-069 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 0.5A • Full Step



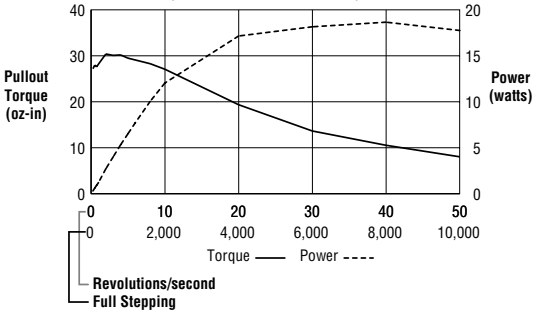
HT17-070 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 0.375A • Full Step



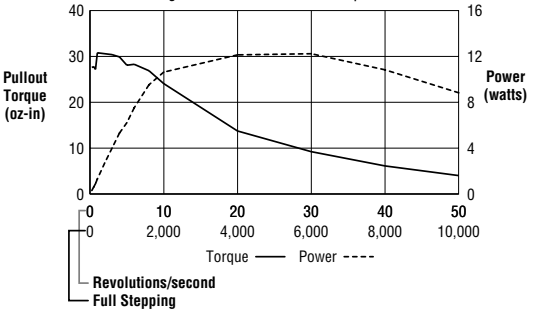
HT17-071 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 1.25A • Full Step



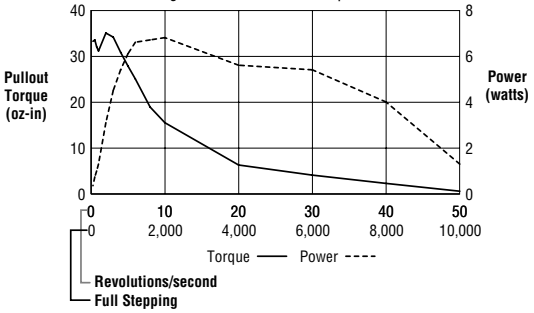
HT17-072 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • .875A • Full Step



HT17-073 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • .5A • Full Step



*Full steps/rev = Rev/sec x 200.

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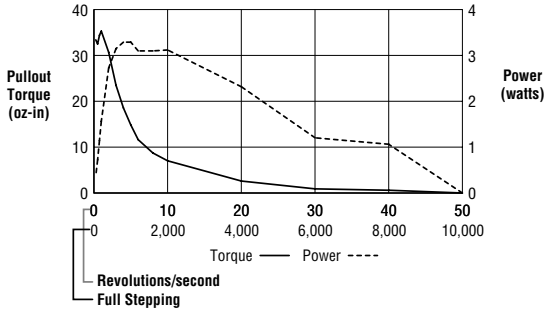
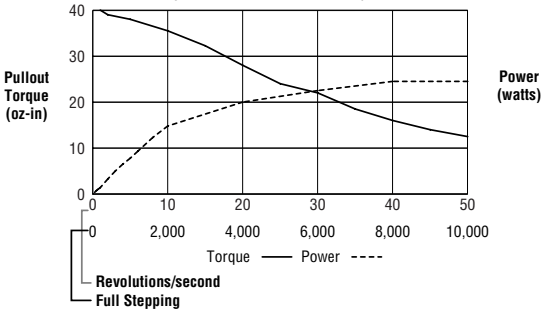
Size HT17 Motor

Typical Speed/Torque Performance*

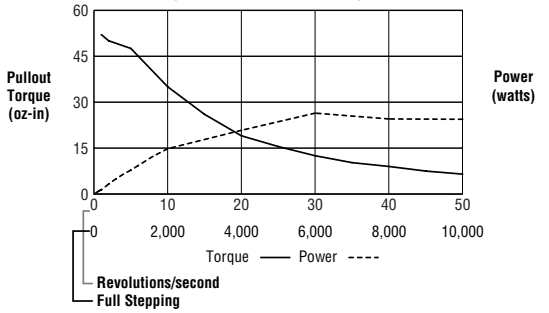
HT17-074 HIGH TORQUE MOTOR
Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • .25A • Full Step



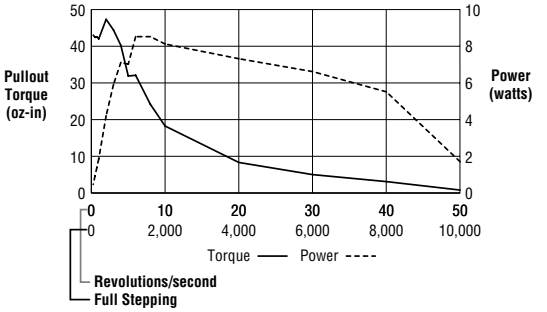
HT17-075 HIGH TORQUE MOTOR
Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 1.25A • Full Step



HT17-076 HIGH TORQUE MOTOR
Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • .875A • Full Step



HT17-077 HIGH TORQUE MOTOR
Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • .5A • Full Step



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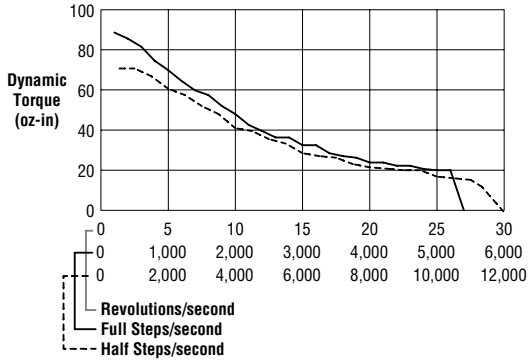
Dynamic Torque Data

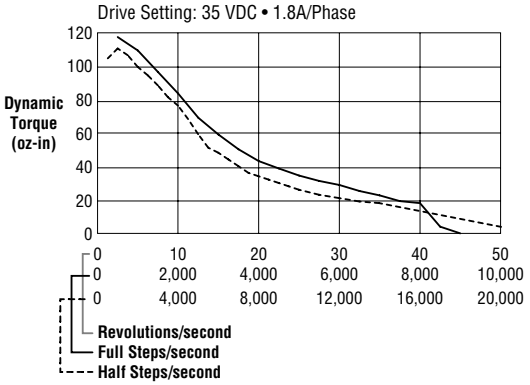
Size 23 Motor

Typical Speed/Torque Performance*

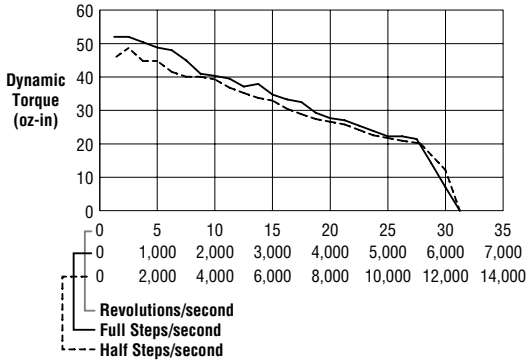
4023-819 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.0A/Phase



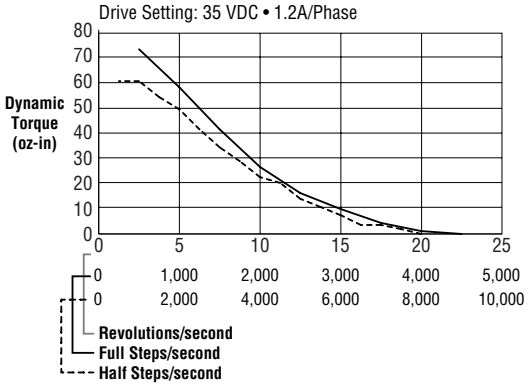
4023-830 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.8A/Phase



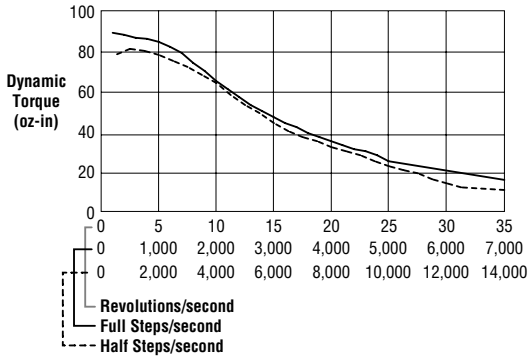
4023-839 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.0A/Phase



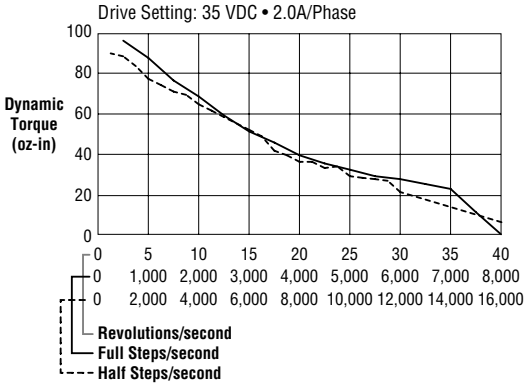
5023-094 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.2A/Phase



5023-100 MOTOR
Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 2.0A/Phase



5023-122 MOTOR
Motor Connection: Parallel
Drive: 2035
Drive Setting: 35 VDC • 2.0A/Phase



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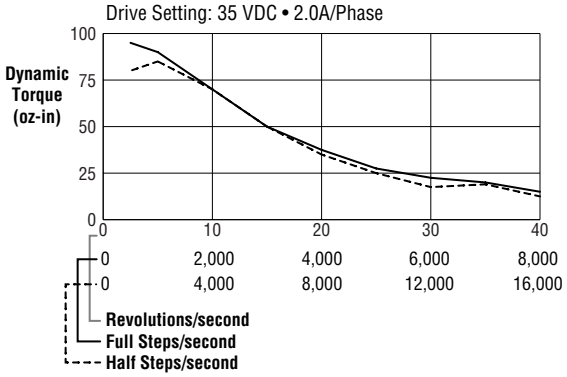
Size 23 Motor

Typical Speed/Torque Performance*

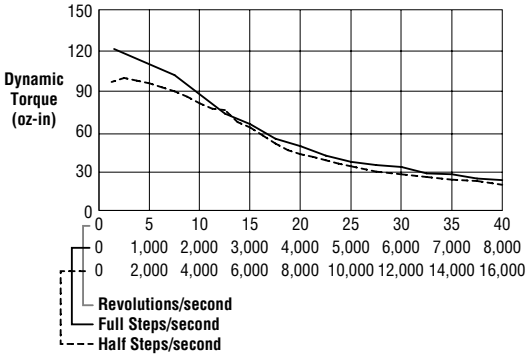
5023-499 MOTOR

Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 2.0A/Phase



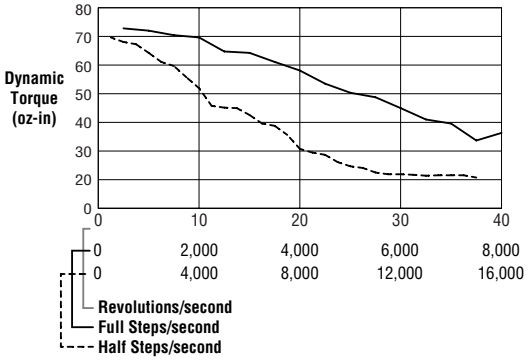
5023-149 MOTOR

Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 2.0A/Phase



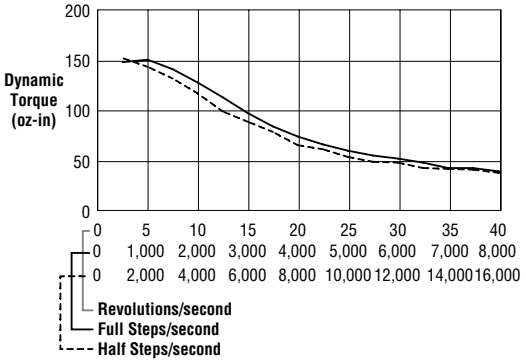
4023-820 MOTOR

Motor Connection: Series
Drive: 3535
Drive Setting: 35 VDC • 2.7A/Phase



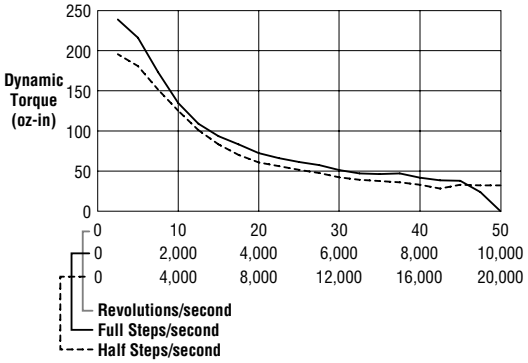
4023-828 MOTOR

Motor Connection: Series
Drive: 3535
Drive Setting: 35 VDC • 3.3A/Phase



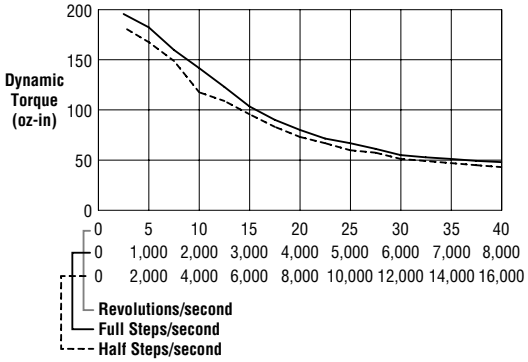
4023-833 MOTOR

Motor Connection: Series
Drive: 3535
Drive Setting: 35 VDC • 3.2A/Phase



4023-835 MOTOR

Motor Connection: Center Tap to End
Drive: 3535
Drive Setting: 35 VDC • 2.9A/Phase



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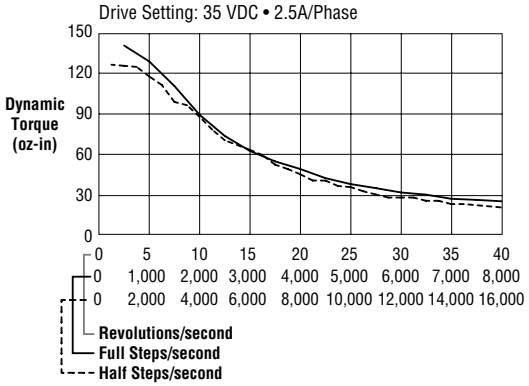
Dynamic Torque Data

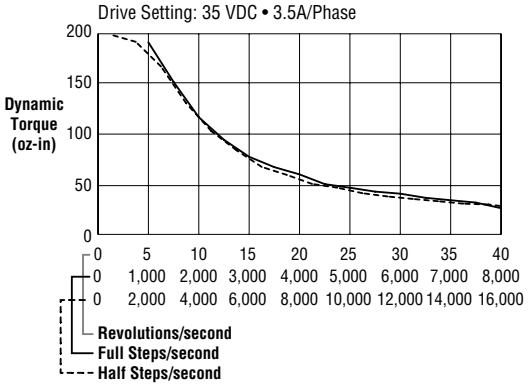
Size 23 Motor

Typical Speed/Torque Performance*

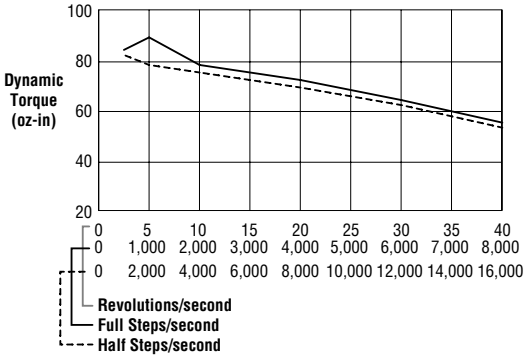
5023-123 MOTOR
Motor Connection: Parallel
Drive: 3535
Drive Setting: 35 VDC • 2.5A/Phase



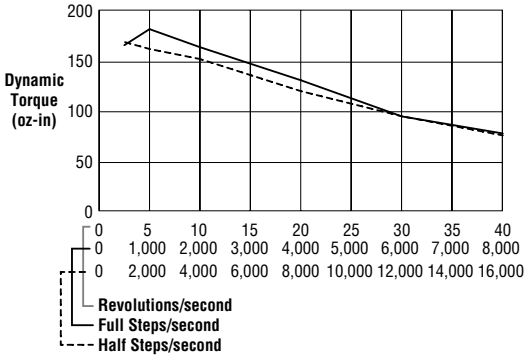
5023-124 MOTOR
Motor Connection: Parallel
Drive: 3535
Drive Setting: 35 VDC • 3.5A/Phase



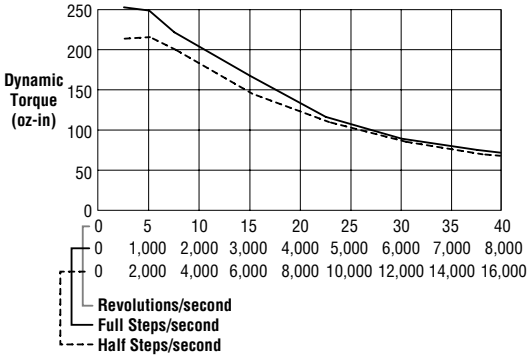
4023-820 MOTOR
Motor Connection: Series
Drive: 5560
Drive Setting: 60 VDC • 2.8A/Phase



4023-828 MOTOR
Motor Connection: Series
Drive: 5560
Drive Setting: 60 VDC • 3.3A/Phase



4023-833 MOTOR
Motor Connection: Series
Drive: 5560
Drive Setting: 60 VDC • 3.2A/Phase



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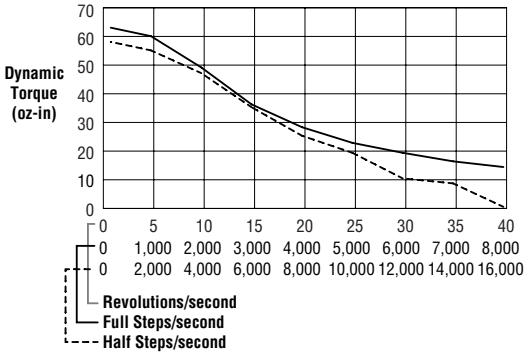
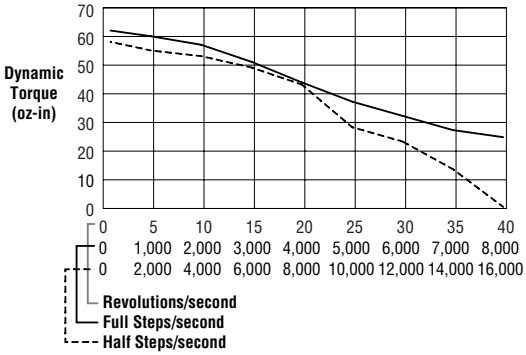
Size HT23 Motor

Typical Speed/Torque Performance*

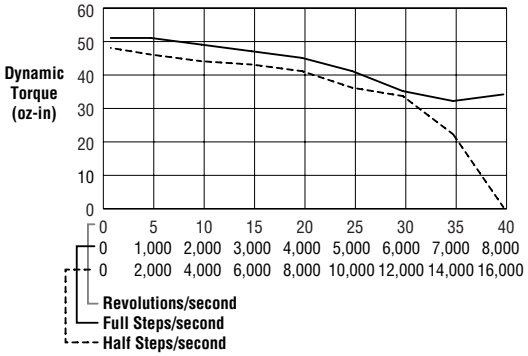
HT23-393 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 1.4A/Phase



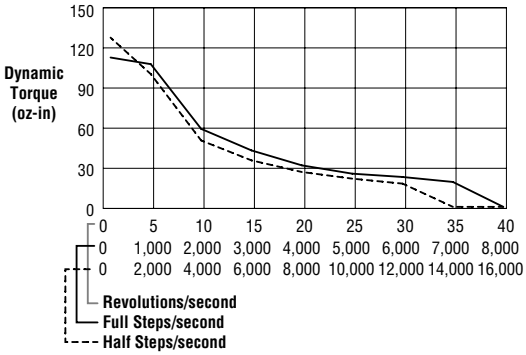
HT23-394 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 2.8A/Phase



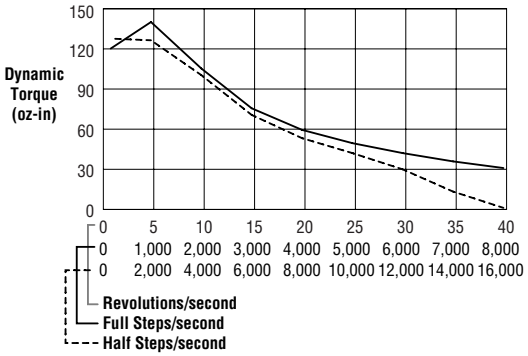
HT23-395 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 3.5A/Phase



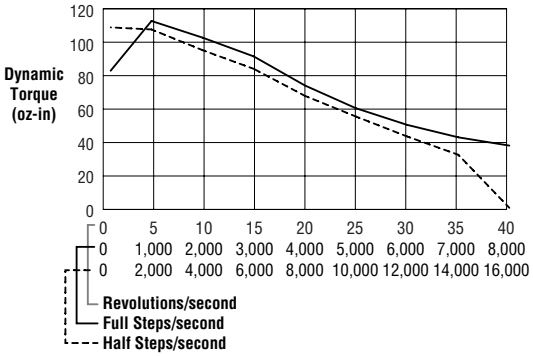
HT23-396 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 1.4A/Phase



HT23-397 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 2.8A/Phase



HT23-398 MOTOR
Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 3.5A/Phase



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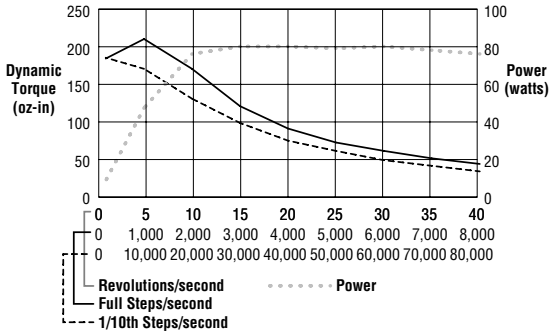
Dynamic Torque Data

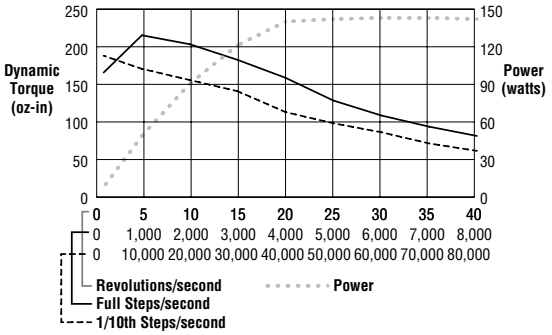
Size HT23 Motor

Typical Speed/Torque Performance*

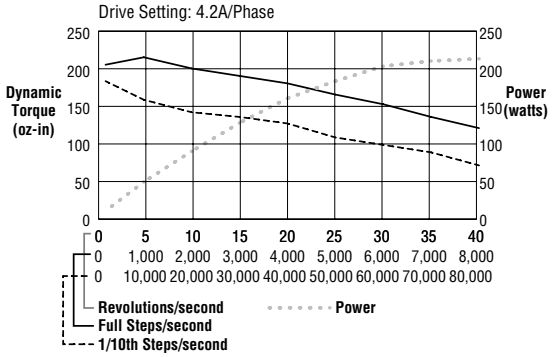
HT23-399 MOTOR
Motor Connection: Parallel
Drive: PD5580
Drive Setting: 1.4A/Phase



HT23-400 MOTOR
Motor Connection: Parallel
Drive: PD5580
Drive Setting: 2.8A/Phase



HT23-401 MOTOR
Motor Connection: Parallel
Drive: PD5580
Drive Setting: 4.2A/Phase



*Full steps/sec = Rev/sec x 200. Half steps/sec = Rev/sec x 400.

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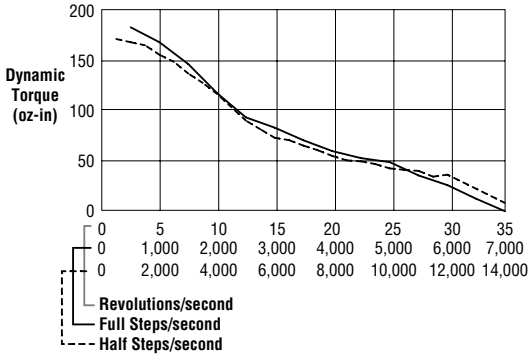
Size 34 Motor

Typical Speed/Torque Performance*

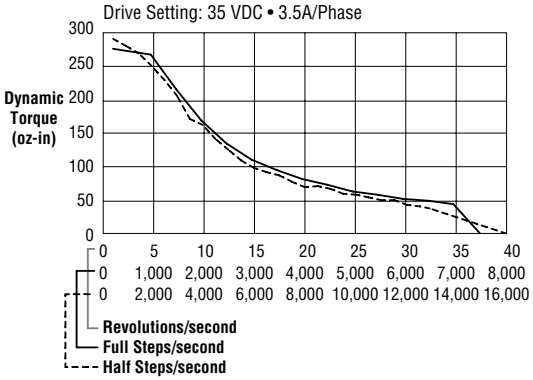
4034-324 MOTOR

Motor Connection: Center Tap to End
Drive: 3535
Drive Setting: 35 VDC • 3.1A/Phase



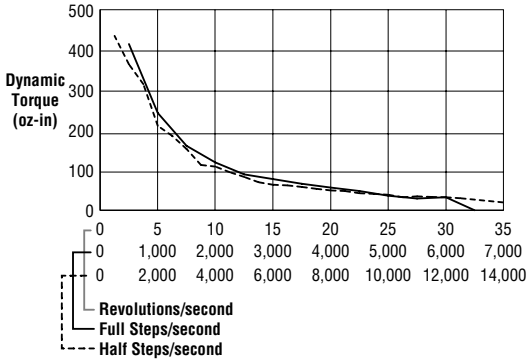
4034-329 MOTOR

Motor Connection: Center Tap to End
Drive: 3535
Drive Setting: 35 VDC • 3.5A/Phase



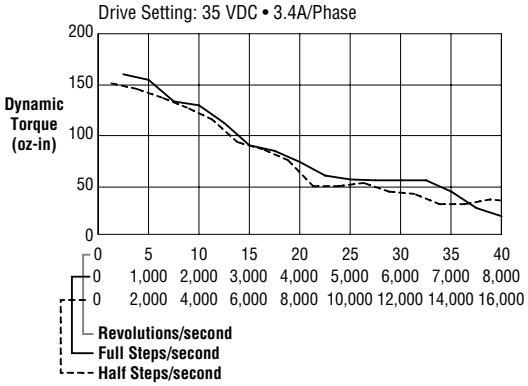
4034-334 MOTOR

Motor Connection: Center Tap to End
Drive: 3535
Drive Setting: 35 VDC • 3.5A/Phase



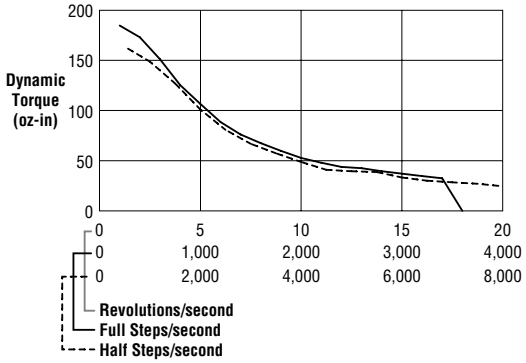
5034-348 MOTOR

Motor Connection: Parallel
Drive: 3535
Drive Setting: 35 VDC • 3.4A/Phase



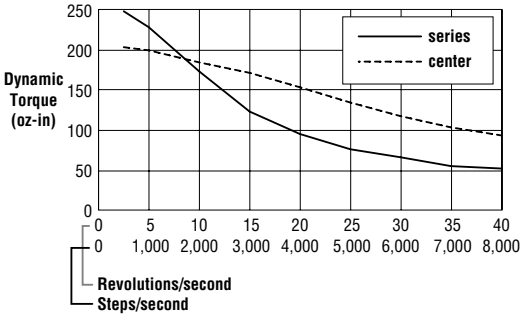
4034-322 MOTOR

Motor Connection: Center Tap to End
Drive: 2035
Drive Setting: 35 VDC • 1.6A/Phase



4034-326 MOTOR

Operation Mode: Full Step
Drive: 5560
Drive Setting: 60 VDC • 3.3A series/4.7A center Phase



*Full steps/sec = Rev/sec x 200. Half steps/sec = Rev/sec x 400.

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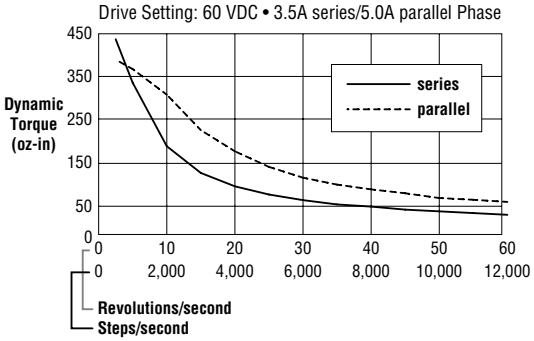
Dynamic Torque Data

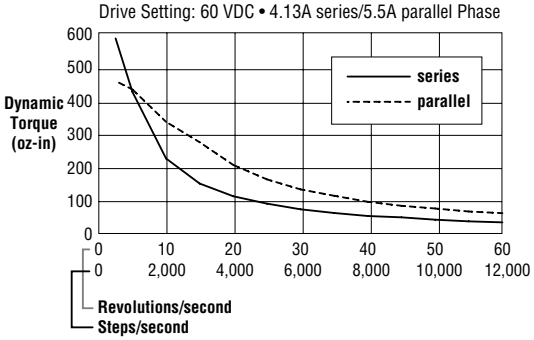
Size 34 Motor

Typical Torque/Power vs. Speed Curve*

5034-349 MOTOR
Operation Mode: Full Step
Drive: 5560
Drive Setting: 60 VDC • 3.5A series/5.0A parallel Phase



5034-350 MOTOR
Operation Mode: Full Step
Drive: 5560
Drive Setting: 60 VDC • 4.13A series/5.5A parallel Phase



* Full steps/sec = Rev/sec X 200. 1/10th Steps/sec = Rev/sec X 2,000

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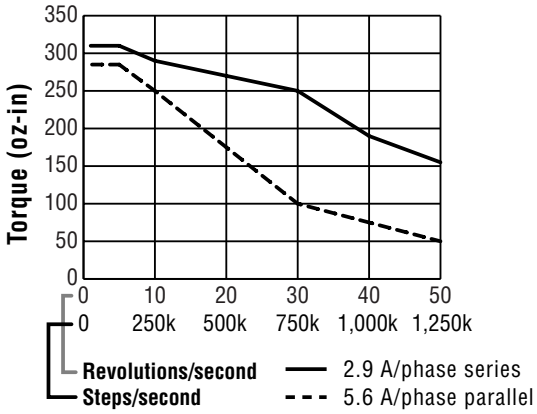
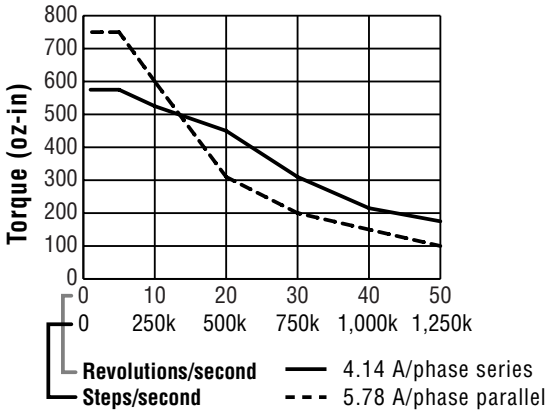
Size HT34 Motor

Typical Speed/Torque Performance

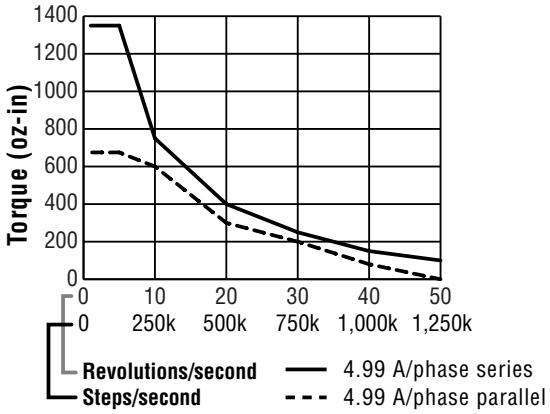
HT34-435 MOTOR



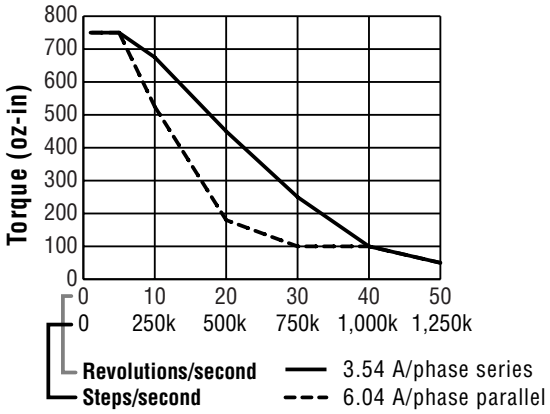
HT34-436 MOTOR



HT34-437 MOTOR



HT34-438 MOTOR



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Step Motor Drives & Controls

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STEP MOTOR SYSTEMS require electronic circuits to accept command signals and provide power to the motor. This special "electronic circuit" is called a step motor driver or more simply, a drive. Systems also require electronics and software to compute and execute the motion profile, interface to other systems and control the sequence and timing of events. Such electronics and software devices are called indexers or controls. A product that combines an indexer and drive into one package is an drive/indexer.

Applied Motion's step motor electronics are divided into three families: open frame drives, packaged drives and drive/indexers.

Our open frame drives offer low cost and small size. The open frame drives all require a DC power source. Some are available with internal ramping pulse generators (oscillators). Applied Motion's open frame drive family includes the 1030, 1035D, 2035, 2035-O, 3535 and 3535-O full/half step drives, as well as the 3540M, 3540MO, and 5560 microstepping drives. Most open frame drives include screw terminal connectors, rugged 1/4" thick aluminum chassis, efficient high performance switching amplifiers and easy to use dip switch set up features.

Packaged drives have built in power supplies and sturdy sheet metal enclosures. They can be operated from 110 or 220 volts AC (except the 8400 series) and are switch selectable. Our packaged drive family includes the PD2035 full & half step drive with enhanced digital oscillator as well as the PD5580 and PD8400 microstepping drives. All packaged units include pluggable, screw terminal connectors, rugged linear power supplies and efficient high performance switching amplifiers.

Drive/indexers include packaged types Si5580 and MC8400 and open frame types 3540i and 7080i. The Si5580 and MC8400 combine the power supply and drive from a PD5580 or PD8400, respectively, with our powerful yet easy to use *"Si™"* programmable indexer. This same *"Si™"* indexer is embedded into the 3540M and 7080 drive boards to form our 3540i and 7080i open frame drive/indexers.

Applied Motion Products also offers the Si-1 and Si-100 stand alone motion controllers that can be used with any of our drives or with any pulse and direction servo amplifier. All "i" or *"Si™"* products can be linked together to create a host computer controlled, multiaxis system via our *SiNet™* Hub. Using a *SiNet™* Hub will allow you to connect and control up to 20 axes of motion from a single host computer com port.

We also provide two power supplies for use with the open frame drives as well as motion component accessories such as an operator interface panel and a CNC hand wheel.

All drive and control products are 100% tested and burned-in before shipment to assure the highest quality and reliability. All drives and controls are designed and manufactured in the United States of America.

Please refer to one of our selection guides for help in choosing the appropriate product for your application. Detailed specifications for open frame drives, packaged drives, controls, DC power supplies, motion component accessories and *Si Programmer™* software can be found in this section of our catalog.

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PULSE & DIRECTION DRIVES ONLY

Part Number	Motor Current Range (amps)	Power Supply Voltage Range	Step Resolution per Rev.	Construction Type	Catalog Page
1030	0 - 1.0	12 - 30 VDC	200 - 800	Open frame	60
1035D	0 - 1.0	12 - 35 VDC	200/400	Plastic case	62
2035	0.125 - 2.0	12 - 35 VDC	200/400	Open frame	63
3535	0.4 - 3.5	12 - 35 VDC	200/400	Open frame	65
3540M	0.4 - 3.5	12 - 42 VDC	400 - 12,800	Open frame	67
5560	1.0 - 5.5	24 - 60 VDC	200 - 12,800	Open frame	70
7080	0.8 - 7.0	24 - 80 VDC	200 - 50,800	Open frame	71
PD5580	0.5 - 5.5	110/220 AC	200 - 50,800	Metal case	77
PD8400	0 - 8.0	110 AC	2,000 - 50,800	Metal case	81

DRIVES WITH BUILT-IN OSCILLATOR

Part Number	Motor Current Range (amps)	Power Supply Voltage Range	Step Resolution per Rev.	Construction Type	Catalog Page
2035-O	0.125 - 2.0	12 - 35 VDC	200/400	Open frame	64
3535-O	0.4 - 3.5	12 - 35 VDC	200/400	Open frame	66
3540MO	0.4 - 3.5	12 - 42 VDC	12,800	Open frame	67
PD2035	0.125 - 2.0	110/220 AC	200/400	Metal case	75

DRIVES WITH BUILT-IN INDEXER

Part Number	Motor Current Range (amps)	Power Supply Voltage Range	Step Resolution per Rev.	Construction Type	Catalog Page
3540i	0.2 - 3.5	12 - 42 VDC	400 - 50,800	Open frame	67
7080i	0.8 - 7.0	24 - 80 VDC	200 - 50,800	Open frame	71
Si5580	0.5 - 5.5	110/220 AC	200 - 50,800	Metal case	77
MC8400	0 - 8.0	110 AC	2,000 - 50,800	Metal case	81

INDEXERS & OSCILLATORS

Part Number	Method of Programming	Power Supply Voltage Range	Step Resolution per Rev.	Construction Type	Catalog Page
Si-1	Built-in terminal	8 - 35 VDC	N/A	Metal case	113
Si-100	Si program	110/220 AC	200 - 50,800	Metal case	119
057A	Trim pots	5 VDC	N/A	Open frame	112

Drives/Controls Section Guide

OPEN FRAME SYSTEMS

	FULL & HALF STEP DRIVES						MICROSTEPPING DRIVES			MICROSTEPPING DRIVE/*Si*™ INDEXER		
FEATURES	**1030**	**1035D**	**2035**	**2035 O**	**3535**	**3535 O**	**3540M**	**3540MO**	**5560**	**7080**	**3540i**	**7080i**
Motor Current (A/phase)	0.1–1.0	0.1–1.0	0.125–2.0	0.125–2.0	0.4–3.5	0.4–3.5	0.4–3.5	0.4–3.5	1.0–5.5	0.8–7.0	0.2–3.5	0.8–7.0
Input Voltage	12–30 DC	12–35 DC	12–35 DC	12–35 DC	12–35 DC	12–35 DC	12–42 DC	12–42 DC	24–60 DC	24–80 DC	12–42 DC	24–80 DC
Steps/revolution	200/800	200/400	200/400	200/400	200/400	200/400	400–12,800	12,800	200–12,800	200–50,800	400–50,800	2,000–50,800
Maximum Output Power (W)	30	35	70	70	120	120	147	147	330	560	147	560
Overall Size (inches)	2.25 x 1.6 x .77	2.4 x 1.0 x 3.55	3 x 4 x 1.5	3 x 4 x 1.5	3 x 4 x 1.5	3 x 4 x 1.5	3 x 4 x1.5	3 x 4 x 1.5	3 x 6 x 2	3 x 6 x 2	3 x 5 x 1.5	3 x 6 x 2
Typical NEMA Motor Size	14, 17, 23	14, 17, 23	14, 17, 23	14, 17, 23	23, 34	23, 34	14, 17, 23	14, 17, 23	23, 34	17–42	14, 17, 23	17–42
Built-in Power Supply												
Screw Terminal Connectors			•	•	•	•	•	•	•	•	•	•
Pluggable Connectors		•										
Built-in Oscillator				•		•		•				
Oscillator Speed Range				0–5,000 Hz		400–5,000 Hz		0–25 RPS				
Bipolar Chopper (20kHz)	•	•	•	•	•	•	•	•	•	•	•	•
Idle Current Reduction			•	•	•	•	•	•	•	•	•	•
Short Circuit Protection									•	•		•
Thermal Protection		•	•	•	•	•	•	•	•	•	•	•
Fault Indicator (LED)									•	•	•	•
Fault Output (Signal)												
Made in USA	•	•	•	•	•	•	•	•	•	•	•	•
CE	•	•	•	•	•	•	•	•		•	•	•
Optional Cover			•	•	•	•	•		•	•	•	•
Integral Indexer												
Programmable Inputs/Outputs											8/3	8/3
Encoder Interface												
Enable Input					•	•	•	•	•	•		
Catalog Page #	60	62	63	64	65	66	67	67	70	71	67	70
Curve Page #	101	101	102	102			104	104		108	104	108

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	FULL & HALF STEP DRIVES	MICROSTEPPING DRIVES		MICROSTEPPING DRIVES/*Si*™ INDEXER			STAND ALONE INDEXER/OSCILLATOR		
FEATURES	**PD2035**	**PD5580**	**PD8400**	**Si5580**	**MC8400**	**MC8400F**	**057A**	**Si-1**	**Si-100**
Motor Current (A/phase)	0.125–2.0	0.5–5.5	0–8.0	0.5–5.5	0–8.0	0–8.0			
Input Voltage	110/200 AC	110/220 AC	110 AC	110–220 AC	110 AC	110 AC	5 DC	8–35 DC	10/220 AC
Steps/revolution	200/400	200–50,800	200–50,800	2,000–50,800	200–50,800	200–50,800			200–50,800
Maximum Output Power (W)	70	140	1300	440	1300	1300			
Overall Size (inches)	4 x 6.8 x 1.75	3 x 5.3 x 8	4 x 9 x 9.5	3 x 5.3 x 8	6 x 9 x 9.5	6 x 9 x 9.5			
Typical NEMA Motor Size	14, 17, 23	14, 17, 23			23, 34	23, 34			
Built-in Power Supply	•	•	•	•	•	•			•
Screw Terminal Connectors	•	•	•	•	•	•		•	
Pluggable Connectors	•	•	•	•	•	•			•
Built-in Oscillator	•						•		
Oscillator Speed Range	10–12,000 Hz						0–320 kHz		
Bipolar Chopper (20kHz)	•	•	•	•	•	•			
Idle Current Reduction	•	•	•	•	•	•			
Short Circuit Protection		•	•	•	•	•			
Thermal Protection	•	•	•	•	•	•			
Fault Indicator (LED)		•	•	•	•	•			
Fault Output (Signal)		•	•	•	•	•			
Made in USA	•	•	•	•	•	•	•	•	•
CE		•		•			•	•	•
Integral Indexer				•	•	•		•	•
Programmable Inputs/Outputs				8/3	12/9	12/9		2/1	8/3
Encoder Interface					•	•			
Enable Input	•	•	•						
Catalog Page #	75	77	81	77	81	81	113	114	119
Curve Page #	102	106	110	106	110	110			

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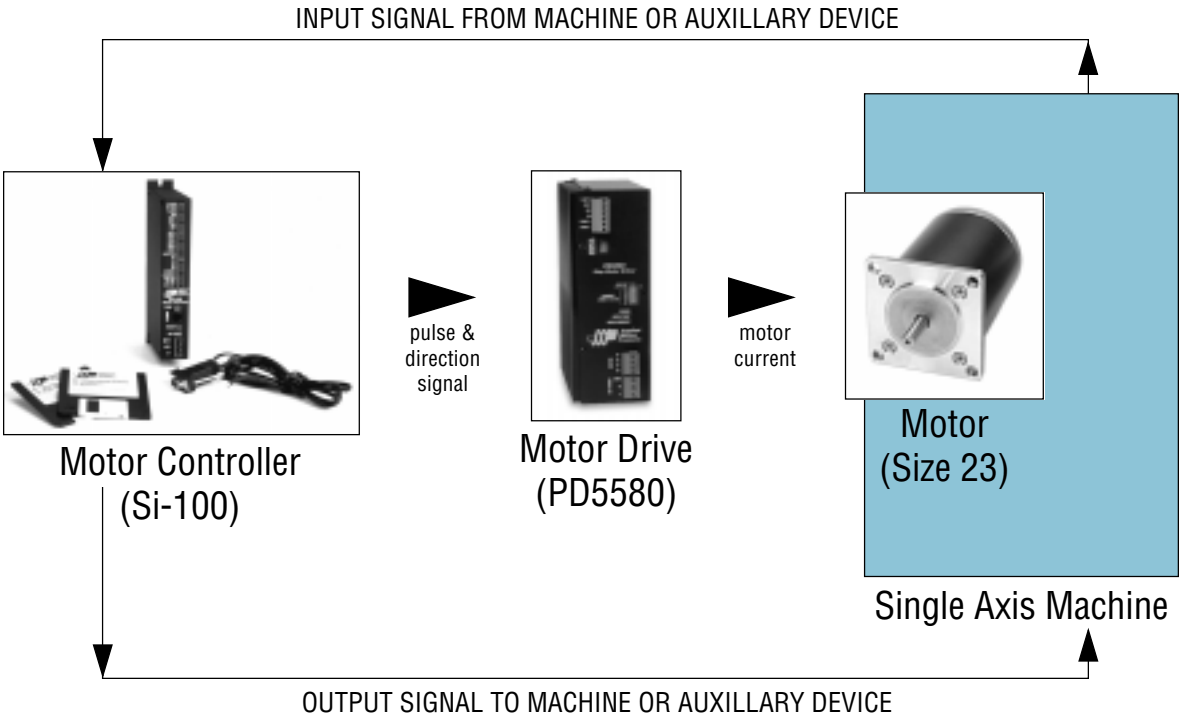
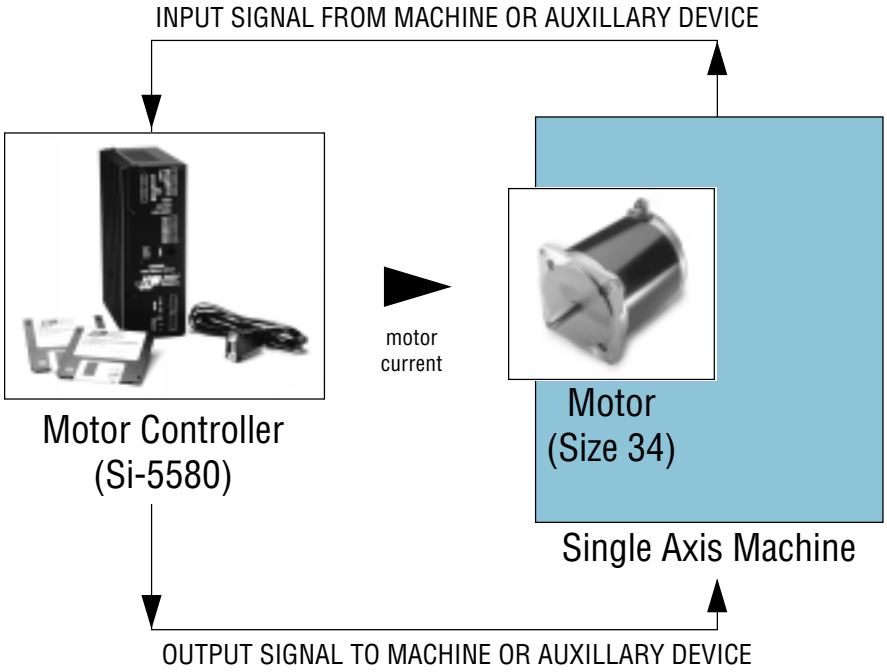
Typical Single Axis System With Separate Drive and Control in Stand Alone Mode…



Typical Single Axis System With Control and Drive in a Single Package in Stand Alone Mode…



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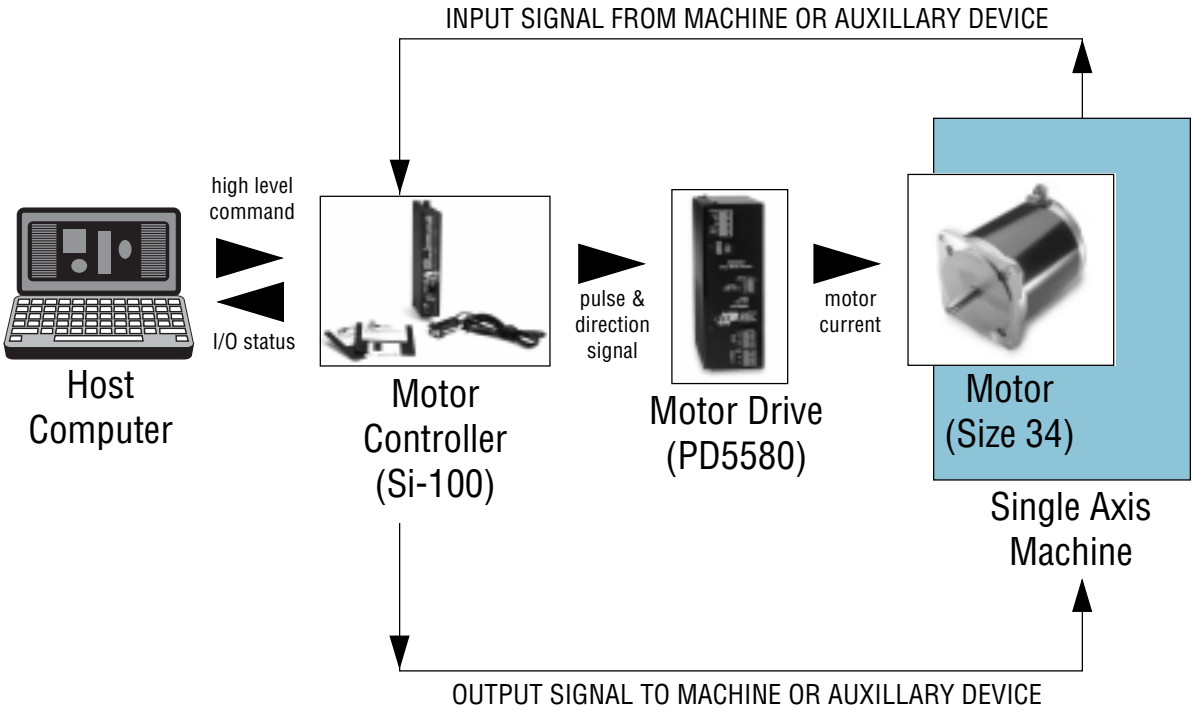
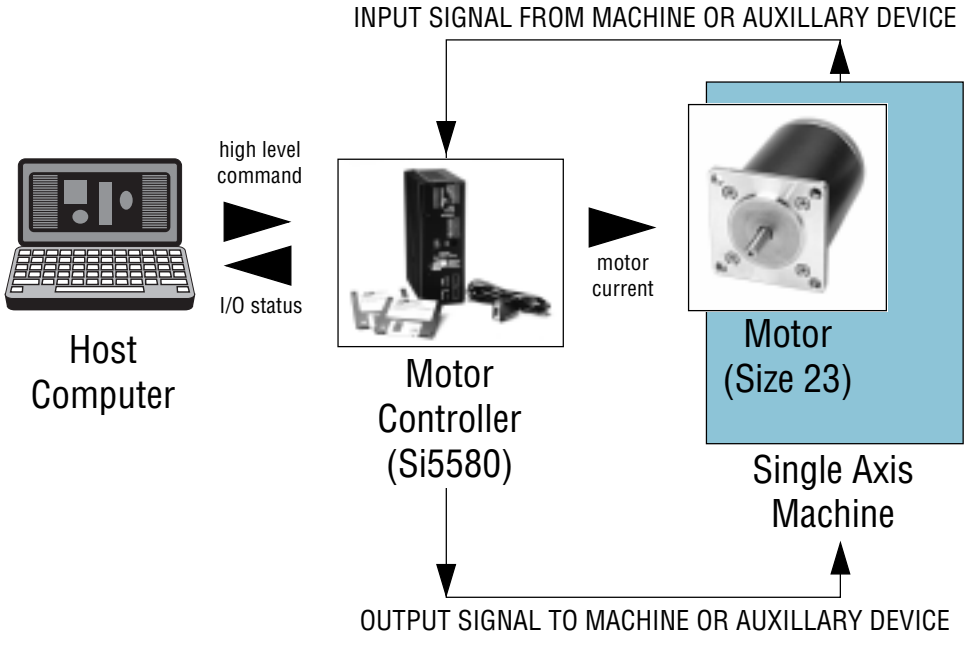
Typical Single Axis System With Separate Drive and Controller Connected to a Host Computer…



Typical Single Axis System With Control and Drive in a Single Package Connected to a Host Computer…



Application Diagrams

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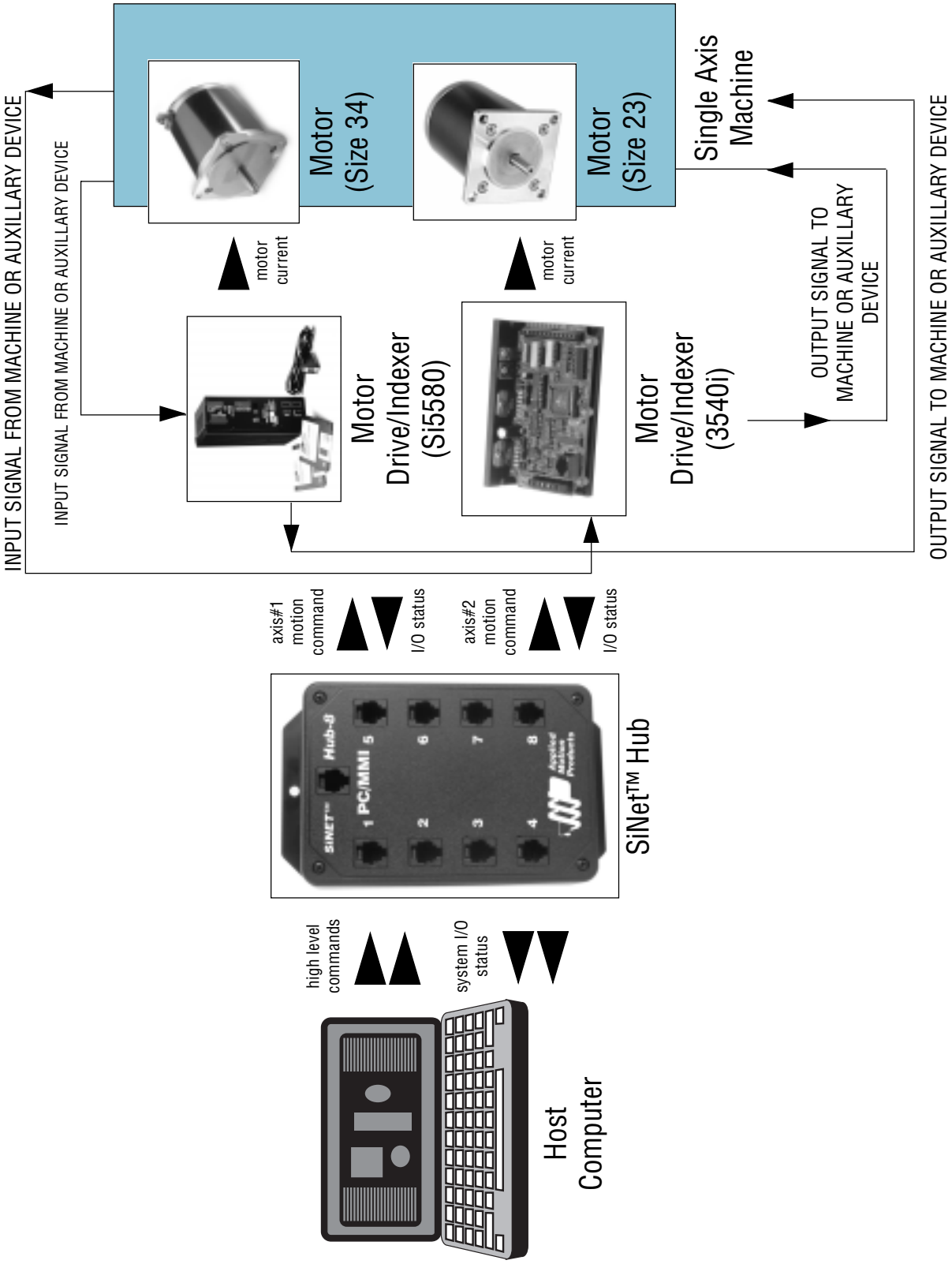
Typical Multi-Axis System With Drive and Control in Single Package Connected to a Host Computer Via a SiNet™ Hub…



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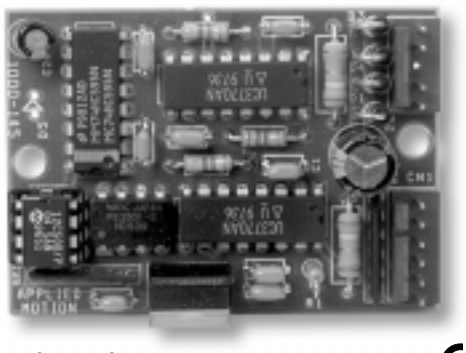
Step Motor Driver

Full & Half Step
2A, 35V Bipolar Chopper



ACTUAL SIZE

Amplifiers

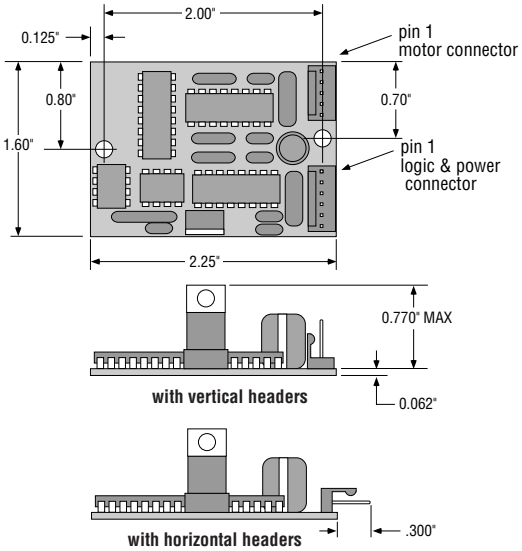
Dual, bipolar H-bridge, fixed off time switching at 20-30kHz. 12-30 VDC input (including ripple). 1.0 amps/phase output current. Automatic idle current reduction, reduces current to 60% of setting after 1/2 second. CE compliant.

Inputs

Step and direction, 5-12V, optically isolated. Motor steps on rising edge of step line.

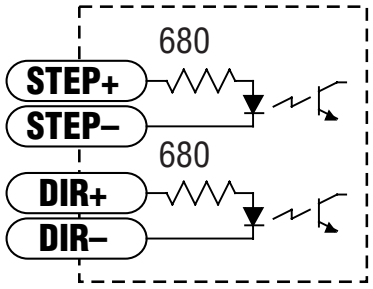
Physical

Constructed on .062" thick epoxy-glass printed circuit board.
Two Ø.157 mounting holes.
Overall size with vertical headers: 0.53 x 2.25 x 1.60 inches.
Overall size with horizontal headers: 0.53 x 2.55 x 1.60 inches.
Ambient temp range (operating): 0 - 70˚C.



Connectors

AMP MTA-100 vertical latching headers.
Motor: 5 position.
1 = motor phase A+
2 = motor phase A-
3 = ground
4 = motor phase B+
5 = motor phase B-
Signal Input & Power Supply: 6 position.
1 = ground
2 = 10 - 30 VDC
3 = STEP-
4 = STEP+
5 = DIR-
6 = DIR+



Input Circuit

Factory Installed Options

- Step resolution: full, half or quarter step
- Idle Current Reduction: 0%, 20%, 60% or 100%
- Current: 0 to 1 amps
- 24V step & direction input
- Vertical or horizontal headers

Note:
Mating connectors are only supplied with sample orders. See the 1030 user's manual for mating connector part numbers.

See speed/torque curves for 1030 on page 101.

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Model 1030 Configuration Form

Thank you for your interest in the model 1030 step motor driver. The 1030 is a low cost, compact step motor driver. All options are set at the factory as a part of the manufacturing process.

Therefore, before we accept your order and build your drives, we need you to fill out and sign this form indicating the options you want. After we process the form, we will assign a unique part number to your configuration. In the future, you may simply order that part number, and we won't ask you to fill out any more forms.

Thanks again for your interest in Applied Motion Products.

Current setting (Amps/phase):

❑ 1.0 ❑ .85 ❑.71
❑.59 ❑.49 ❑.40
❑.33 ❑.25 ❑.20

_____
Name

_____
Company

_____

_____
Address

Idle Current (percentage of current setting)
❑ 0% (no current when idle)
❑ 20%
❑ 60%
❑ 100% (full current when idle)

Steps/Rev
❑ 200 (full step) ❑ 400 (half step) ❑ 800 (1/4 step)

Connectors

❑ Vertical headers

❑ Horizontal Headers

Note: mating connectors and standoffs are only included with samples orders.

Step & Direction Input Voltage
❑ 5 - 12V (drive will have 680 input impedance, ok for most indexers & oscillators)
❑ 24V (drive will have 2200 input impedance, required by some PLCs)

Your signature _____
(Indicating that these are the options you want, and that you understand that these options cannot be changed once the drives are built.)

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Dual Step Motor Drive

Features

- Accepts 12 – 35 VDC power supply (including ripple).
- Adjustable motor current: 0 to 1.0 amps/phase.
- Full or half step (jumper selectable).
- Compact size (1.0 x 2.4 x 3.55 inches).
- Mounts on DIN rail.
- Optically isolated 5 – 24V step and direction inputs can be configured for sinking or sourcing logic.
- Automatic idle current reduction.
- Drives 4, 6 or 8 lead step motors, sizes 14 – 23.
- Compatible step motors available from stock.
- Lightweight, rugged molded case.
- Pluggable, screw terminal connectors.
- CE compliant.

ACTUAL SIZE

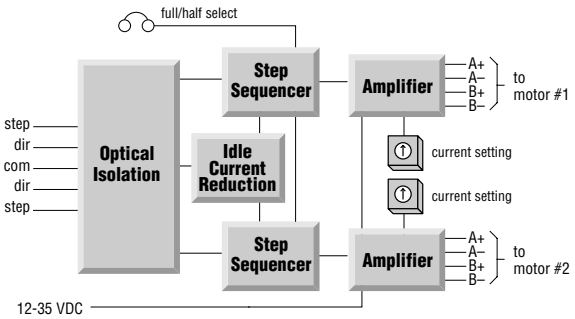
Description

The 1035D consists of two stepper drives that can operate in full or half step mode. Each driver can be individually controlled via its step and direction inputs. Each driver includes an automatic feature to lower motor current anytime the motor is left at rest for more than one-half second.

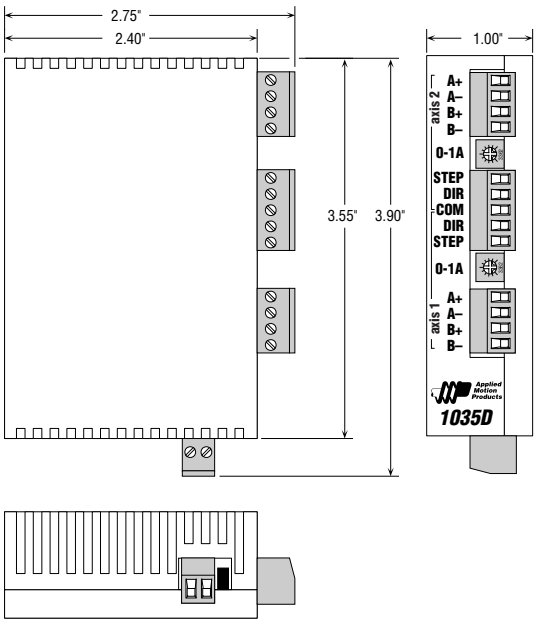
The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current for each axis is independently adjustable by front panel potentiometers.

Applied Motion Products also makes a wide range of full step, half step and microstepping drives & controls and a full line of stepping motors. We also provide custom designed motors, drives and controls for qualifying OEMs.

BLOCK DIAGRAM



MECHANICAL OUTLINE



See speed/torque curves for 1035D on page 101.

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Step Motor Driver

Full & Half Step
2A, 35V Bipolar Chopper

Features

- Accepts 12–35 VDC motor supply (including ripple)
- 125 mA – 2 amps/phase motor current
- DIP switch selectable current from 16 levels
- jumper selectable full and half step
- thermal protection
- optional heat sink
- screw terminal connectors
- inaudible PWM amplifiers
- optoisolated inputs accept sinking or sourcing inputs, 5 – 24 V
- automatic idle current reduction, switch selectable
- drives 4, 6 or 8 lead step motors, sizes 14–23
- enable input
- CE compliant

Description

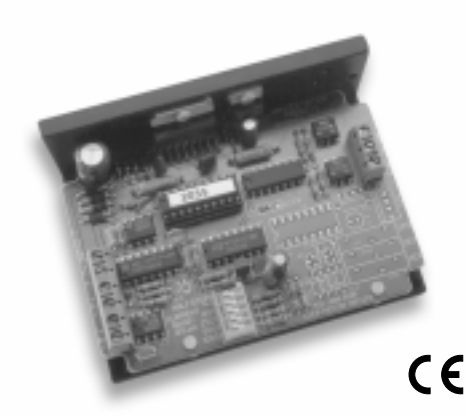
The 2035 step motor driver contains a full and half step phase sequencer, two switching amplifiers and optoisolation circuits. This driver also includes an automatic feature to lower motor current anytime the motor is left at rest for more than one second.

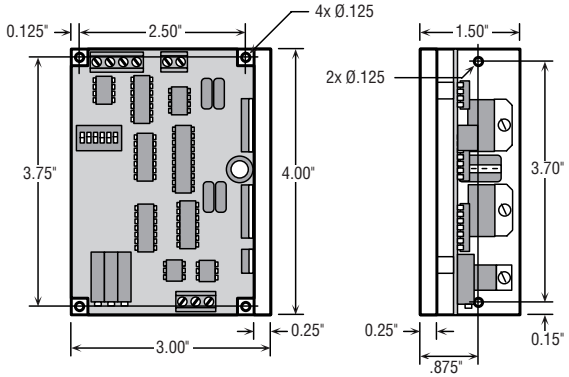
The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 16 levels by a DIP switch. Full or half step operation is also selected by the DIP switch.

The 2035 is a PC board mounted on an aluminum angle heat transfer chassis. Mating heat sink available for stand alone operation.

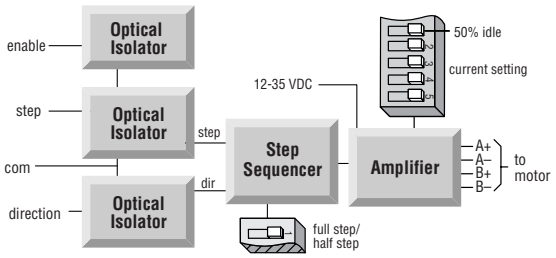
Options

- on board oscillator (Model 2035 O)
- add on heat sink (Model 2035 H)





MECHANICAL OUTLINE



BLOCK DIAGRAM

See speed/torque curves for 2035 on pages 102 & 103.

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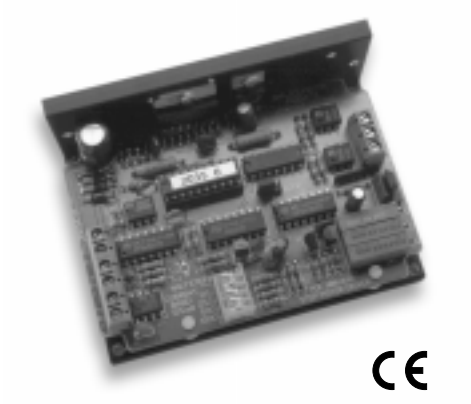
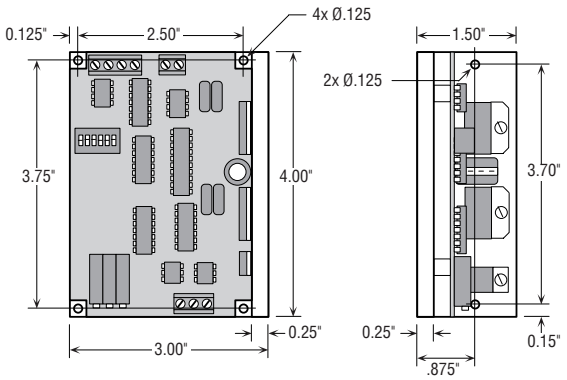
Step Motor Driver with Oscillator

Full & Half Step
2A, 35V Bipolar Chopper

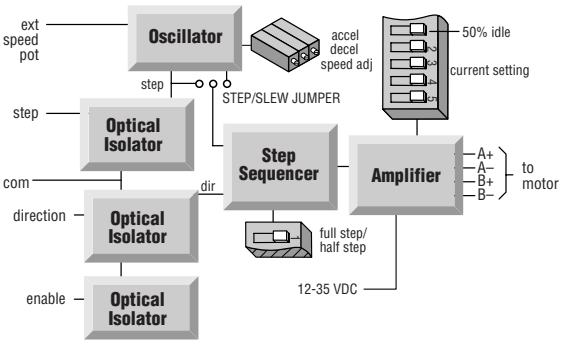
Features

- Accepts 12–35 VDC motor supply (including ripple)
- 125 mA – 2 amps/phase motor current
- DIP switch selectable current from 16 levels
- switch selectable full and half step
- internal ramping pulse generator with adjustable slew speed, acceleration and deceleration rates
- thermal protection
- optional heat sink
- screw terminal connectors
- inaudible PWM amplifiers
- optoisolated inputs accept sinking or sourcing inputs, 5 – 24 V
- automatic idle current reduction, switch selectable
- drives 4, 6 or 8 lead step motors, sizes 14–23
- enable input
- input for optional remote speed control pot
- CE compliant





MECHANICAL OUTLINE



BLOCK DIAGRAM

Description

The 2035 0 step motor driver contains a full and half step phase sequencer, two switching amplifiers, a ramping pulse generator and optoisolation circuits. This driver also includes an automatic feature to lower motor current anytime the motor is left at rest for more than one second.

The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 16 levels by a DIP switch. Full or half step operation is also selected by the DIP switch.

The internal oscillator is selected by a jumper. In oscillator mode, the pulse input becomes a run/stop signal: when this signal is set high, the motor accelerates to a preset speed and slews. Lowering the input signal causes the driver to decelerate to rest.

The 2035 0 is a PC board mounted on an aluminum angle heat transfer chassis. Mating heat sink available for stand alone operation.

Options

- add on heat sink (Model 2035 HO)

See speed/torque curves for 2035 0 on pages 102 & 103.

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Step Motor Driver

Full & Half Step
3.5A, 35V Bipolar Chopper

Features

- Accepts 12–35 VDC motor supply (including ripple)
- 0.4 amps – 3.5 amps/phase motor current
- DIP switch selectable current from 32 levels
- switch selectable full and half step
- thermal protection
- optional heat sink
- screw terminal connectors
- inaudible PWM amplifiers
- optoisolated inputs
- automatic idle current reduction
- drives 4, 6 or 8 lead step motors, sizes 14–34
- enable input
- CE compliant

Description

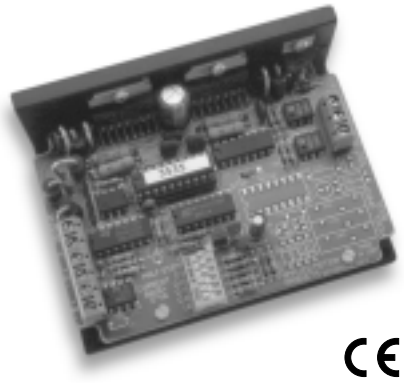
The 3535 step motor driver contains a full and half step phase sequencer, two switching amplifiers and optoisolation circuits. This driver also includes an automatic feature to lower motor current anytime the motor is left at rest for more than one second.

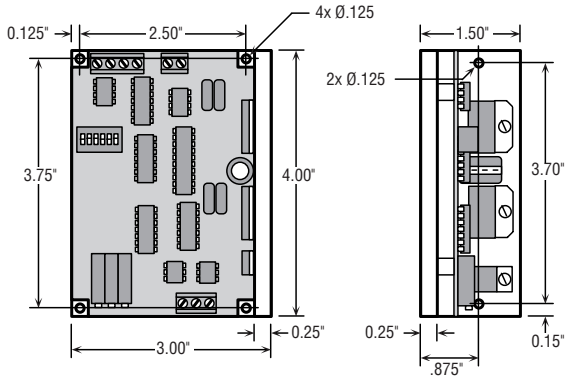
The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 32 levels by a DIP switch. Full or half step operation is also selected by the DIP switch.

The 3535 is a PC board mounted on an aluminum angle heat transfer chassis. Mating heat sink available for stand alone operation.

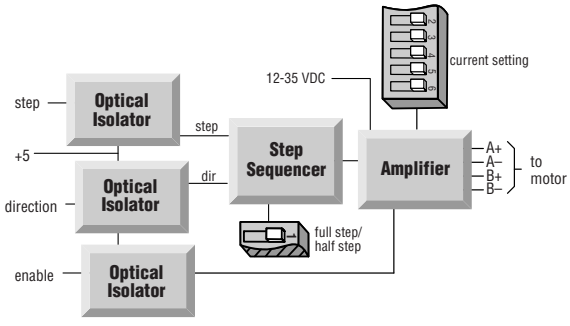
Options

- on board oscillator (Model 3535 O)
- add on heat sink (Model 3535 H)





MECHANICAL OUTLINE



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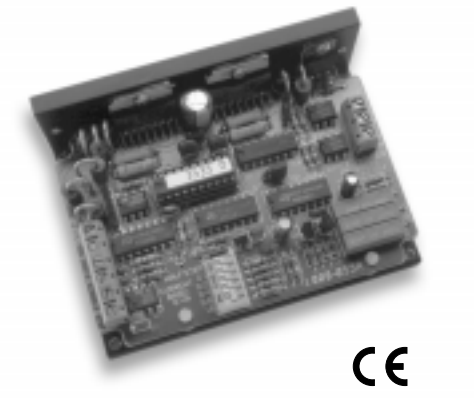
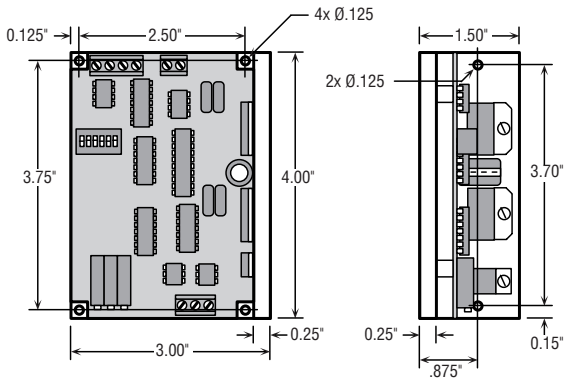
Step Motor Driver with Oscillator

Full & Half Step
3.5A, 35V Bipolar Chopper

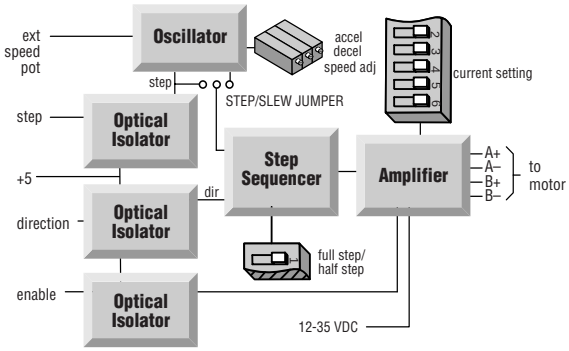
Features

- Accepts 12–35 VDC motor supply (including ripple)
- 0.4 amps – 3.5 amps/phase motor current
- DIP switch selectable current from 32 levels
- switch selectable full and half step
- internal ramping pulse generator with adjustable slew speed, acceleration and deceleration rates
- thermal protection
- optional heat sink
- screw terminal connectors
- inaudible PWM amplifiers
- optoisolated inputs
- automatic idle current reduction
- drives 4, 6 or 8 lead step motors, sizes 14–34
- enable input
- input for optional remote speed control pot
- CE compliant





MECHANICAL OUTLINE



BLOCK DIAGRAM

Description

The 3535 0 step motor driver contains a full and half step phase sequencer, two switching amplifiers, a ramping pulse generator and optoisolation circuits. This driver also includes an automatic feature to lower motor current anytime the motor is left at rest for more than one second.

The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 32 levels by a DIP switch. Full or half step operation is also selected by the DIP switch.

The internal oscillator is selected by a jumper. In oscillator mode, the pulse input becomes a run/stop signal: when this signal is set high, the motor accelerates to a preset speed and slews. Lowering the input signal cause the driver to decelerate to rest.

The 3535 0 is a PC board mounted on an aluminum angle heat transfer chassis. Mating heat sink available for stand alone operation.

Options

- add on heat sink (Model 3535 HO)

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3540 Series

The 3540 series consists of a 3540M step motor drive, 3540MO drive/oscillator and 3540i drive/controller. All three products are designed around a precision state of the art, microstepping, motor drive capable of powering NEMA 14 through NEMA 34 frame size motors. Each device produces 122 watts of usable power and microsteps at resolutions up to 12,800 steps per revolution. Microstepping resolutions up to 50,800 steps/rev are available at motor speeds up to 50 rps on the 3540i. One of the main features of the 3540i is Applied Motion's "Simple Indexer Technology™" Windows™ graphical user interface for stand alone applications. No program language to learn, no software engineer to consult, no code to write. The system does the programming, you need only input the move parameters. If your single axis application requires the 3540i to be operated by a host computer simply connect it to your PC or PLC and invoke our SiNet™ Command Language. All series 3450 products are CE compliant.

See speed/torque curves for 3540 series on pages 104 & 105.

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Technical Specifications

3540M – PULSE & DIRECTION DRIVE

Physical	1.5 x 3 x 4 inches, built on a black anodized aluminum chassis.
Connectors	Screw terminal blocks.
Inputs	Optically isolated, 5 - 12 VDC (24V requires external dropping resistors). Step: Drive makes one step per input pulse. Direction: Set direction of rotation. Enable: removes all motor current when active.
Step Resolutions	Switch selected: 400, 1000, 2000, 12800 steps/rev. Other resolutions are available. Consult the factory.
Current	Switch selected, 0.4 - 3.5 A.
Idle Current	Switch selected, 50% or 100%.
Power Supply	12 - 42 VDC (including ripple).
Self Test	Switch selected.
Agency Approval	CE & TUV

3540MO - DIGITAL OSCILLATOR/JOYSTICK DRIVE

Physical	1.5 x 3 x 4 inches, built on a black anodized aluminum chassis.
Connectors	Screw terminal blocks.
Inputs	Optically isolated, 5 – 24 VDC. Run: tells drive to run or stop. Direction: sets direction of rotation. Speed: selects high speed (25 rps) or low speed (5 rps) range. Enable: removes all motor current when active. Wiper: 0 - 5V analog input for external speed signal, pot or joystick.
Internal Pots	Accel (1 - 250 rev/sec/sec), Low Speed (0 - 5 rps), High Speed (0 - 25 rps).
External Speed	Pot/Joystick 3 terminal type, 1k - 10k ohms.
Output	Tach: 5 - 24V optically isolated, 100 pulses per revolution.
Step Resolution	12800 steps/rev.
Current	Switch selected, 0.4 - 3.5 A.
Idle Current	Switch selected, 50% or 100%.
Power Supply	12 - 42 VDC (including ripple).
Agency Approval	CE & TUV

3540i – INDEXER/DRIVE (see page 92 for Si program information)

Physical	1.5 x 3 x 5 inches, built on a black anodized aluminum chassis.
Connectors	Screw terminal blocks for power, motor, I/O. RJ11 for RS-232 port.
Serial Communications	RS-232 port, cable included.
Inputs	8 user programmable inputs, optically isolated, 5 - 24 VDC: • 2 dedicated limit switch inputs. • 4 general purpose inputs. Can be used for Feed to Sensor moves, homing, branching and triggering. • 2 jog inputs, can also be used as general purpose inputs.
Outputs	3 optically isolated 5- 24V outputs for interfacing to other equipment.
Step Resolutions	Software selected: 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800 steps/rev.
Current	Software selected, 0.2 - 3.5 A.
Idle Current	Software selected, 0%, 25%, 50% or 100%.
Power Supply	12 - 42 VDC (including ripple).
Parameter Ranges	Distance: 1 to 16,000,000 steps. Speed: .025 to 50 rev/sec. Acceleration: 1 to 3000 rev/sec/sec. Deceleration: 1 to 3000 rev/sec/sec (set independently from acceleration). Time delays: .01 to 300 seconds. Output pulse width: 2 to 500 milliseconds. Iterations per loop: 1 to 65,535. Loops per program: unlimited.
Agency Approval	CE & TUV
Optional Operator Terminal (MMI)	NEMA 4X rated (splash proof and dust proof). 4 x 20 character liquid crystal display (LCD). 20 key membrane keypad. Overall size: 4.9 x 4.9 x 1.42 inches.

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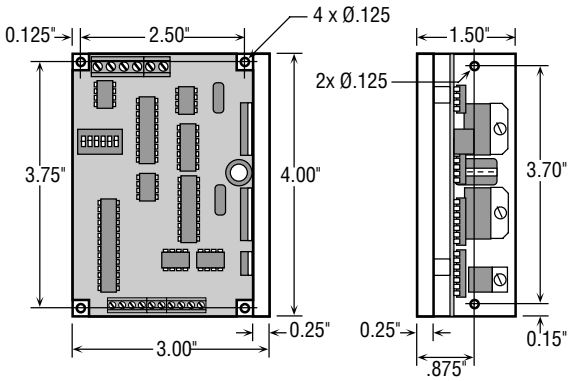
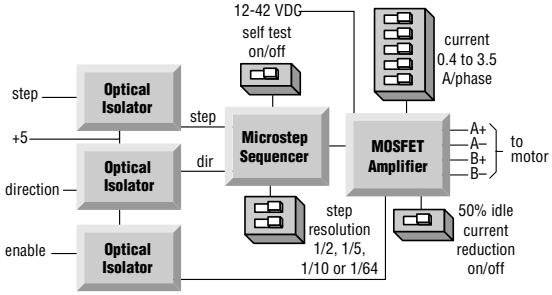
Technical Drawings

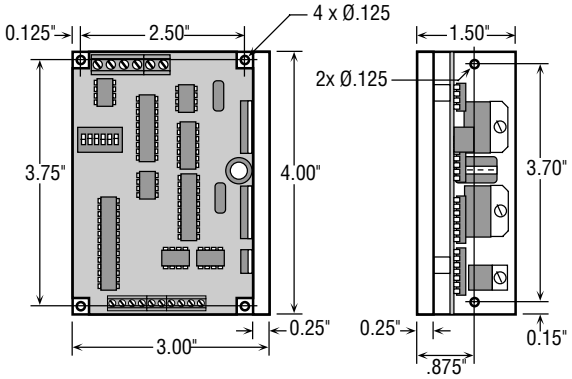
3540M MECHANICAL OUTLINE



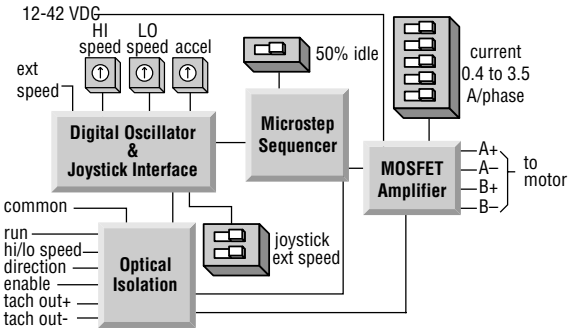
3540M BLOCK DIAGRAM



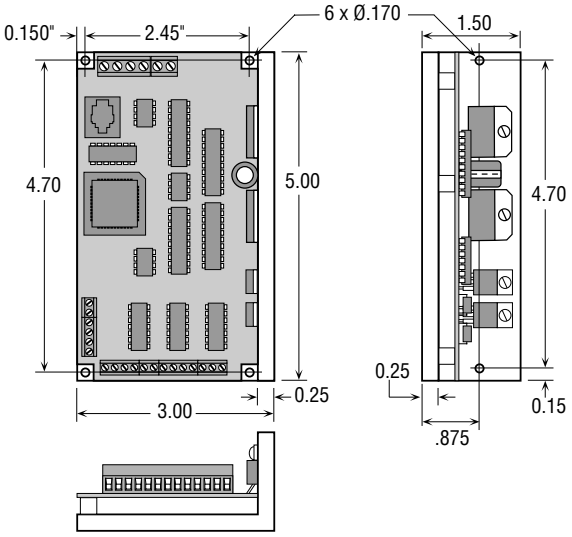
3540MO MECHANICAL OUTLINE



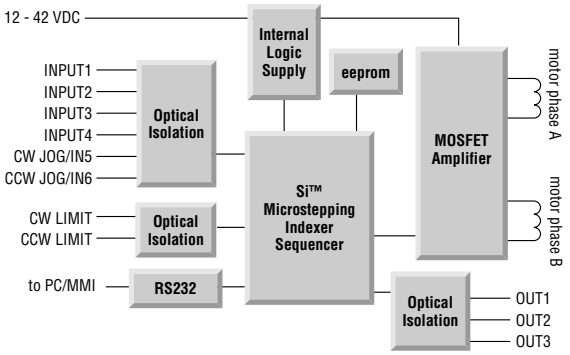
3540MO BLOCK DIAGRAM



3540i MECHANICAL OUTLINE



3540i BLOCK DIAGRAM



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Step Motor Driver

Microstep
5.5A, 60V Bipolar Chopper

Features

- Accepts 24–60 VDC motor supply (including ripple)
- 1.0 – 5.5 amps/phase motor current
- DIP switch selectable current from 16 levels
- 200, 400, 800, 1000, 1600, 2000, 3200, 4000, 5000, 6400, 8000, 9000, 10000, 12000, 12700, 12800 steps/rev
- thermal protection
- overvoltage protection
- short circuit protection
- built in heat sink
- screw terminal connectors
- inaudible 20 kHz MOSFET PWM amplifiers
- optoisolated inputs
- 250 kHz max input frequency
- automatic idle current reduction (defeatable)
- drives 4, 6 or 8 lead step motors, sizes 14 – 42
- enable input

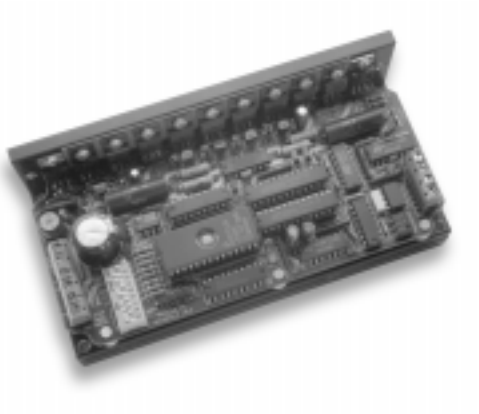
Description

The 5560 step motor driver contains a microstep sequencer, two switching amplifiers, optoisolation circuits and protective circuitry. This driver also includes an automatic feature to lower motor current anytime the motor is left at rest for more than one second.

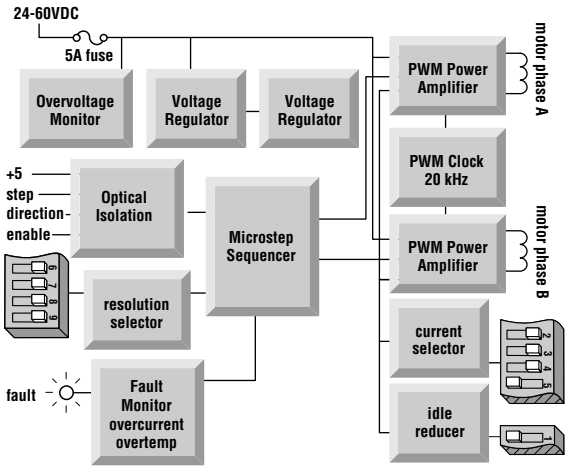
The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 16 levels by DIP switches. Step resolution is selected by a bank of 4 DIP switches.

The 5560 is a PC board mounted on an aluminum chassis with integral heat sink. Drive can be mounted on 3" x 6" (finned) side or 2" x 6" (flat) side.

Microstep resolutions other than those listed above can be programmed for your specific application.



MECHANICAL OUTLINE



BLOCK DIAGRAM

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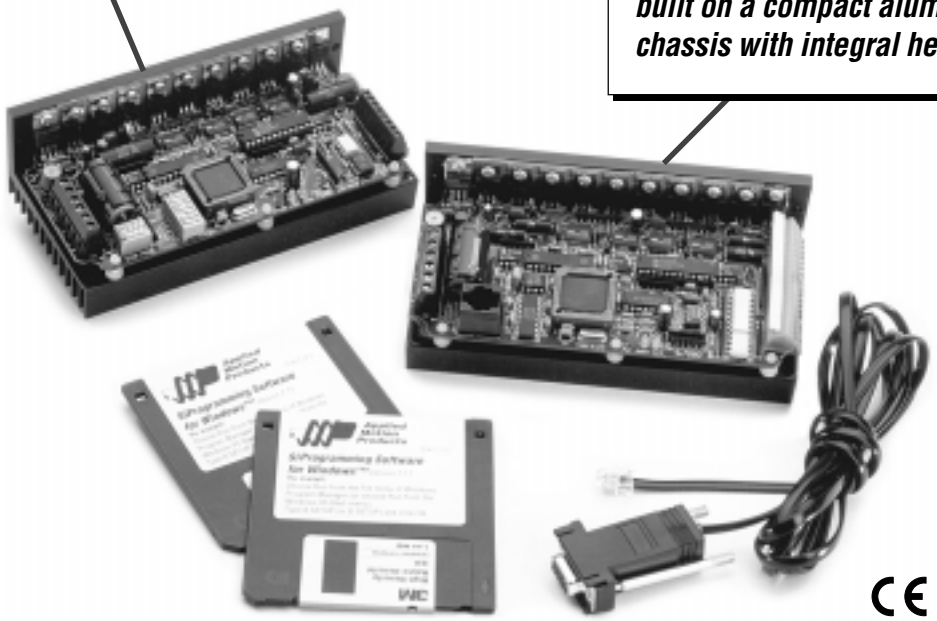
7080 Series

The 7080 is a microstepping chopper drive, built on a compact aluminum chassis with integral heat sink.

The 7080i is a microstepping chopper drive with indexer, built on a compact aluminum chassis with integral heat sink.



The 7080 series consists of a 7080 step motor drive and 7080i drive/controller. Both products are designed around a precision state of the art step motor drive capable of powering NEMA 14 through NEMA 42 frame size motors. Each device produces 560 watts of usable power and microsteps at resolutions up to 50,800 steps per revolution. Full microstepping resolution of 50,800 steps is available at motor speeds up to 50 rps. One of the main features of the 7080i is Applied Motion's "Simple Indexer Technology™" Windows™ graphical user interface for stand alone applications. No program language to learn, no software engineer to consult, no code to write. The system does the programming, you need only input the move parameters. If your single axis application requires the 7080i to be operated by a host computer simply connect it to your PC or PLC and invoke our SiNet™ Command Language. All 7080 series products are CE compliant.

See speed/torque curves for 7080 series on pages 108 & 109.

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Technical Specifications

POWER AMPLIFIER (MOTOR DRIVE) SECTION 7080 SERIES:

AMPLIFIER TYPE	MOSFET, dual H-Bridge, all parts rated for 100 volts.
CURRENT CONTROL	3 state, pulse width modulated, switching at 25KHz.
OUTPUT CURRENT	0.8 to 7.0 amps: **7080i** software selectable, **7080** dip switch selectable.
DC BUS VOLTAGE	24 to 80 VDC (including ripple).
MAXIMUM OUTPUT POWER	560 Watts.
PROTECTION CIRCUITS	Short circuit and over temperature.
IDLE CURRENT REDUCTION	**7080i:** 0%, 25%, 50%, or 100% software selectable. **7080:** 0% or 50% dip switch selectable.
MOTOR RESOLUTION	**7080:** 16 resolutions. Steps per revolution with 1.8˚ motor: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800. **7080i:** 13 resolutions. 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800.
INPUTS (7080 ONLY)	Step and direction optically isolated, 5V–24V differential. Motor steps on falling edge of step input. 250 hsec minimum pulse, 2 MHz maximum step rate. 1 msec setup and hold time for direction signal.
ENABLE INPUT (7080 ONLY)	Two terminals on the logic connector (EN+ AND EN–) that can be used to disable the drive. The current to the stepper motor will be turned off. The 7080 operates normally without any connections to the enable circuit. Use this feature only to disable the amplifier.

CONTROLLER (INDEXER) SECTION 7080i: (see page 92 for Si program information)

SERIAL COMMUNICATION	RS-232 programming port.
STATUS LED'S	DC power (red), Overtemp (yellow) and Short (yellow).
INPUTS	8 user programmable inputs. 2 dedicated, optically isolated limit switch inputs, 5–24 VDC. 4 general purpose, filtered inputs. The *Feed to Sensor* instruction can use these inputs for homing or other sensing needs. The *Wait Input* instruction can wait for one of the inputs to see a given voltage state or signal edge. The *If Input* instruction can branch based on the state of an input. 2 jog inputs (cw and ccw) that can also be used as general purpose inputs.
OUTPUTS	4 user outputs. Drive fault (activated by overcurrent or overtemperature condition). 3 general purpose, optically isolated outputs for interfacing to other equipment. Can be set to a voltage or programmed to send a pulse by the *Set Output* instruction.
PARAMETER RANGES	Distance: 1 to 16,000,000 steps. Speed: .025 to 50 revolutions per second (in any microstep resolution). Acceleration: 1 to 3,000 rev/sec/sec. Deceleration: 1 to 3,000 rev/sec/sec (set independently from acceleration). Time Delays: .01 to 300 seconds. Output Pulse Widths: 2 to 500 milliseconds. Iterations per loop: 1 to 65,535.
OPTIONAL OPERATOR INTERFACE (MMI)	NEMA 4X rated (splash proof & dust proof). 4 x 20 characters liquid crystal display (LCD). 20 key membrane keypad. Overall size: 4.9 x 4.9 x 1.42 inches.

SYSTEM SPECIFICATIONS:

OVERALL SIZE	2 x 3 x 6 inches. See mechanical outline on page 5.
CHASSIS MATERIAL	Aluminum, black anodized with integral heat sink.
WEIGHT	1 lbs.
AMBIENT TEMPERATURE	0˚ to 50˚C (32˚ to 122˚F).
HUMIDITY	Maximum of 90% non-condensing.
CONNECTORS	Screw terminal connectors for input power and motor, Wago cage clamp connector for signal I/O.
MOTORS	Can drive 4, 6 or 8 lead motors, NEMA sizes 14–42.
OPTIONAL COVER	Steel mesh, black powder coated.
AGENCY APPROVAL	CE & TUV.

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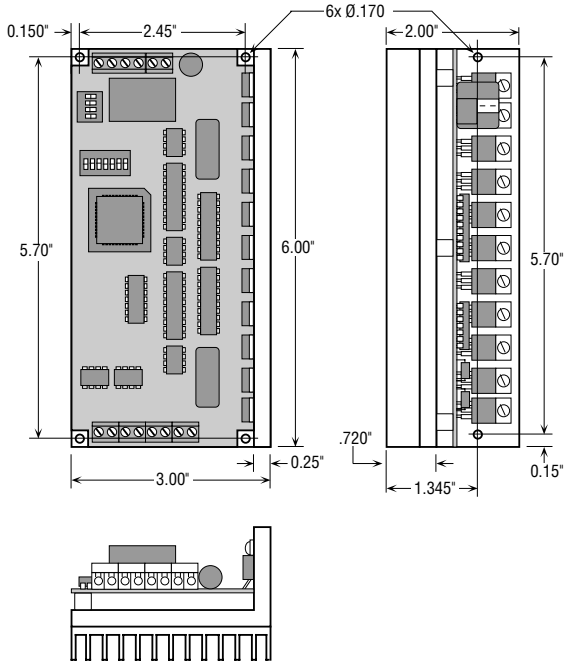
7080 Technical Drawings

MECHANICAL OUTLINE



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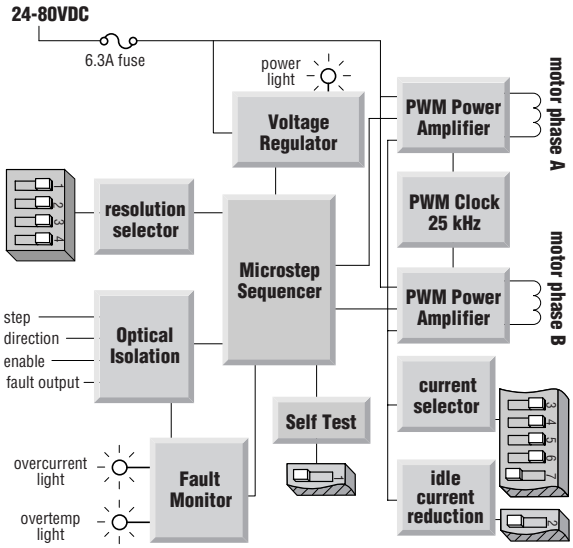
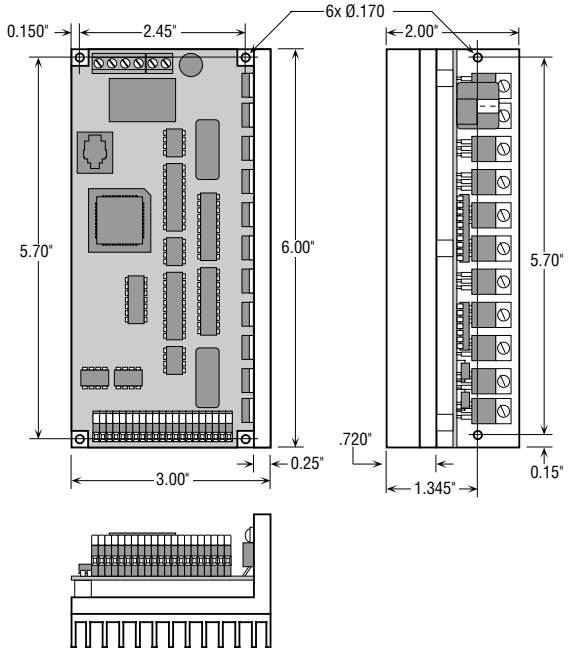


7080i Technical Drawings

MECHANICAL OUTLINE



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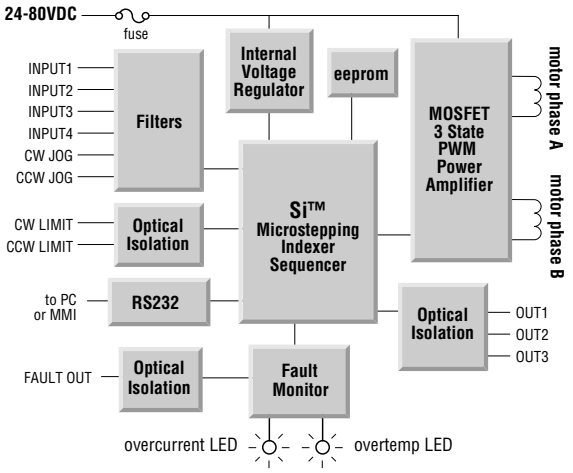

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Step Motor Driver

Full & Half Step
2A, 35V Bipolar Chopper with Digital Oscillator and Power Supply

Features

- 110/220 VAC input (built in 35 VDC supply)
- 125 mA–2 amps/phase motor current
- DIP switch selectable current from 16 levels
- full and half step—switch selectable
- internal ramping pulse generator with adjustable slew speed, acceleration and deceleration rates
- 10–1,200 and 100–12,000 pps digital oscillator speed range (switch selectable)
- digital oscillator pulse output for interface to counter
- amplifier enable input (logic signal to turn off motor current)
- can be operated in pulse & direction or run/stop mode
- speed can be controlled from built-in front panel potentiometer, remote potentiometer or 0–5V analog signal. Connectors included.
- pluggable screw terminal connectors for motor, power, step & direction
- inaudible PWM amplifiers
- optoisolated inputs
- built in fuse
- automatic 50% idle current reduction (defeatable by jumper)
- drives 4, 6 or 8 lead step motors, sizes 14-23
- can be operated from active logic or switches/relays

Description

The PD 2035 step motor driver contains a power supply, full and half step phase sequencer, two switching amplifiers, a digital ramping pulse generator and optoisolation circuits. This driver also includes a power saving feature to automatically lower motor current anytime the motor is left at rest for more than one second.

The amplifiers regulate motor current by chopping at a constant, inaudible frequency. Phase current is selected from 16 levels by a dip switch. Full or half step operation is also selected by the dip switch.

The internal oscillator is selected by a dip switch. In oscillator mode, the pulse input becomes a run/stop signal: when this signal is set low, the motor accelerates to a preset speed and slews. Raising the input high (to 5 volts) causes the driver to decelerate to rest. Two oscillator speed ranges are provided: 10–1,200 steps/sec and 100–12,000 steps/sec.

The digital oscillator derives it's timing from a quartz crystal for low drift and repeatable ramps. The speed of the oscillator can be set by an on-board potentiometer, or an external pot, or an external 0–5 volt analog signal.

The PD 2035 is built on an aluminum heat transfer plate, and is surrounded by a sturdy, ventilated steel enclosure.

See speed/torque curves for PD2035 on pages 102 & 103.

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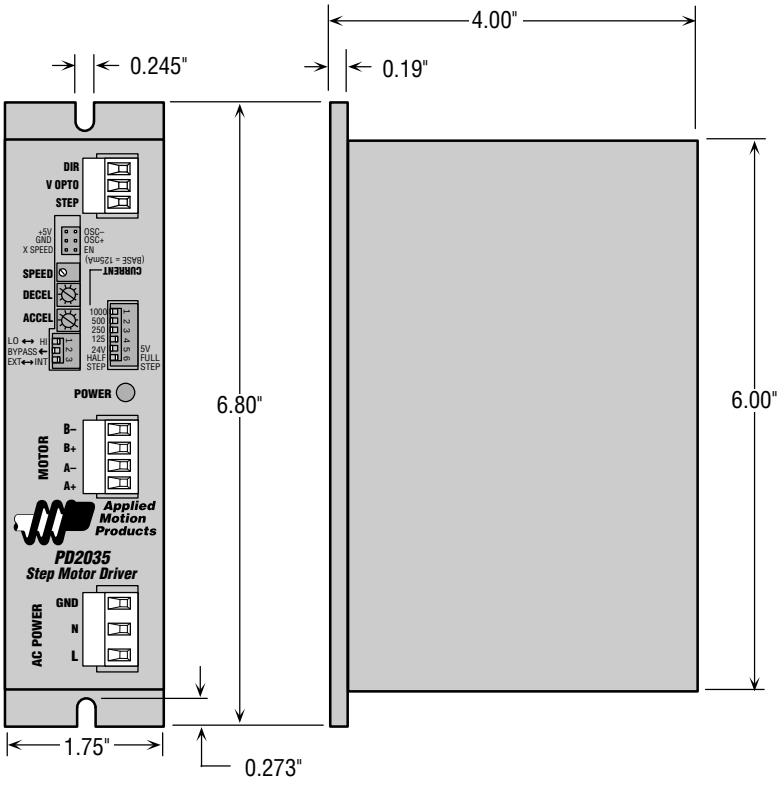
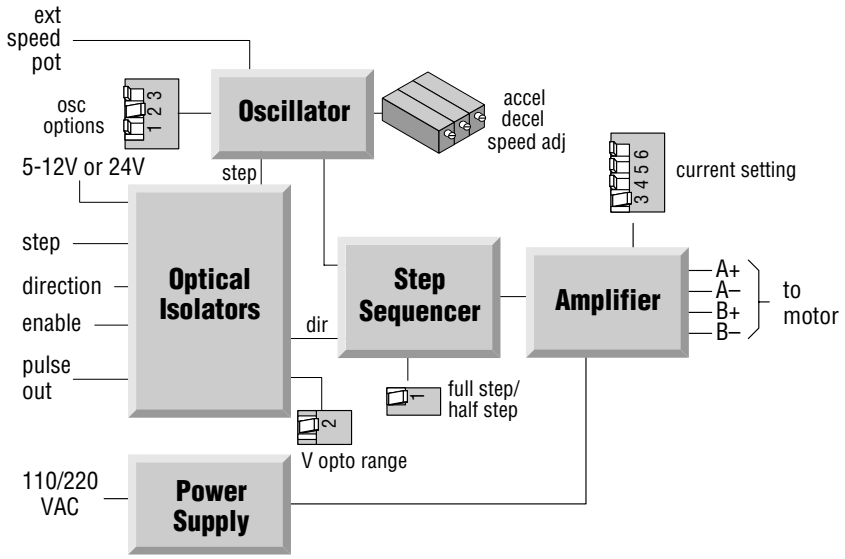
Technical Drawings



MECHANICAL OUTLINE



BLOCK DIAGRAM

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PD/Si 5580 Series

SI5580

PD5580

The 5580 Series drive and drive/indexer systems are designed around a precise, high power step drive suitable for use with NEMA 14 through NEMA 42 motors. Reliable and rugged the 5580 series is capable of microstepping resolutions up to 50,800 steps per revolution at speeds to 50 RPS while providing smooth torque, low vibration and precise positioning.

One of the Si5580's outstanding features is Applied Motion's "Simple Indexer Technology™" Windows™ graphical user interface for stand alone applications. No programming to learn, no software engineer to consult, no code to write. All you do is POINT-CLICK-MOVE. The Si™ interface does the programming, you need only input the move parameters. If your single axis application requires the Si5580 to be operated by a host computer simply connect it to your PC or PLC and invoke our SiNet™ Command Language. All series 5580 products are CE compliant.

See speed/torque curves for PD/Si 5580 series on pages 106 & 107.

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Technical Specifications

POWER AMPLIFIER (MOTOR DRIVE) SECTION 5580 SERIES:

AMPLIFIER TYPE	MOSFET, dual H-Bridge, all parts rated for 100 volts.
CURRENT CONTROL	3 state, pulse width modulated, switching at 25KHz.
OUTPUT CURRENT	0.5 to 5.5 amps: **Si5580** software selectable, **PD5580** dip switch selectable.
DC BUS VOLTAGE	80 VDC.
AC INPUT VOLTAGE	110 or 220 VAC (switch selectable) 50–60 Hz.
MAXIMUM OUTPUT POWER	440 Watts.
PROTECTION CIRCUITS	Short circuit and over temperature.
IDLE CURRENT REDUCTION	**Si5580:** 0%, 25%, 50%, or 100% software selectable. **PD5580:** 0% or 50% dip switch selectable.
MOTOR RESOLUTION	**PD5580:** 16 resolutions. Steps per revolution with 1.8˚ motor: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800. **Si5580:** 13 resolutions. 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800.
INPUTS (PD5580 ONLY)	Step and direction optically isolated, 5V–24V differential. Motor steps on falling edge of step input. 250 hsec minimum pulse, 2 MHz maximum step rate. 1 msec setup and hold time for direction signal.
ENABLE INPUT (PD5580 ONLY)	Two terminals on the logic connector (EN+ AND EN–) that can be used to disable the drive. The current to the stepper motor will be turned off. The PD5580 operates normally without any connections to the enable circuit. Use this feature only to disable the amplifier.

CONTROLLER (INDEXER) SECTION Si5580: (see page 92 for Si program information)

SERIAL COMMUNICATION	RS-232 programming port.
STATUS LED'S	DC power (red), Overtemp (yellow) and Short (yellow).
INPUTS	8 user programmable inputs. 2 dedicated, optically isolated limit switch inputs, 5–24 VDC. 4 general purpose, filtered inputs. The *Feed to Sensor* instruction can use these inputs for homing or other sensing needs. The *Wait Input* instruction can wait for one of the inputs to see a given voltage state or signal edge. The *If Input* instruction can branch based on the state of an input. 2 jog inputs (cw and ccw) that can also be used as general purpose inputs.
OUTPUTS	4 user outputs. Drive fault (activated by overcurrent or overtemperature condition). 3 general purpose, optically isolated outputs for interfacing to other equipment. Can be set to a voltage or programmed to send a pulse by the *Set Output* instruction.
PARAMETER RANGES	Distance: 1 to 16,000,000 steps. Speed: .025 to 50 revolutions per second (in any microstep resolution). Acceleration: 1 to 3,000 rev/sec/sec. Deceleration: 1 to 3,000 rev/sec/sec (set independently from acceleration). Time Delays: .01 to 300 seconds. Output Pulse Widths: 2 to 500 milliseconds. Iterations per loop: 1 to 65,535.
OPTIONAL OPERATOR INTERFACE (MMI)	NEMA 4/12 rated (splash proof & dust proof). 4 x 20 characters liquid crystal display (LCD). 20 key membrane keypad. Overall size: 4.9 x 4.9 x 1.42 inches.

SYSTEM SPECIFICATIONS:

OVERALL SIZE	3 x 8 x 5.3 inches. See mechanical outline.
CHASSIS MATERIAL	Aluminum, black anodized with integral heat sink.
WEIGHT	1 lbs.
AMBIENT TEMPERATURE	0˚ to 50˚C (32˚ to 122˚F).
HUMIDITY	Maximum of 90% non-condensing.
CONNECTORS	Screw terminal connectors for input power and motor, and I/O signals.
MOTORS	Can drive 4, 6 or 8 lead motors, NEMA sizes 14–42.
CASE	Steel with black paint and white epoxy silk screen. Integral heat sink, mounting brackets & switch covers included.
AGENCY APPROVAL	CE & TUV.

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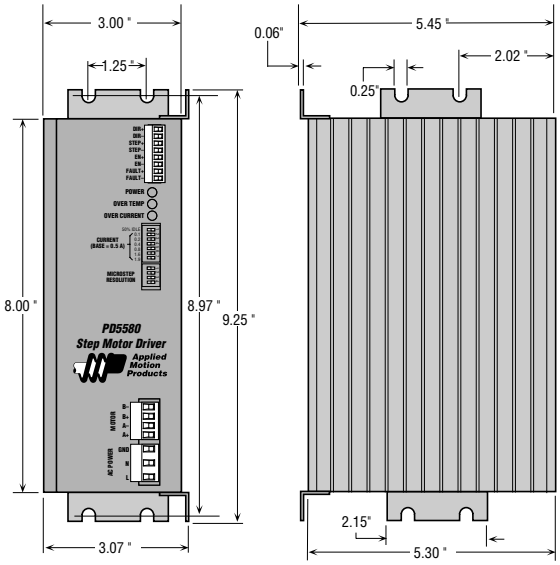
PD5580 Technical Drawings

MECHANICAL OUTLINE



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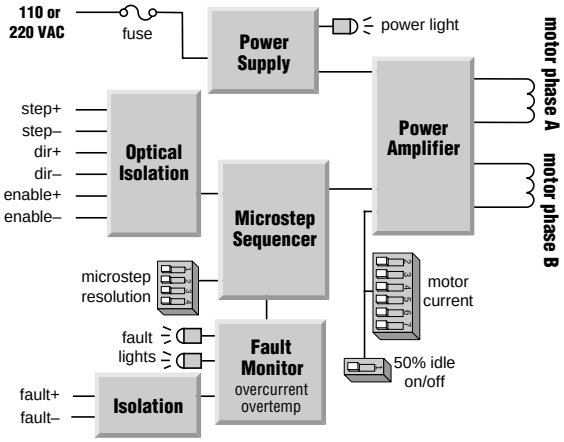
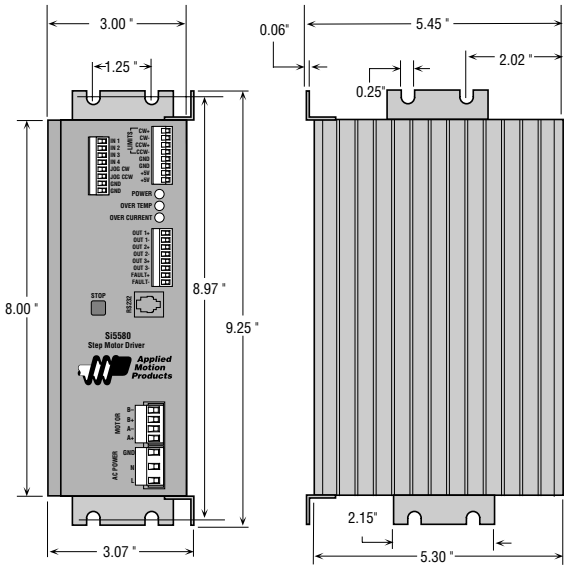


Si5580 Technical Drawings

MECHANICAL OUTLINE



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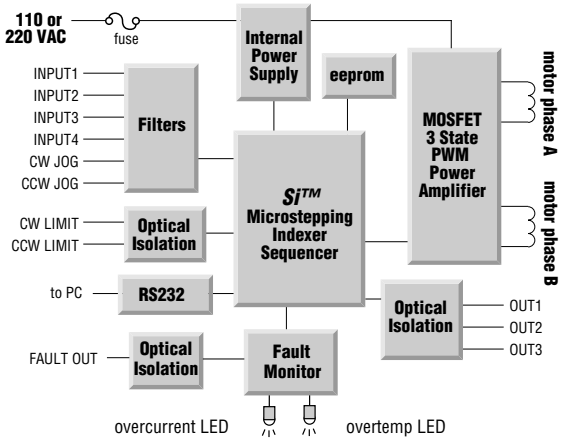

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Connector/Switch Diagrams

connector
motor controller

status LEDs
power
over temp
over Current

DIP switches
resolution setting
idle current setting
current setting

connector
motor

connector
AC power

connector
general purpose
inputs
jog inputs

stop button

connector
limit switches

status LEDs
power
over temp
over Current

connector
fault output
general purpose
outputs

connector
RS-232
programming
port/MMI port

connector
motor

connector
AC power

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PD/MC 8400 Series

The 8400 series consists of the PD8400 packaged step motor drive, MC8400 packaged drive/machine controller, and MC8400F packaged machine controller with encoder following capability. All three products are designed around a high-power, precision, state of the art, step motor driver capable of powering NEMA 23 through NEMA 42 frame size motors. Each produces 1,300 watts of usable power and microsteps at resolutions up to 50,800 steps per revolution. One of the 8400 series many features is electronic damping and midrange stability circuitry which provides smooth torque, low vibration and precise positioning. Also, incorporated in the design is a high speed, proprietary H-bridge controller capable of driving the motor to speeds of 6000 rpm.

All systems are shipped complete with mating connectors, switch covers, mounting hardware, integral heat sink and internal cooling fan. Matching system motors come ready for service with a 10' cable, boot and connector.

See speed/torque curves for PD/MC 8400 series on page 110.

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General Features

FEATURES COMMON TO ALL MODELS:

- Torques from 70 to 1125 oz-in (motor dep).
- Peak currents from 0.1 to 8.4 amps per phase.
- Speeds to 100 RPS (6000 RPM at 20,000 steps/rev) with a maximum step input rate of 2 MHz.
- Sixteen user selectable resolutions to 50,800 steps/rev.
- Multistep current control for reduced motor heat.
- Damping circuitry to improve low speed and midrange performance.
- The drive uses 250 volt power amplifier components and is internally fan cooled for maximum reliability.
- Soft-start circuitry eliminates AC current spikes at power on.
- Multilayer printed circuit board construction minimizes RFI and increases reliability.

FEATURES COMMON TO THE MC8400 AND MC8400F:

- A MC68302 microprocessor is used for optimized communication and process control functions.
- All math calculations are done in double precision floating point for pinpoint accuracy.
- Two high speed RS-232c serial communication channels for interaction with other MC8400's, computers, PLC's, operator interface devices and data acquisition subsystems.
- Optional internal Solid State Relay (SSR) modules on most of the input and output lines let the 8400 accept high voltage inputs and drive real world loads without the need for an external relay rack.
- Built in dual power supplies provide enough power for your encoder, user interface panel, limit switches, sensors, switches and more.
- MOTION MASTER FPGA generates step rates in excess of 2 MHz.
- MOTION MASTER delivers motor start delay times as short as 25 microseconds from input or program events.
- Motor moves can be based on distance, velocity or time, motion parameters and input/output events can be changed "on the fly."
- Sophisticated motion profiling software allows the user to create multisegment and variable "S" curve moves combining up to 40 motion elements (each element consists of an accel/decel value plus velocity and a distance), and up to 38 separate input and output events.
- 8K or optional 32K EEPROM's provide for a lifetime of safe program storage with no batteries to wear out and a capacity of over 2500 program lines and up to 510 individual programs.
- MACRO (MAchine ContRol Operation) software is optimized for motion and machine control operation and provides single software commands for many high level functions including jog and homing routines, as well as repetitive, high speed, cyclical (back and forth) and unidirectional moves.
- Conditional program branching and complex conditional evaluations using mathematical, variable and input/output manipulation can all be performed using MACRO commands.
- Extensive program instructions for display device manipulation let you create many types of custom user interface screens.
- MACRO commands allow you to log data as the events occur and store that data in the EEPROM.
- Password control and read-only functions insure security of application programs and machine operation.
- MACRO provides for many math operations including powers, roots, trig and log functions, and Boolean logic operators.
- All variables can be numeric (floating point), string (characters), or arrays of data and can be identified with any user desired combination of numbers or characters.
- The number of variables or the size of a variable array is limited only by the available memory and could reach 2500 or more.

UNIQUE FEATURES OF THE MC8400F:

- Digital, lock-shaft following insures instant response to changes in the encoder signal and none of the position or velocity errors found in software interpolated following systems.
- MACRO-FOLLOW provides for speed and position moves based on a master axis encoder, preset moves at a ratio of the master axis velocity, synchronous moves based on registration marks, cam profiling and "on the fly" ratio changes.
- MACRO-FOLLOW allows acceleration and deceleration parameters to be ratiometrically altered "on the fly" and ratiometric distances to be based on the speed of the master axis encoder.
- MACRO-FOLLOW allows for direction reversal of the master axis with no loss of position.

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Technical Specifications

POWER AMPLIFIER (MOTOR DRIVE) SECTION 8400 SERIES:

AMPLIFIER TYPE	MOSFET, dual H-Bridge, all parts rated for 250 volts.
CURRENT CONTROL	3 state, pulse width modulated, switching at 25KHz.
OUTPUT CURRENT	0.1 to 8.4 amps, software selectable in 0.1 increments.
DC BUS VOLTAGE	160VDC.
MAXIMUM OUTPUT POWER	1300 Watts per phase.
PROTECTION CIRCUITS	Short circuit, over temperature and soft start shutdown.
AC INPUT VOLTAGE	95–135 VAC, 50–60Hz.
IDLE CURRENT REDUCTION	25%, 50%, 75% or 100% in automatic mode using the dip switches or a custom idle current can be set in software from 0.1 to 8.4 amps at any point in the program.
MOTOR RESOLUTION	16 resolutions. Steps per revolution with 1.8˚ motor: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800.
WAVEFORMS	
USER POWER SUPPLY (MC8400 & MC8400F ONLY)	
PS 1	+5 VDC, 0.30 amps, regulated, isolated from the motor drive.
PS 2	+24 VDC, 0.15 amps, regulated, isolated from the motor drive.
INPUTS (PD8400 ONLY)	Step and direction optically isolated, 5V-24V differential. Motor steps on falling edge of step input. 250 hsec minimum pulse, 2 MHz maximum step rate. 1 hsec setup and hold time for direction signal.
ENABLE INPUT (PD8400 ONLY)	Two terminals on the logic connector (EN+ AND EN–) that can be used to disable the drive. The current to the stepper motor will be turned off. The PD8400 operates normally without any connections to the enable circuit. Use this feature only to disable the amplifier.

CONTROLLER (INDEXER) SECTION MC8400/MC8400F:

MICROPROCESSOR	Motorola 68302.
SYSTEM MEMORY	256K of ROM, 256K of RAM.
USER MEMORY	EEPROM, 8K or optional 32K.
SERIAL COMMUNICATION	2 RS-232c serial communication ports which can operate from 300 to 19,200 baud.
STATUS LED'S	AC power (red), CW direction (green), Step (green), Motor Power (red), Overtemp (yellow) and Short (yellow).
INPUTS	8 user programmable inputs, CW limit, CCW limit, Home limit, 2 Encoder inputs and Motion Trigger input. Each input can be separately connected for sinking OR sourcing operation.
OUTPUTS	9 user programmable outputs, each output can be separately connected for sinking OR sourcing operation.
OPTOISOLATOR OPTION	
INPUT SIGNAL VOLTAGE (ON)	3.0 to 24 VDC, 5ma to 20ma.
INPUT SIGNAL VOLTAGE (OFF)	0.0 to 0.5 VDC.
OUTPUT SIGNAL VOLTAGE RANGE	0.0 to 24 VDC, maximum of 25ma per output.
SOLID STATE RELAY OPTION	
INPUT SIGNAL VOLTAGE (ON)	5.0 to 60 VDC or 24 to 240 VAC, 5ma to 20ma.
INPUT SIGNAL VOLTAGE (OFF)	0.0 to 0.5 VAC or DC.
OUTPUT SIGNAL VOLTAGE RANGE	0.0 to 150 VDC, 0 to 3 amps per output or 0.0 to 240 VAC, 0 to 3 amps per output.
ENCODER RESOLUTION	1000 lines (4000 counts) per revolution standard, other resolutions can be used.

SYSTEM SPECIFICATIONS:

CASE SIZE	MC8400/MC8400F: 9.48 x 8.76 x 5.86. PD8400: 9.48 x 8.76 x 4.06.
CASE MATERIAL	Aluminum, finished with textured black epoxy powder coat paint.
WEIGHT	PD8400: 6.4 lbs. MC8400/MC8400F: 8.5 lbs.
MATING CONNECTORS	
MOTOR	Phoenix 9 position.
AC POWER	Phoenix 3 position.
LOGIC	
SERIAL	Phoenix 6 position.
LIMITS	Phoenix 8 position.
I/O-12	Phoenix 12 position.
I/O-6	Phoenix 6 position.
AMBIENT TEMPERATURE	0˚ to 50˚C (32˚ to 122˚F).
HUMIDITY	Maximum of 90% non-condensing.

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Software Command Summary—MC8400/MC8400F

AGAIN ..... Marks the end of a FOR, LOOP or WHILE command sequence.

AMOVE ..... Move the motor shaft to a location referenced to the absolute HOME (0) position, at the specified velocity and direction.

BACKOFF ..... Reverse the direction of motor travel and back the motor off of an active limit switch. Works only within an ON sequence.

BREAK ..... Break out of the current FOR, LOOP or WHILE program segment.

CEIL ..... Round a value or math sequence to the next higher whole number.

CHKSUM ..... Calculate a numeric value that indicates the size and state of the user memory used primarily to insure that the user memory has not been changed or corrupted.

CLS ..... Clear the display screen connected to the indicated RS-232c serial port.

CMODE ..... Normally, all programs will stop execution when a Ctrl-C is received via the first RS-232c serial port. The command CMODE 0 will cause a program to ignore the Ctrl-C, CMODE I will cause a program to recognize Ctrl-C again.

CMOVE ..... Move the motor shaft continuously in one direction and at one speed until otherwise instructed.

COMPILE ..... Compile and test a program for syntax errors.

COPY ..... Copy the program commands from one file name to another.

CURSOR ..... Position the cursor of the device connected to the indicated RS-232c serial port.

DEBOUNCE ..... Specify the debounce time for all inputs.

DELAY ..... Pause program execution for a specified amount of time.

DELETE ..... Delete a user program from the nonvolatile memory.

DIR ..... List the names of all user programs currently stored in memory.

DISABLE ..... Disable a previously defined interrupt driven input.

EDIT ..... Begin the process of making changes (edits) to the indicated program.

ELSE ..... An alternate program sequence used in an IF statement.

ENABLE ..... Enable a previously defined interrupt driven input.

END ..... Establishes the end of the program, it is always the last command in any user program and comes after all subroutines.

ENDIF ..... Marks the end of an IF or IFINPUT command program sequence.

ENDON ..... Marks the end of an ON command sequence.

EXIT ..... Leave the current program and return to command mode.

FLIP ..... Change the state of the designated outputs to the opposite state.

FLOOR ..... Round a value or math sequence to the next lower whole number.

FOR ..... Repeat the program sequence that follows (ending with AGAIN), incrementing the variable by the stated amount each time the sequence is repeated, until the desired value is reached.

GET ..... Get a numeric value from the indicated RS-232c serial port.

GETC ..... Get a previously received character value from the indicated RS-232c serial port storage buffer.

GETCRNT ..... Sample the motor current and place the value in a variable.

GETENC ..... Read the value of the encoder absolute position register and place the value in a variable.

GETMOTOR ..... Read the value of the motor absolute position register and place the value in a variable.

GOSUB ..... Execute the indicated subroutine.

GOTO ..... Continue execution of the program with the command line following the corresponding LABEL command.

IF ..... Execute the program sequence that follows (ending with ENDIF), if the comparisons or conditions are true.

IFINPUT ..... Execute the program sequence that follows (ending with ENDIF), if the status of the designated inputs is true.

INPUT ..... Read the state of the general purpose inputs and set a designated variable to a value that indicates the state of these inputs.

JOG ..... Move the motor in the direction indicated by the selected input, at the specified velocity, until that input is no longer active.

JOGKEY ..... Initiate the built in, RS-232c computer based, jog routine.

LABEL ..... Tag which marks the destination point of a GOTO statement.

LIST ..... Print a list of the programs command statements to the terminal connected to the first RS-232c serial port.

LOCK ..... Prevents the program from being edited, changed or deleted.

LOOP ..... Repeat the program sequence that follows (ending with AGAIN), the specified number of times.

LOWER ..... Convert an ASCII value from upper to lower case.

MENU ..... Exit the Command Mode and return to the Main Menu (same as QUIT).

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MOTORCLR ..... Clear any Motor errors and reset the motion controller.
MOTORENA ..... Enable or Disable the motor drive's amplifiers.
ON ..... Designates a type of special purpose function block, options include limit switches, stall detection and error conditions.
OUTPUT ..... Set the general purpose outputs to the indicated states.
PASSWORD ..... Wait for a specific password to be entered before executing the next command, characters entered are NOT echoed to the screen. The user may choose to echo a user specified character instead.
PMOVE ..... Initiate a previously defined motor move.
PMOVEDEF ..... Start the definition of a predefined motor move.
PMOVEEND ..... End the definition of a predefined motor move.
PREP ..... Repeat a predefined motor move a designated number of times.
PRINT ..... Output character and numeric information to the indicated RS-232c serial port.
PURGE ..... Clear any previously received data from the indicated RS-232c serial port storage buffer.
QUIT ..... Exit the Command Mode and return to the Main Menu (same as MENU).
REM ..... A remark or comment that annotates a program.
REMOTE ..... Allow commands received via the first RS-232c serial port to be sent back out the second RS-232c serial port.
RENAME ..... Change the name of a user program.
REPEAT ..... Marks the start of a repeating section within a predefined move.
RETURN ..... Establishes the end of a subroutine, it is always the last command in any subroutine and it causes the execution of the program to return to the first command line following the initial GOSUB.
RGMOVE ..... Move the motor shaft at the specified velocity and direction. No more than the maximum distance indicated, searching for a specified input, which, if seen, will cause the motor to move the distance indicated at the specified velocity.
RMOVE ..... Move the motor shaft the distance indicated at the specified velocity and direction.
ROUND ..... Round a value or math sequence to the nearest whole number.
RUN ..... Execute the indicated program.
SEEK ..... Move the motor shaft until a specific input transition occurs.
SERIAL ..... Set the parameters of the indicated RS-232c serial port, these include the baud rate, parity, data and stop bits.
SET ..... Assign a value to a variable, or array element, math operations can be performed using this command.
SETCRNT ..... Set the value of the amplifier motor current register.
SETENC ..... Set the value of the encoder absolute position register.
SETMOTOR ..... Set the value of the motor absolute position register.
STEP ..... Execute a program, one command at a time.
STOP ..... Designates the end of the main program commands and separates the subroutine definitions from the main program.
SUBRTN ..... Begin the definition of a subroutine program (ending with RETURN), all subroutine definitions must follow the STOP command.
SYSVARS ..... Print a list of all of the systems variables to the device connected to the indicated RS-232c serial port.
TIME ..... Place the value of the elapsed system ON time (in 0.01 see increments) in a variable.
TMOVE ..... Move the motor shaft for the amount of time indicated, at the specified velocity and direction.
UNLOCK ..... Allows the program to be edited, changed or deleted.
UPPER ..... Convert an ASCII value from lower to upper case.
VAR ..... Define a variable, character string, or an array.
VERSION ..... Print the software revision number to the device connected to the first RS-232c serial port.
WAITC ..... Wait for a specified character to be received on the indicated RS-232c serial port before executing the next command.
WAITIN ..... Wait for a specific combination of input states to occur before executing the next command.
WHILE ..... Repeat the program sequence that follows (ending with AGAIN), as long as the comparison is true.
WHILEIN ..... Repeat the program sequence that follows (ending with AGAIN), as long as the specified combination of input states is true.
XMODE ..... All programs that contain the command XMODE 1 will stop execution when a Ctrl-X is received via the first RS-232c serial port. XMODE 0 will cause the program to ignore the Ctrl-X.

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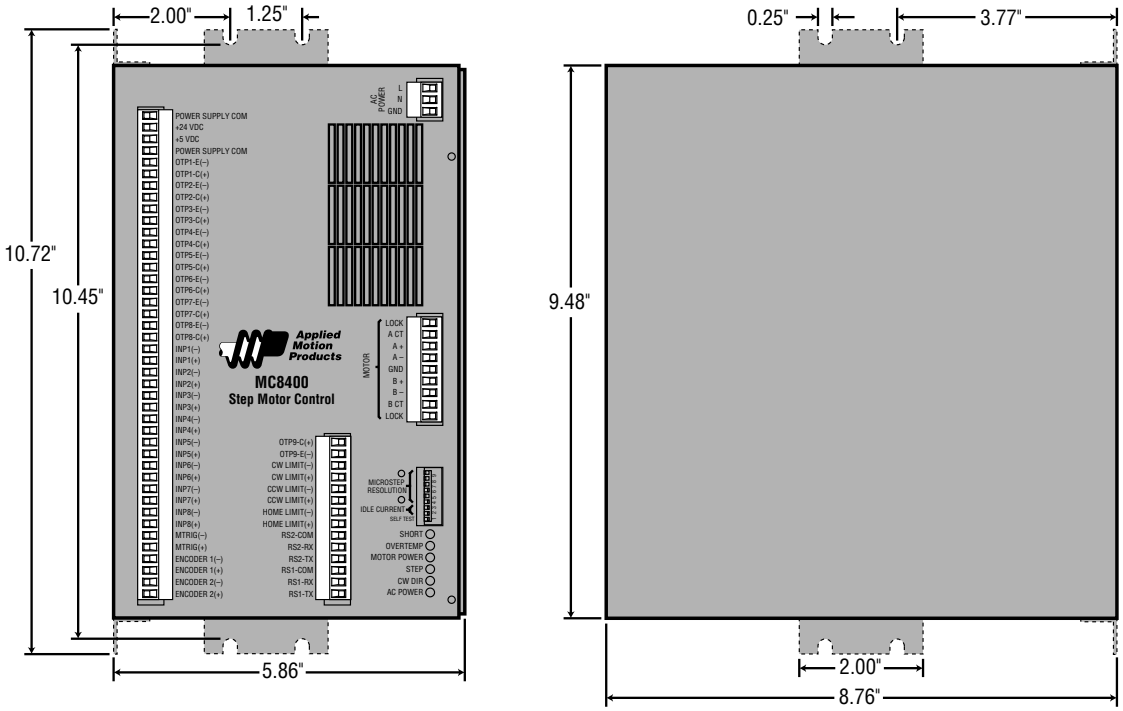
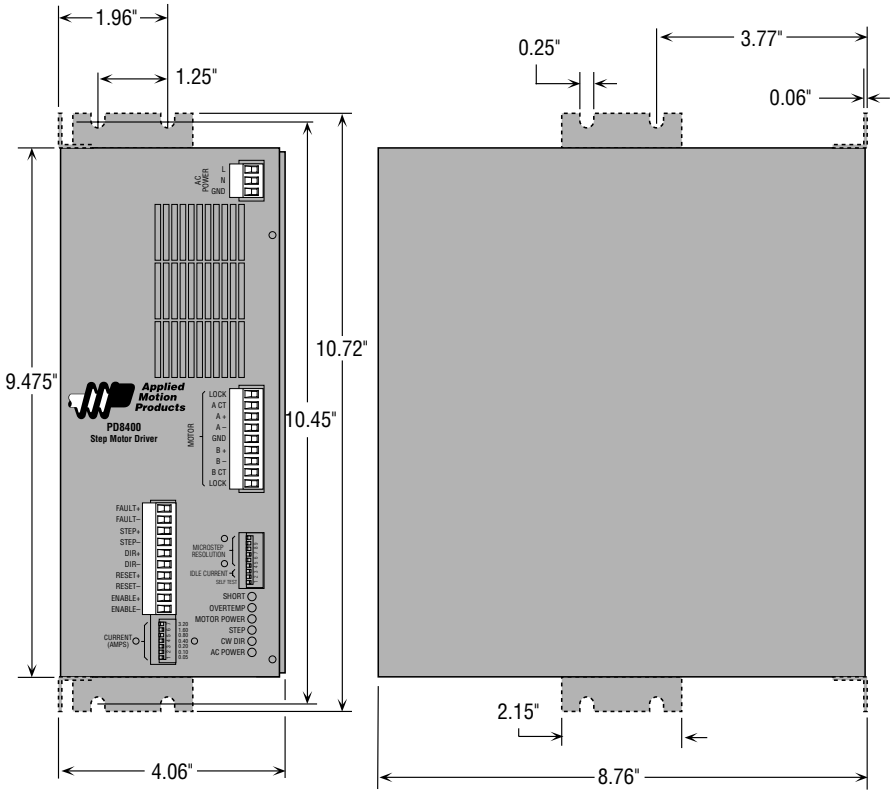
Mechanical Outlines

MC8400



PD8400



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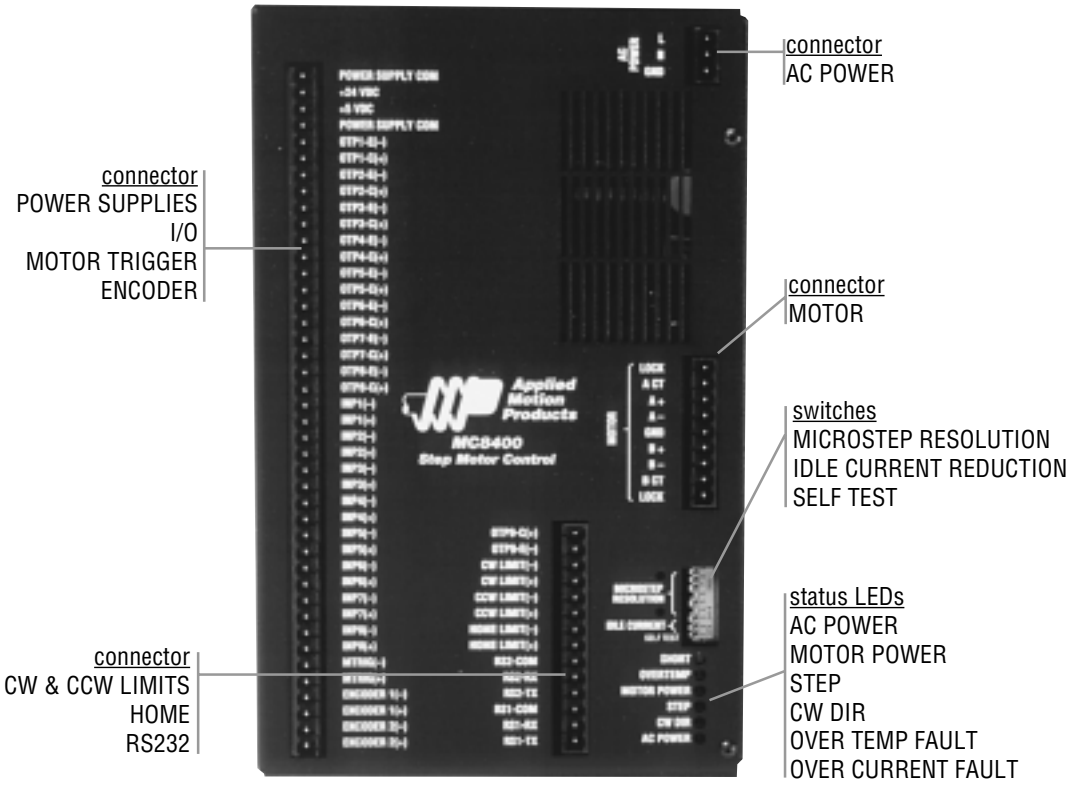
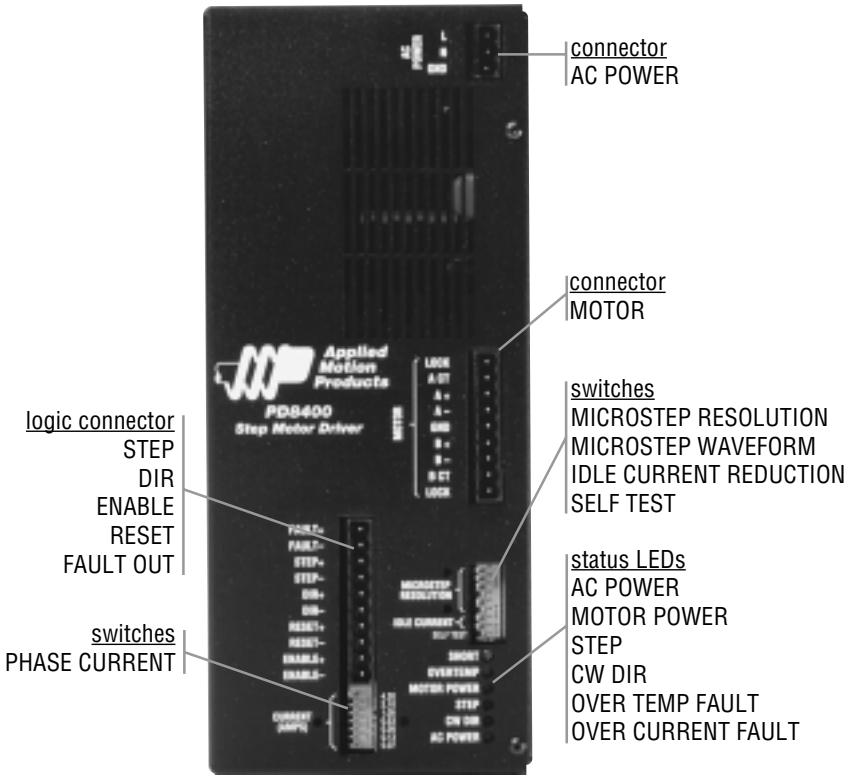
Connector/Switch Diagrams





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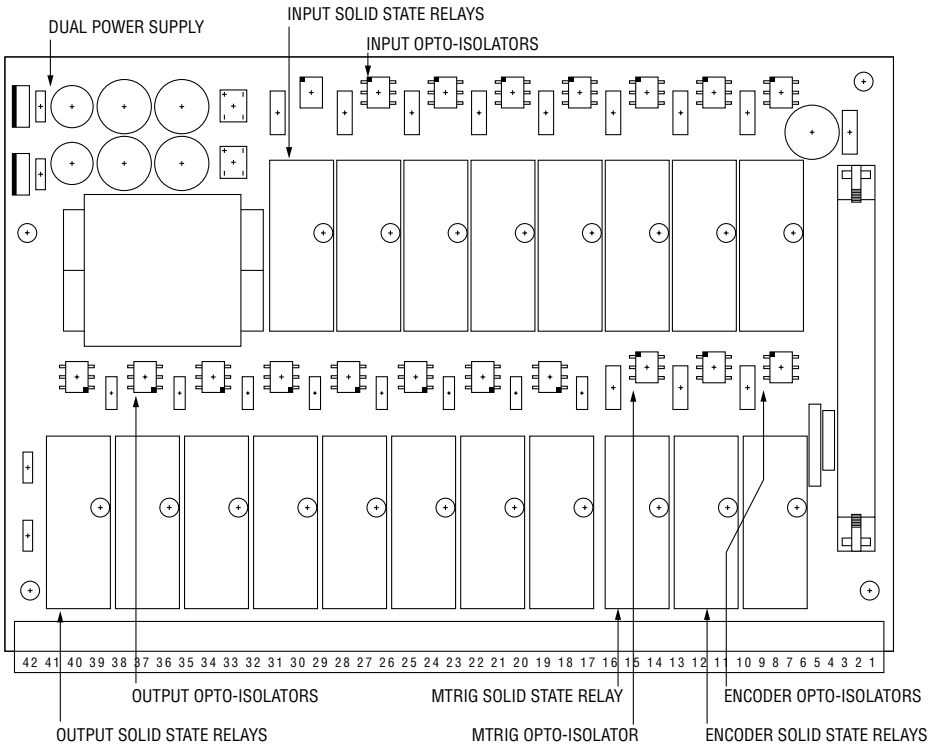
MC8400/MC8400F I/O Configuration

The basic I/O board that is supplied with the MC8400 can be configured to operate in three different ways. It can be supplied with input, output and communication lines that are isolated from the drives high voltage using opto-isolators, solid state relay (SSR) modules, or a combination of the two. The opto-isolators are used to communicate with logic level devices such as PLC's.

The SSR modules can be used to interface the MC8400 to real world devices such as valves, lamps and switches that may operate on either AC or DC voltages.

The MC8400 may be configured using any combination of opto-isolators and solid state relay modules, giving you the most flexibility for your application. The choice is yours, the I/O type or combination of I/O types that you select is solely dependent upon your application.



Communications:
The MC8400 has two RS-232c serial communication channels. Both are capable of functioning independently and can have different communication parameters.

RS-232c PARAMETER	OPTION	FACTORY DEFAULT
Port Number	1 or 2 (first or second RS-232c port)	N/A
Baud Rate	300, 1200, 2400, 4800, 9600 or 19200	9600
Data Bits	7 or 8	8
Parity	EVEN, ODD, SPACE, MARK or NONE	NONE
Stop Bits	1 or 2	1

User Power Supplies (isolated):
The MC8400 I/O board comes with two power supplies that are available for you to use. Both are isolated from the drives' high voltage supply. The first power supply is 5 Vdc with a current capacity of 0.3 amps (300 ma). This supply is regulated and the voltage will remain within +/- 2.5% of 5 volts. The second supply is 24 Vdc with a current capacity of 0.15 amps (150 ma). This supply is regulated and the voltage will remain within +/- 2.5% of 24 volts.

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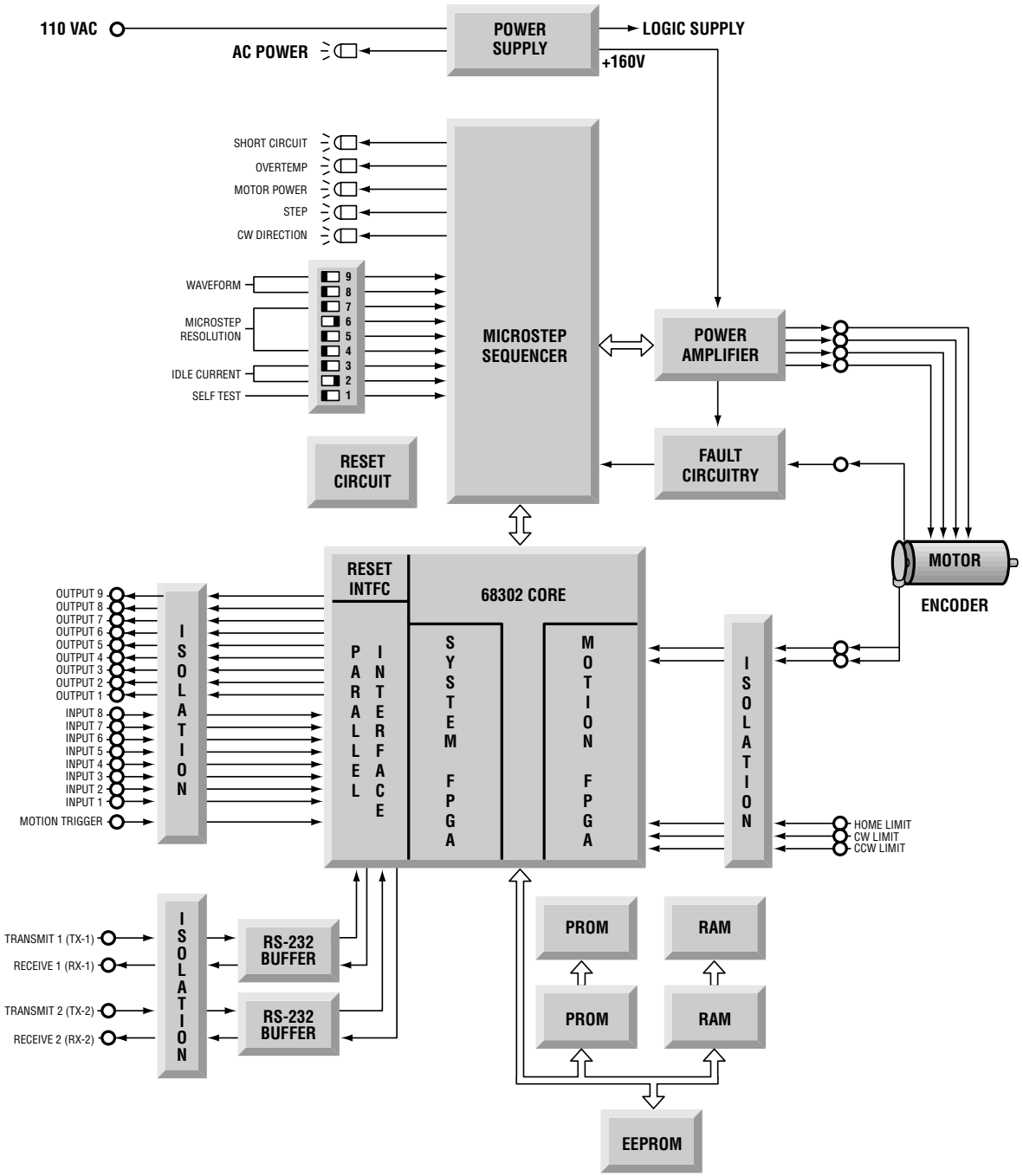
MC8400 Block Diagram



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Part Number Ordering System

To insure your order is correctly processed please provide a complete part number.

EXAMPLE:

MC 8400 F – 365 D

DRIVE OR CONTROL TYPE:
MC – machine controller packaged with integral drive and power supply.
PD – packaged drive only with integral power supply.

POWER RATING:
8.4 amps

F – encoder following
X – standard-no encoder following

MOTOR SIZE:
NEMA 23, 2.0" long – **365**
NEMA 23, 3.0" long – **366**
NEMA 23, 4.0" long – **367**
NEMA 34, 2.5" long – **413**
NEMA 34, 3.7" long – **414**
NEMA 34, 5.1" long – **415**
NEMA 42, 7.7" long – **036**

SHAFT TYPE OR ENCODER:
S – single shaft motor
D – double shaft motor
E – double shaft motor with encoder

NOTE: When ordering packaged drive or machine controller only, you do not need to specify motor or encoder.

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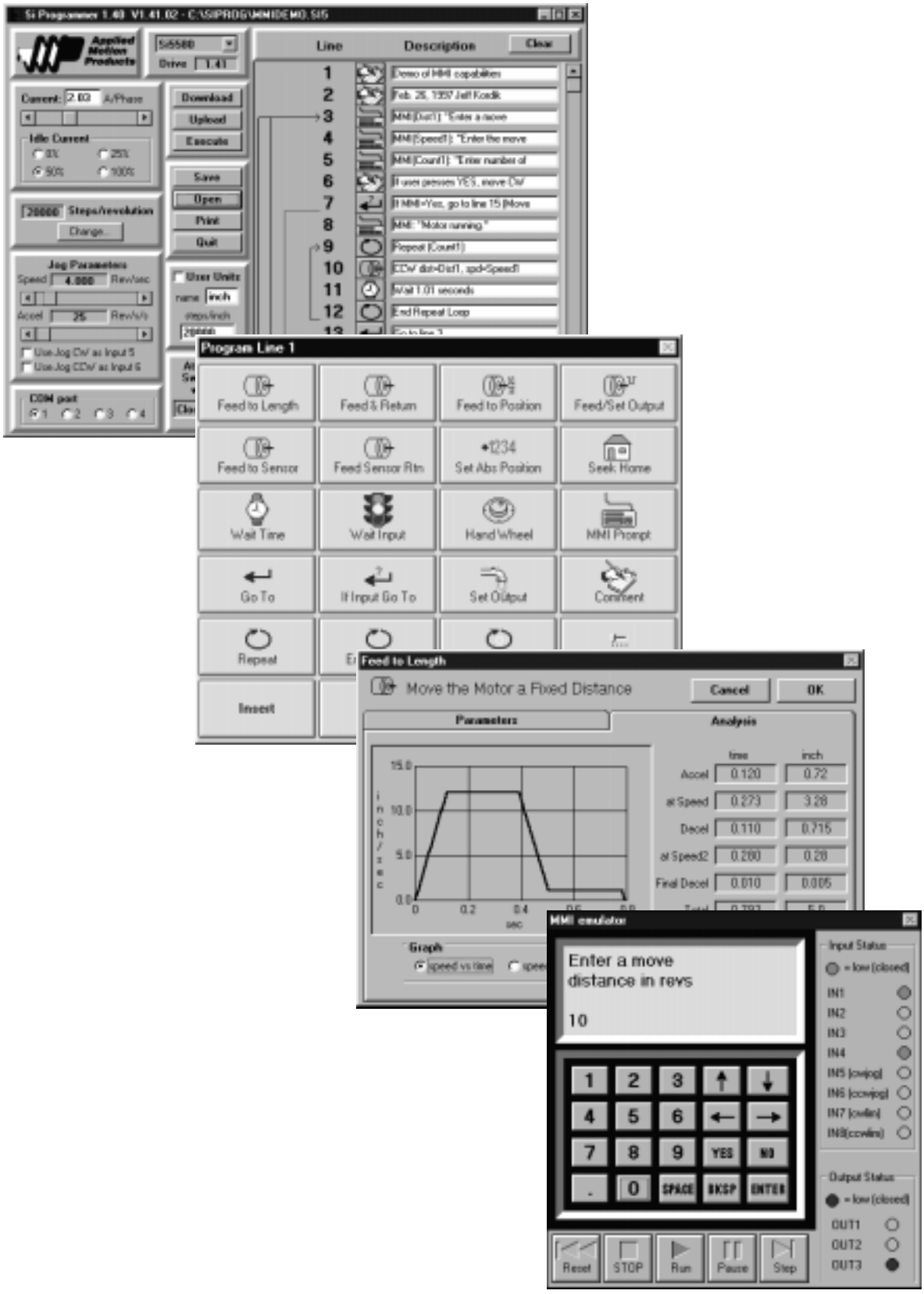
Si Programming Screens



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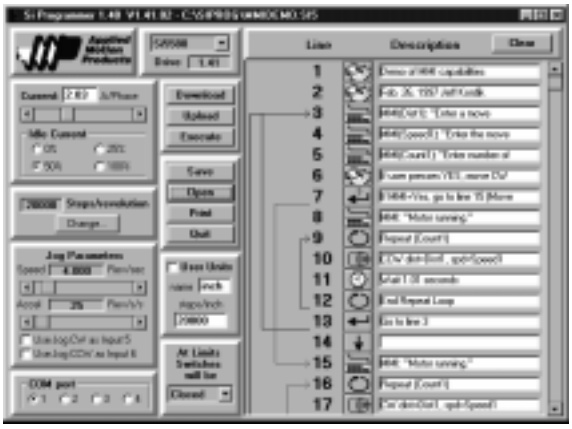
Si Software Specifications

INDEXER PROGRAMMING:
Programmable by RS-232 connection to IBM compatible PC running Windows 3.1, Windows 95, Windows 98 or Windown NT. Programming software and cable included. Programming is very easy to learn and requires no previous programming experience.



Main Programming Screen

Programs can be up to 100 lines long. Instructions are powerful, so 100 lines can provide the user with a sophisticated program. For example, in one program line the motor can be moved until a sensor changes state, then fed a precise distance to a stop, delayed and returned to the starting point. Distances, delays, feed and return speeds, acceleration and deceleration parameters are all included in the single program line. The same move can take 10 program lines or more on other indexers.

There are a total of 20 different instructions, including input/output, branches, loops and motion commands. These instructions can be combined to make a nearly infinite variety of programs, meeting the demands of a wide range of applications.

As you compose your program, you can test it by downloading to a drive and executing. A sophisticated control panel allows you to observe the status input and output terminals in real time, highlights the instruction that's executing, and allows you to pause and single step the program.

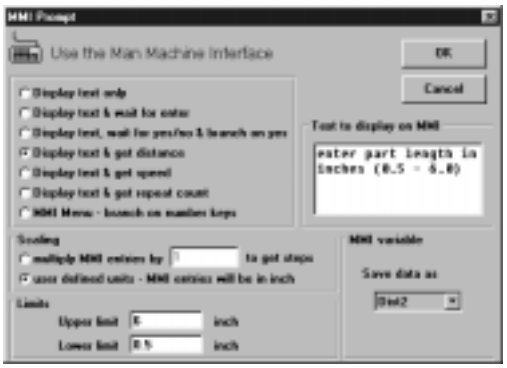
You can even emulate the optional Man Machine Interface on-screen. This allows you to try out the MMI before buying one, and eliminates the need to swap cables between the PC and MMI while you're testing your program.

You can also write programs without a drive connected to your PC and save them to your hard disk.

Once programmed, the cable can be removed and the indexer-drive will run stand alone. Programs and parameters are stored internally in nonvolatile memory. Upon power up, the drive automatically senses the connection to the Windows programming software. If no connection is detected, the program is automatically executed starting on line 1.

All Si products support an optional NEMA 4X operator interface (MMI) that allows the operator to enter variables such as speeds, distances and repeat counts. The MMI attaches to the RS-232 programming port, leaving all inputs and outputs free.

A CNC hand wheel is also available, allowing a machine operator to precise position a motor and load.



Typical Dialog Box
(for setting *Feed to Length* instruction)

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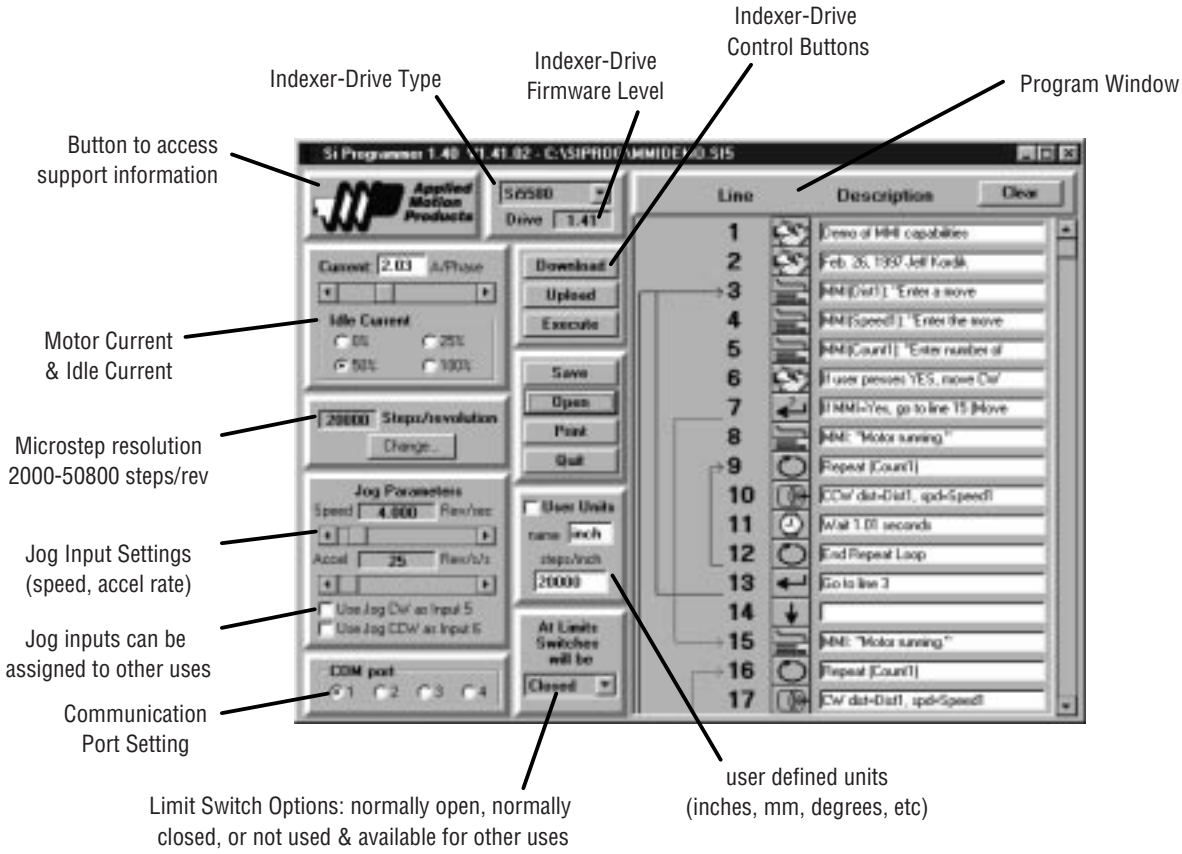
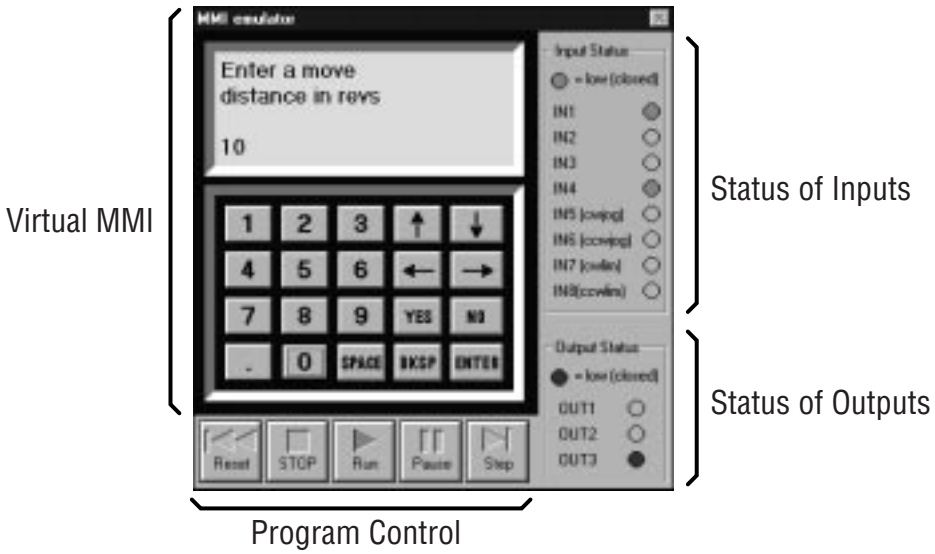
Features of the Main Programming Screen



Features of the Program Control Panel



Si Programming

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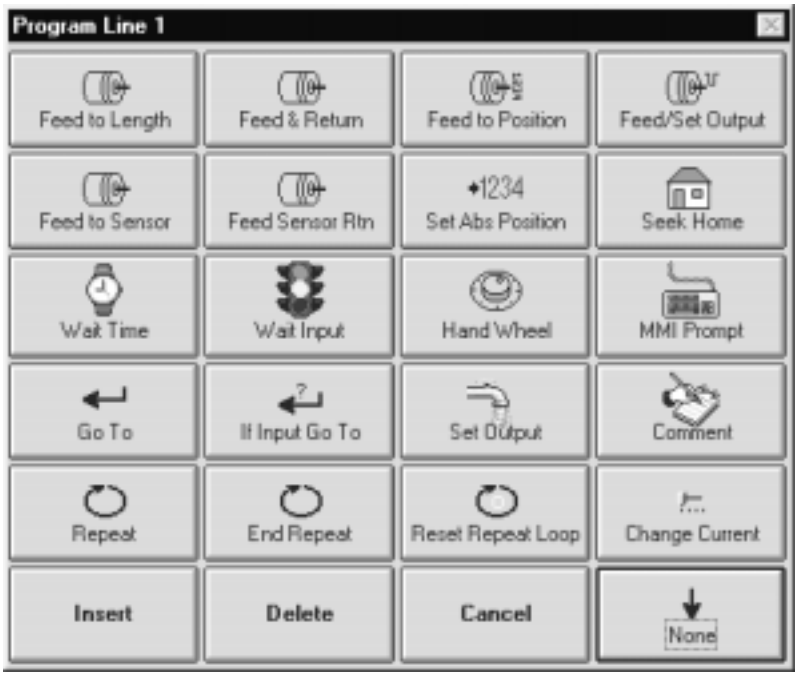
Si Program Instructions



Feed to Length
A point to point move. Parameters are distance, direction, speed, accel and decel. Can also change speeds at a specified distance within the move.

Feed & Return
A point to point move that returns to the starting point after specified delay. Parameters include distance, feed speed, return speed, direction, accel, decel, and return delay time.

Feed to Position
A move to an absolute position. Parameters are position, speed, accel and decel.

Feed & Set Output
A point to point move. An output terminal can be turned on or off during the move, or can be turned on, off or pulsed at the end of the move.

Feed to Sensor
Moves the motor until an input (to which a sensor is connected) changes state, then stops at a specified distance beyond the sensor. Useful for applications like dispensing labels or moving objects on a conveyer. A safety distance can be given; if the motor moves beyond that distance without reaching the sensor, the motor stops and the program branches to a specified line.

Feed to Sensor & Return
Same as Feed to Sensor, but returns to the original starting point. Additional parameters are return speed and return delay time.

Set Abs Position
Assign a value, such as 0 inches, or 10 mm, to the present motor position.

Seek Home
Positions the motor at a home sensor (wired to one of the general purpose inputs) "bouncing off" the limits if necessary.

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Si Program Instructions

Wait Time
Delays a specified amount of time. Range is .01 to 300 seconds. Adding a loop around this instruction can extend the delay time to as much as 18 hours.

Wait Input
Pauses the program until an input, or set of inputs, reaches a given condition. The jog inputs are functional during this instruction. The Wait Input instruction can also display a prompt on the optional MMI and pause until the operator presses the ENTER key.

Hand Wheel
Allows the operator to precisely position the motor and load using an optional CNC hand wheel.

MMI Prompt
Displays a prompt on the optional man-machine interface (MMI) panel and accepts a parameter from the operator. This parameter is saved in nonvolatile memory and can be used as a move speed, move distance or repeat loop count. Speeds and distances can be entered in user defined units such as inches or gallons. The MMI Prompt instruction also allows the operator to choose a sub program from a menu of up to 8 sub programs.

Go To
Forces program to jump to a specific instruction. At the least, you'll need one of these at the end of your program to return execution to the beginning.

If Input
Causes the program to branch to a given line number if an input, or set of inputs, meets a specified condition. The If Input instruction can also display a prompt on the optional MMI and branch if the operator presses the YES key.

Set Output
Set a given output to a high or low voltage state, or can emit a high or low pulse of 2 to 500 milliseconds. This instruction is useful for triggering other motor controllers, relays or cut-off knives. It can also be used to signal events to another indexer or PLC.

Comment
Allows the user to document the program by adding comments. Comments stay with the program even when downloaded to the drive.

Repeat
The beginning of a loop. Repeat a block of instructions a fixed number of times (up to 65,535 times). Loops can be extended by nesting loops around each other (two nested loops allow you to repeat the instructions within them more than 4 billion times).

End Repeat
Marks the end of a repeat loop. The programming software matches these up for you automatically. You don't have to specify a line number. Connections are shown graphically on the screen.

Reset Repeat Loop
Resets a repeat loop counter to 0. Useful for resetting a loop that has been prematurely terminated by an If Input instruction.

Change Current
Allows the program to turn off the motor current, resume the previous current level, or change the current setting anytime.

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Recommended Motors for Drives/Controls

DRIVE PART NUMBER					
1030 1035D	2035 2035 O PD2035	3535 3535 O 3540 M 3540 MO 3540i	5560 PD5580 Si5580	7080 7080i	PD8400 MC8400
MOTOR PART NUMBERS					
5014-842	5014-842	5014-842			
HT17-068 HT17-072 HT17-076	HT17-068 HT17-071 HT17-075	HT17-068 HT17-071 HT17-075	HT17-071 HT17-075	HT17-071 HT17-075	
	5023-127 5023-149	5023-122 5023-123 5023-124	5023-122 5023-123 5023-124	5023-122 5023-123 5023-124	5023-365 5023-366 5023-367
HT23-393 HT23-396 HT23-399	HT23-393 HT23-396 HT23-399	HT23-394 HT23-397 HT23-400	HT23-395 HT23-398 HT23-401	HT23-395 HT23-398 HT23-401	
	4034-324	5034-348 4034-334	5034-348 5034-349 5034-350	5034-348 5034-349 5034-350	5034-413 5034-414 5034-415
			5042-022	5042-022	5042-036

Motor Dimensions

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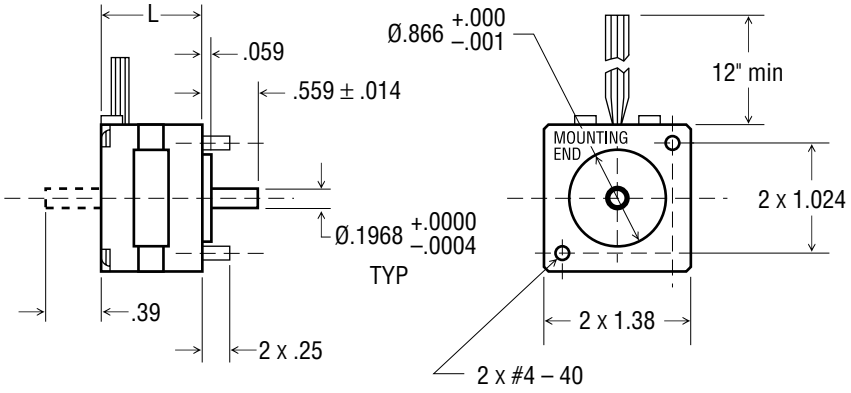
Motor Dimension Drawings

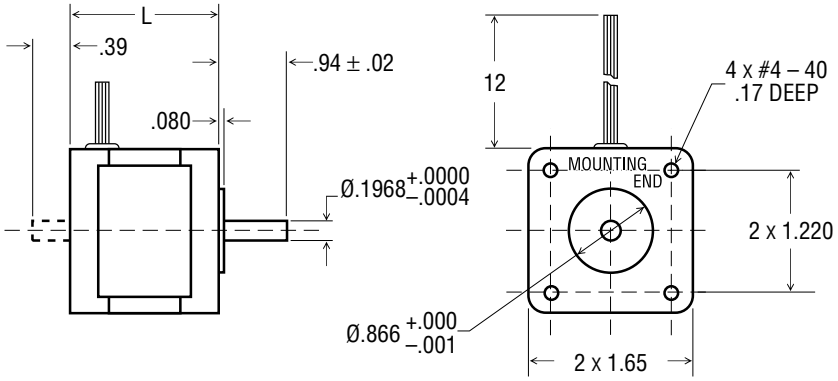
SIZE 14 FRAME

MODEL*	L (motor length)
5014-842	1.57



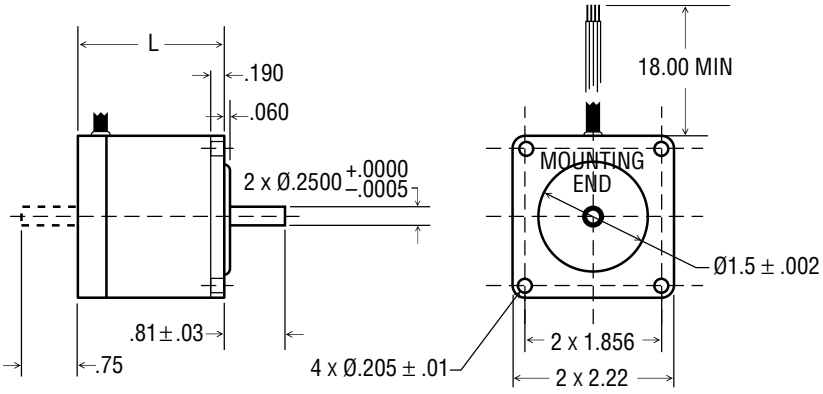
SIZE 17 FRAME HIGH TORQUE MOTOR

MODEL*	L (motor length)
HT17-068	1.30
HT17-071	1.54
HT17-072	1.54
HT17-075	1.85
HT17-076	1.85



SIZE 23 FRAME

MODEL*	L (motor length)
5023-122	2.00
5023-123	3.00
5023-124	4.00
5023-127	2.25
5023-149	3.25



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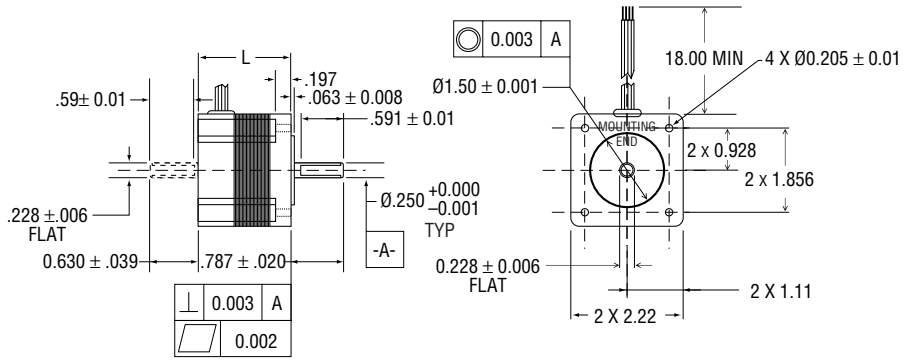
Motor Dimension Drawings

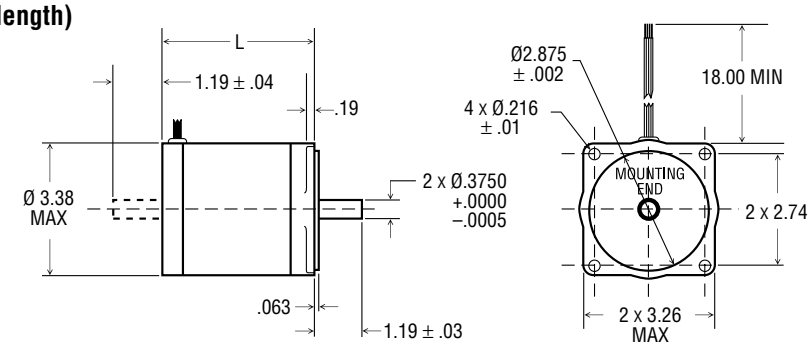
SIZE 23 FRAME HIGH TORQUE MOTOR

MODEL*	L (motor length)
HT23-393	1.54
HT23-394	1.54
HT23-395	1.54
HT23-396	2.13
HT23-397	2.13
HT23-398	2.13
HT23-399	2.99
HT23-400	2.99
HT23-401	2.99



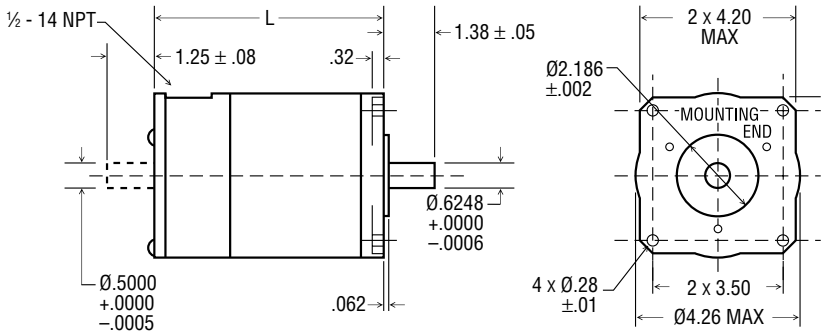
SIZE 34 FRAME

MODEL*	L (motor length)
5034-324	2.50
5034-334	5.10
5034-348	2.50
5034-349	3.70
5034-350	6.10



SIZE 42 FRAME

MODEL*	L (motor length)
5042-022	7.7



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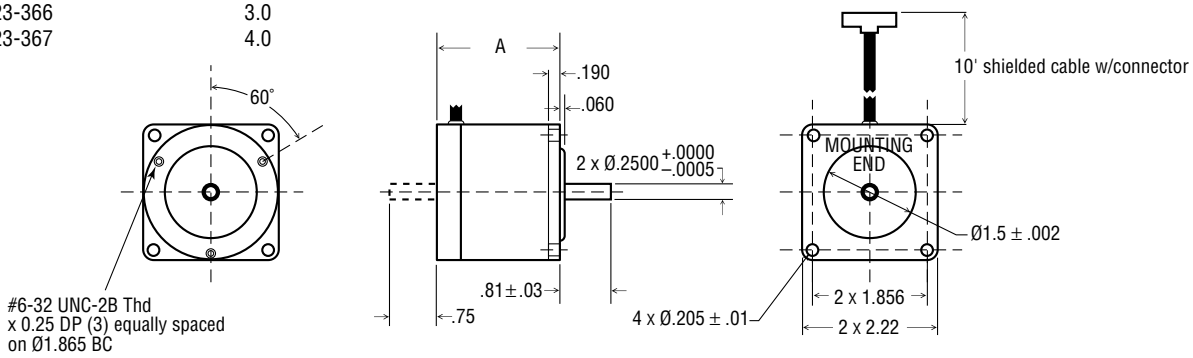
Motor Dimension Drawings

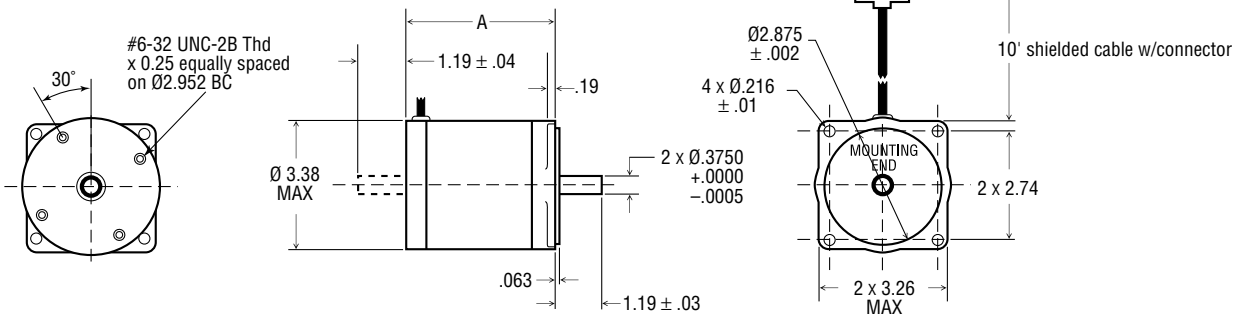
SIZE 23 FRAME

MODEL*	L (motor length)
5023-365	2.0
5023-366	3.0
5023-367	4.0



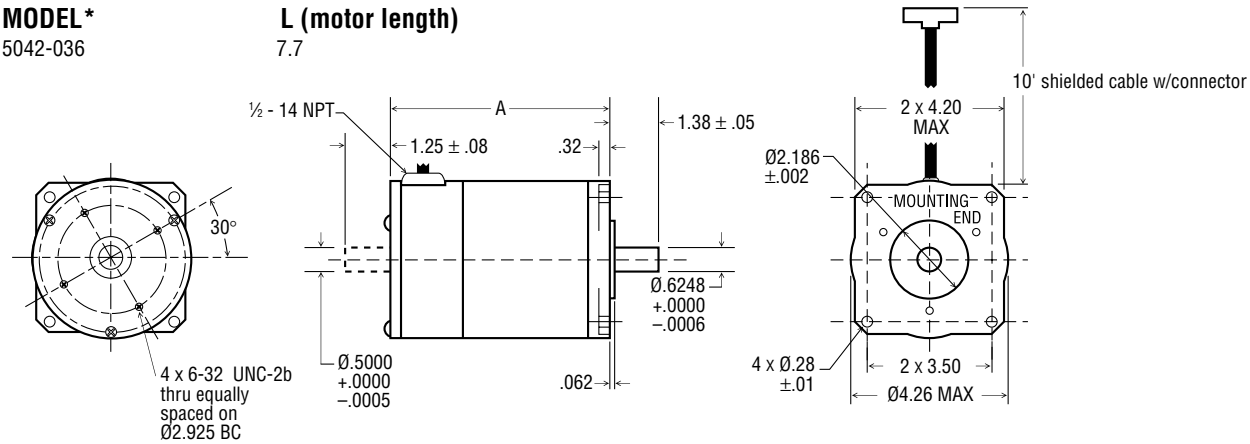
SIZE 34 FRAME

MODEL*	L (motor length)
5034-413	2.5
5034-414	3.7
5034-415	6.1



SIZE 23 FRAME

MODEL*	L (motor length)
5042-036	7.7



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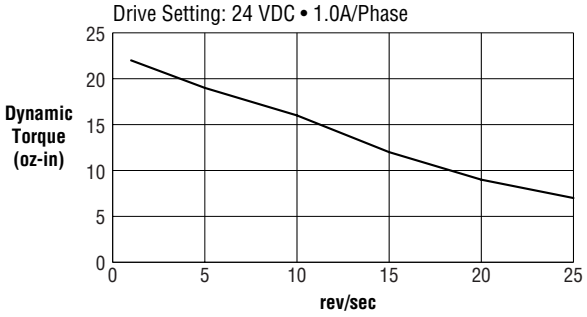
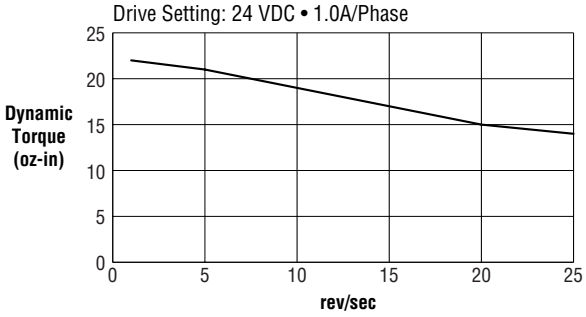
Dynamic Torque Data

1030/1035D Torque Curves

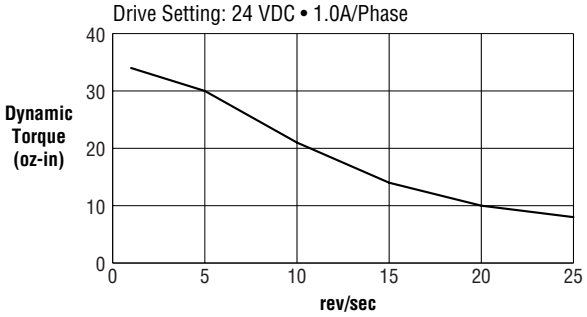
5014-842 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



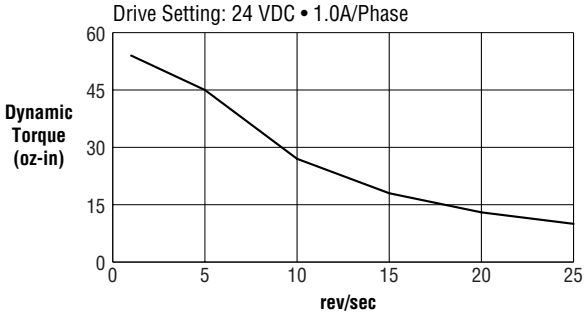
HT17-068 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



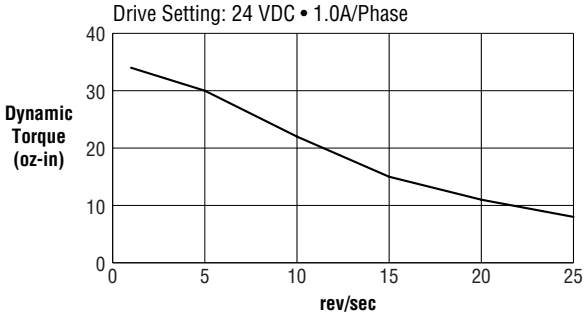
HT17-072 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



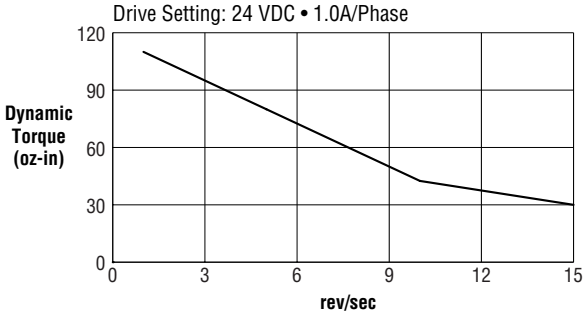
HT17-076 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



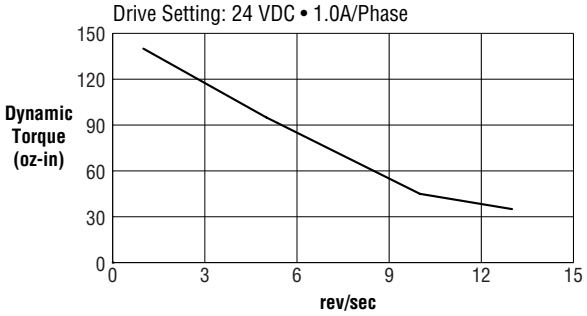
HT23-393 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



HT23-396 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



HT23-399 MOTOR
Motor Connection: Center Tap to End
Drive Setting: 24 VDC • 1.0A/Phase



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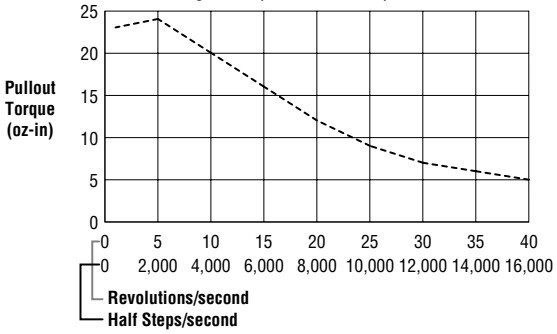
2035/2035 O/PD2035 Series Torque Curves

Half steps/sec = Rev/sec x 400

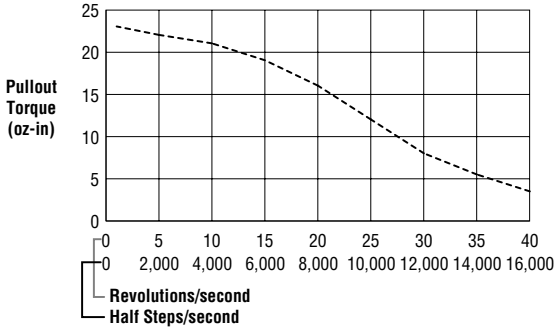
5014-842 MOTOR

Motor Connection: Bipolar
Drive Setting: 1.0 A/phase • Half Step



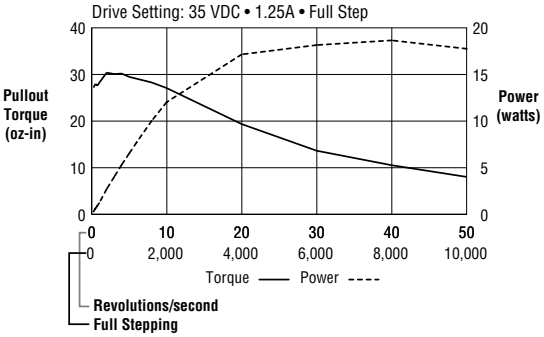
HT17-068 MOTOR

Motor Connection: parallel
Drive Setting: 1.25 A/phase • Half Step



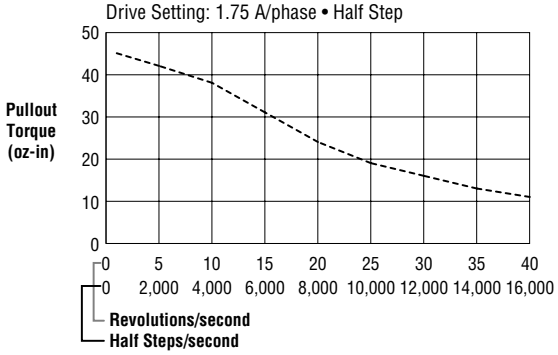
HT17-071 HIGH TORQUE MOTOR

Motor Connection: Parallel
Drive Setting: 35 VDC • 1.25A • Full Step



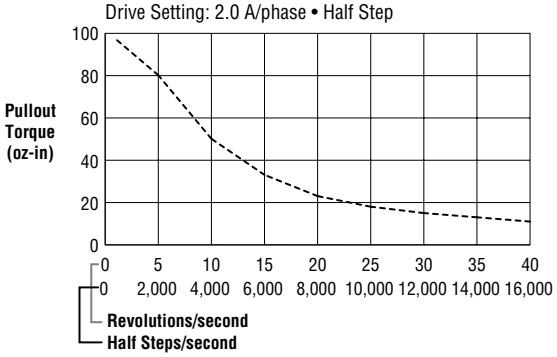
HT17-075 MOTOR

Motor Connection: parallel
Drive Setting: 1.75 A/phase • Half Step



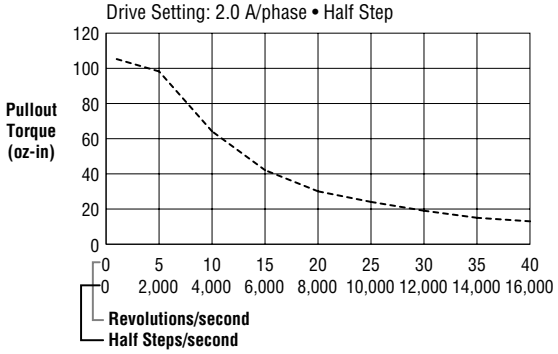
5023-127 MOTOR

Motor Connection: Bipolar
Drive Setting: 2.0 A/phase • Half Step



5023-149 MOTOR

Motor Connection: parallel
Drive Setting: 2.0 A/phase • Half Step



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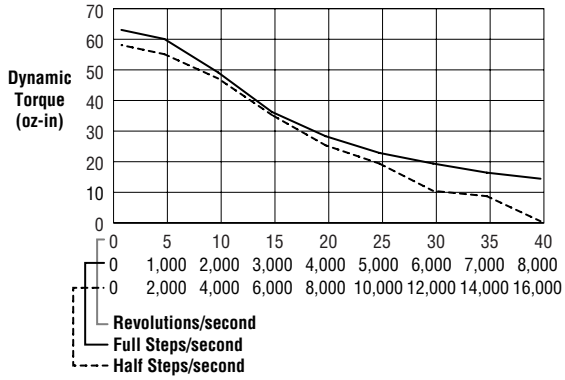
2035/2035 O/PD2035 Series Torque Curves

Half steps/sec = Rev/sec x 400

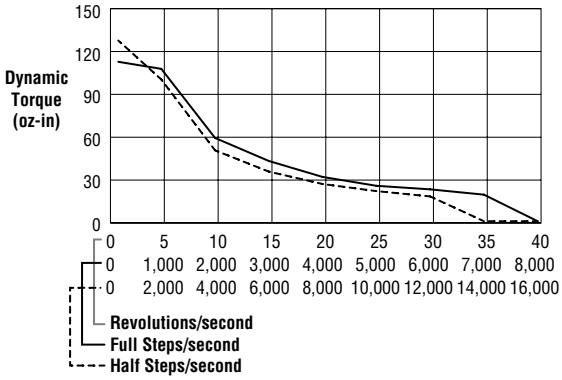
HT23-393 MOTOR

Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 1.4A/Phase



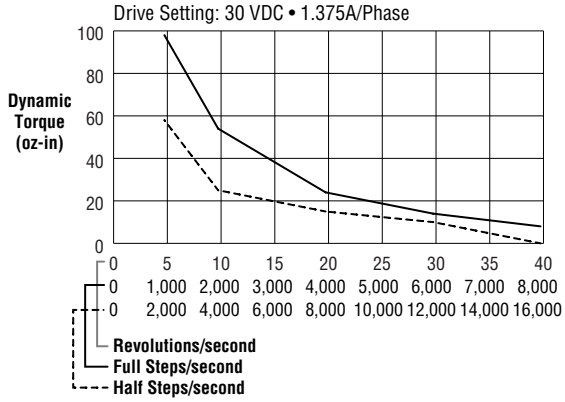
HT23-396 MOTOR

Motor Connection: Parallel
Drive: 3535 w/PS430 power supply
Drive Setting: 30 VDC • 1.4A/Phase



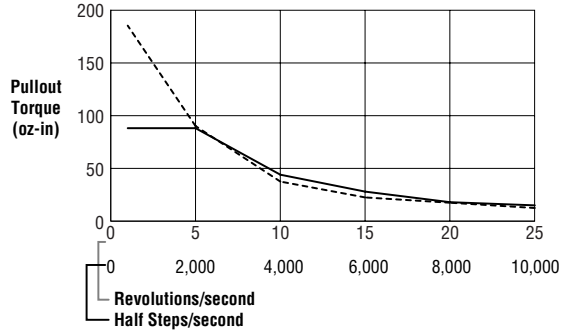
HT23-399 MOTOR

Motor Connection: Parallel
Drive Setting: 30 VDC • 1.375A/Phase



4034-324 MOTOR

Motor Connection: series
Drive Setting: 2.0 A/phase



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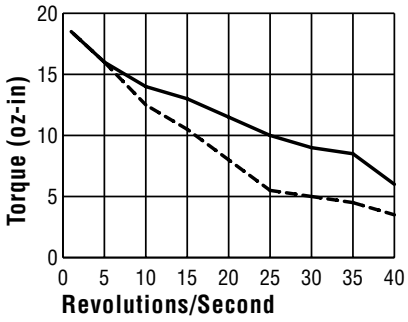
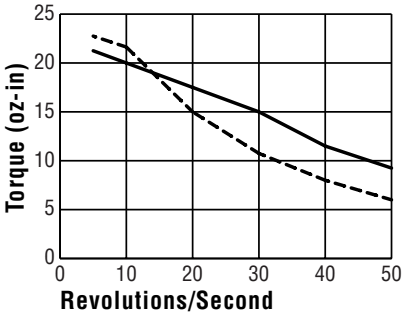
3540 Series Torque Curves

5014-842 MOTOR
Motor Connection: bipolar (4 lead motor)
Drive Setting: 1.0 A/phase



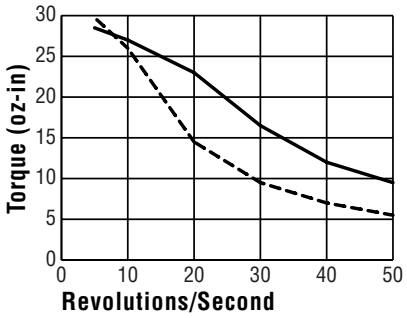
— 40 volt supply
- - - 24 volt supply

HT17-068 MOTOR
Motor Connection: parallel
Drive Setting: 1.4 A/phase



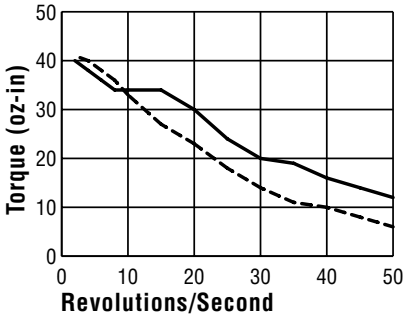
— 40 volt supply
- - - 24 volt supply

HT17-071 MOTOR
Motor Connection: parallel
Drive Setting: 1.7 A/phase



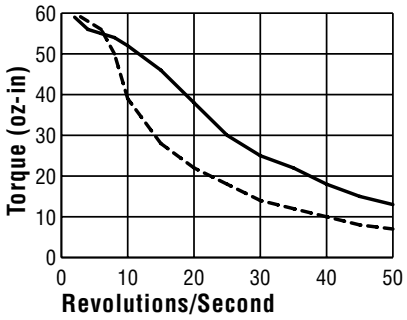
— 40 volt supply
- - - 24 volt supply

HT17-075 MOTOR
Motor Connection: parallel
Drive Setting: 1.7 A/phase



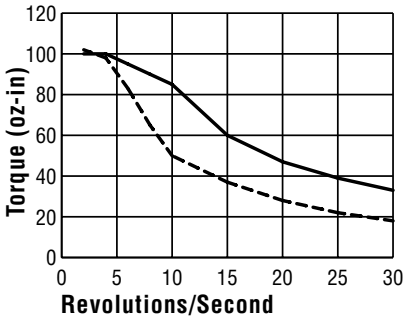
— 40 volt supply
- - - 24 volt supply

5023-122 MOTOR
Motor Connection: parallel
Drive Setting: 2.0 A/phase



— 40 volt supply
- - - 24 volt supply

5023-123 MOTOR
Motor Connection: parallel
Drive Setting: 2.5 A/phase



— 40 volt supply
- - - 24 volt supply

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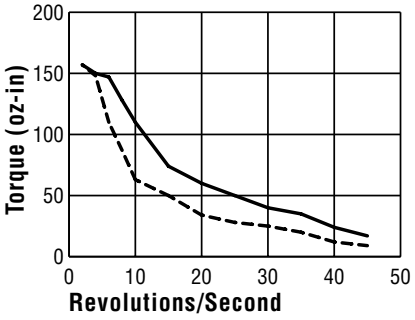
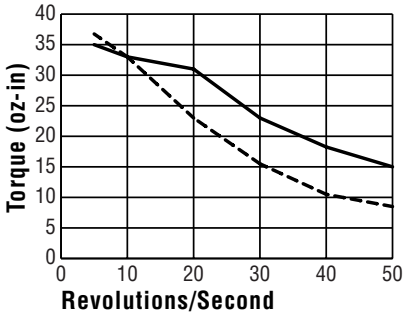
3540 Series Torque Curves

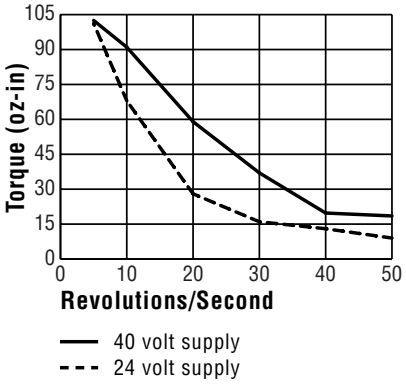
5023-124 MOTOR
Motor Connection: parallel
Drive Setting: 3.5 A/phase



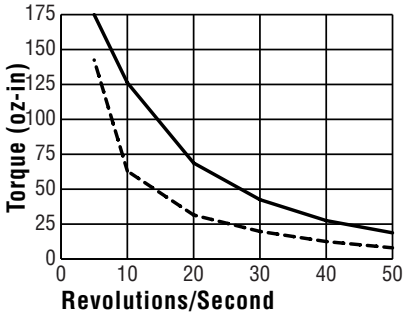
HT23-394 MOTOR
Motor Connection: parallel
Drive Setting: 2.8 A/phase



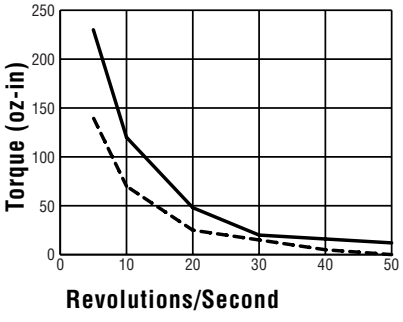
HT23-397 MOTOR
Motor Connection: parallel
Drive Setting: 2.8 A/phase



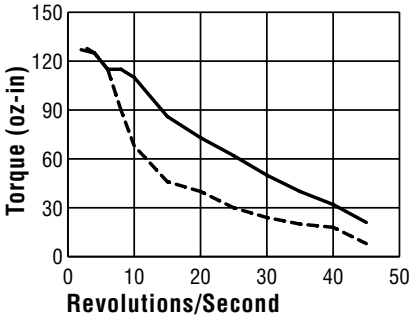
HT23-400 MOTOR
Motor Connection: parallel
Drive Setting: 2.8 A/phase



4034-334 MOTOR
Motor Connection: parallel
Drive Setting: 3.5 A/phase



5034-348 MOTOR
Motor Connection: parallel
Drive Setting: 3.5 A/phase



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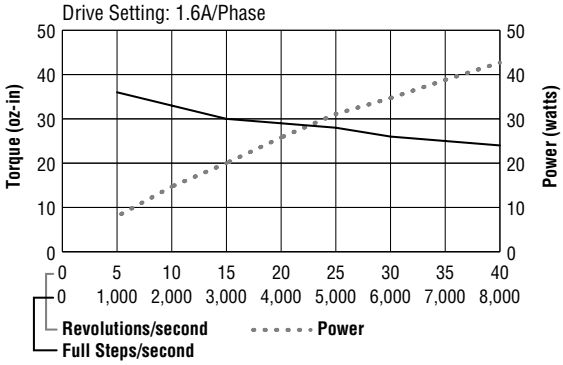
5580 Series Torque Curves

Full steps/sec = Rev/sec x 200. 1/10th steps/sec = Rev/sec x 2,000.

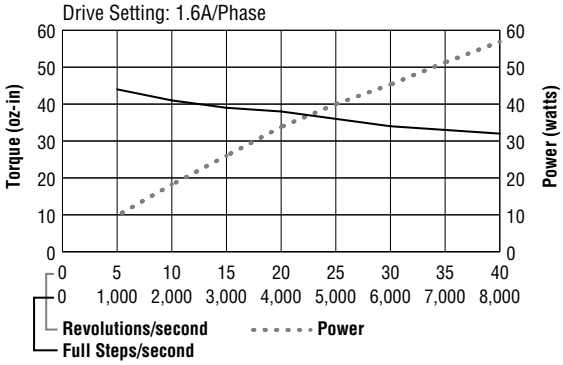
HT17-071 MOTOR

Motor Connection: Parallel
Drive Setting: 1.6A/Phase



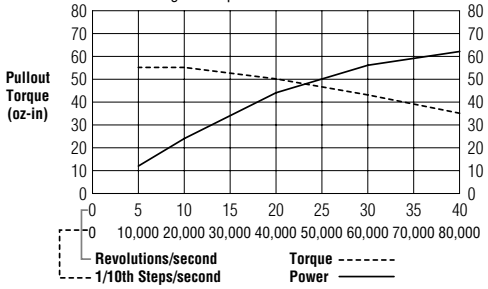
HT17-075 MOTOR

Motor Connection: Parallel
Drive Setting: 1.6A/Phase



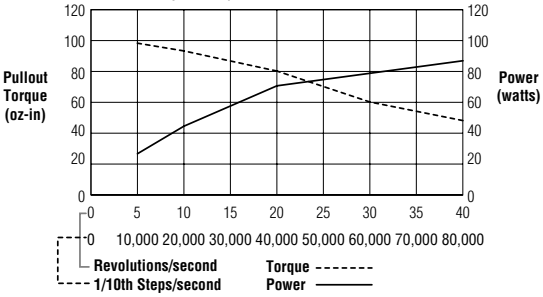
5023-122 MOTOR

Motor Connection: parallel
Drive Setting: 2.0 A/phase



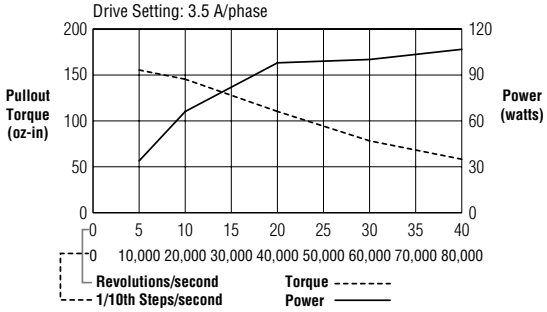
5023-123 MOTOR

Motor Connection: parallel
Drive Setting: 2.5 A/phase



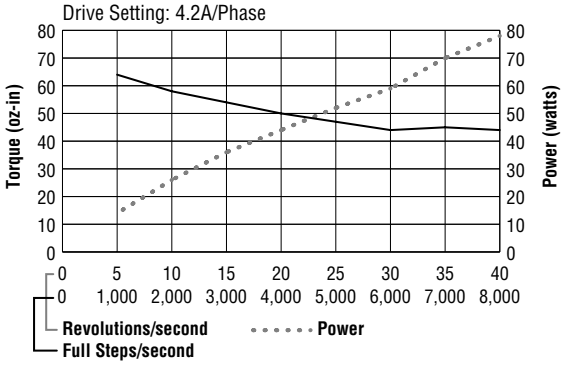
5023-124 MOTOR

Motor Connection: parallel
Drive Setting: 3.5 A/phase



HT23-395 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



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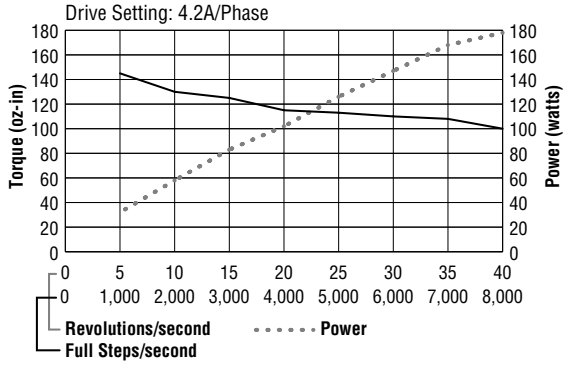
5580 Series Torque Curves

Full steps/sec = Rev/sec x 200. 1/10th steps/sec = Rev/sec x 2,000.

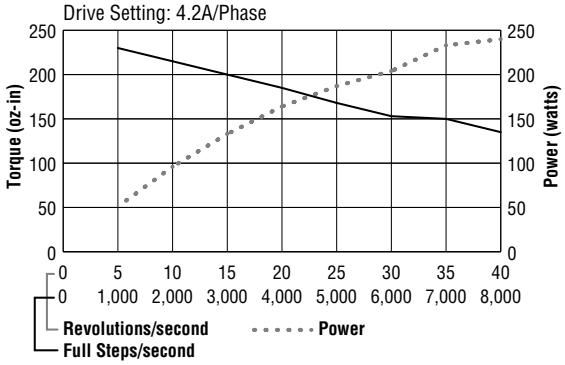
HT23-398 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



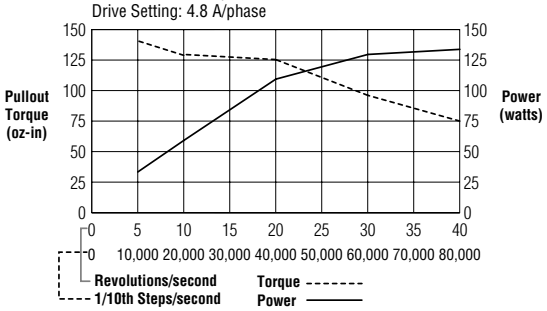
HT23-401 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



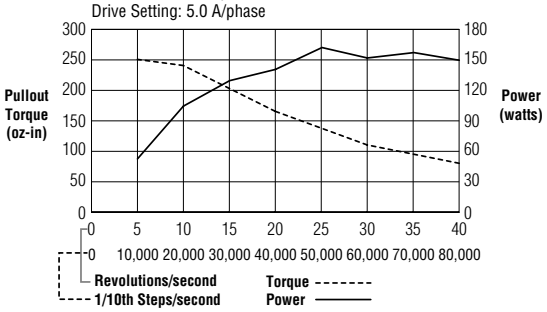
5034-348 MOTOR

Motor Connection: parallel
Drive Setting: 4.8 A/phase



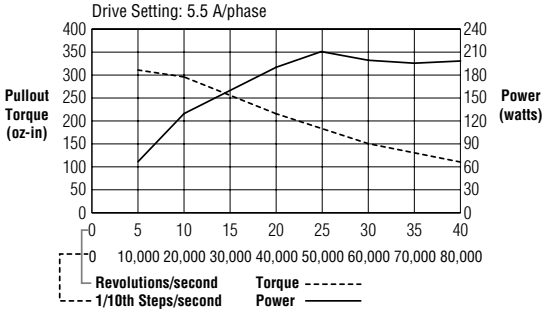
5034-349 MOTOR

Motor Connection: parallel
Drive Setting: 5.0 A/phase



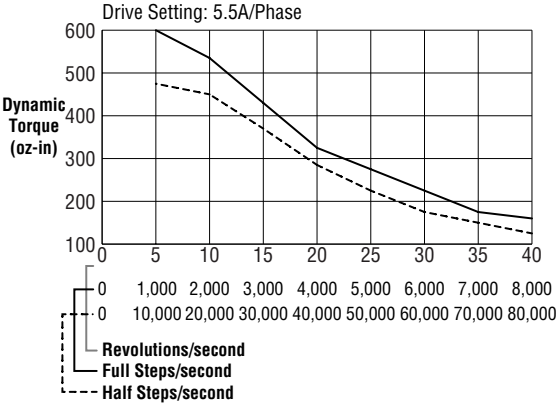
5034-350 MOTOR

Motor Connection: parallel
Drive Setting: 5.5 A/phase



5042-022 MOTOR

Motor Connection: Parallel
Drive Setting: 5.5A/Phase



Dynamic Torque Data

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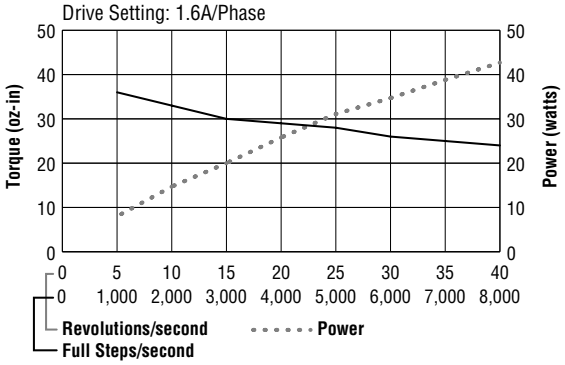
7080 Series Torque Curves

Full steps/sec = Rev/sec x 200. 1/10th steps/sec = Rev/sec x 2,000.
All data measured with 80 VDC power supply.

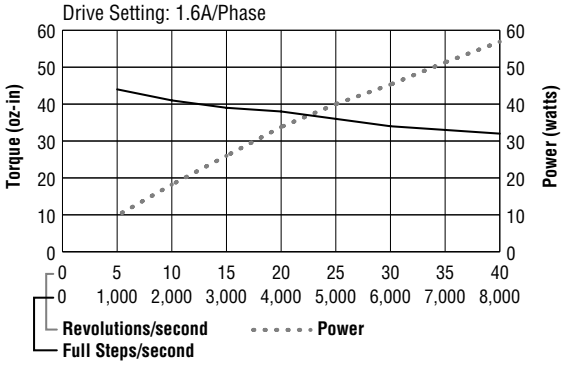
HT17-071 MOTOR

Motor Connection: Parallel
Drive Setting: 1.6A/Phase



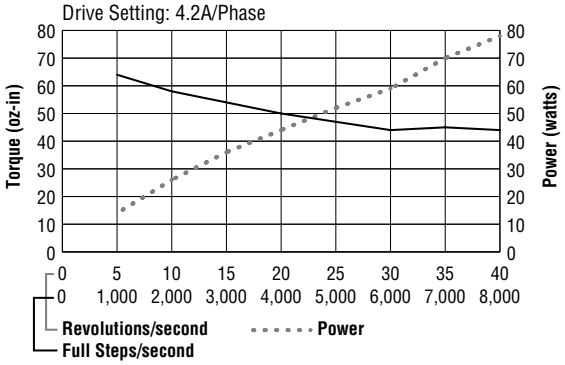
HT17-075 MOTOR

Motor Connection: Parallel
Drive Setting: 1.6A/Phase



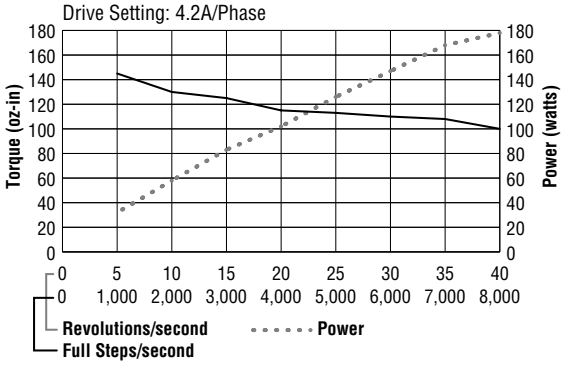
HT23-395 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



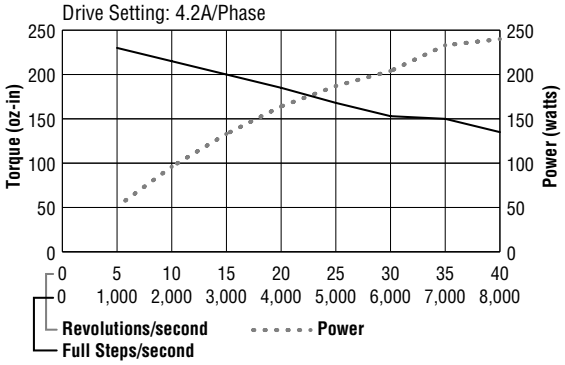
HT23-398 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



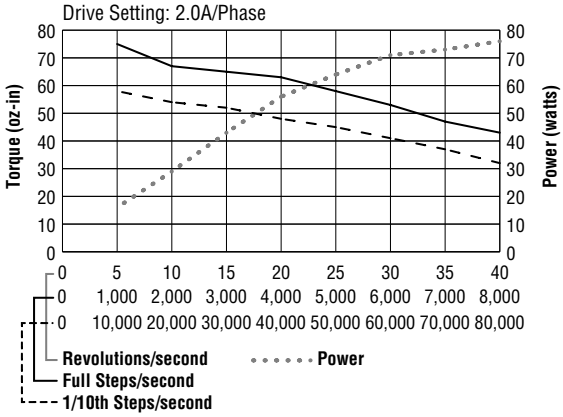
HT23-401 MOTOR

Motor Connection: Parallel
Drive Setting: 4.2A/Phase



5023-122 MOTOR

Motor Connection: Parallel
Drive Setting: 2.0A/Phase



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7080 Series Torque Curves

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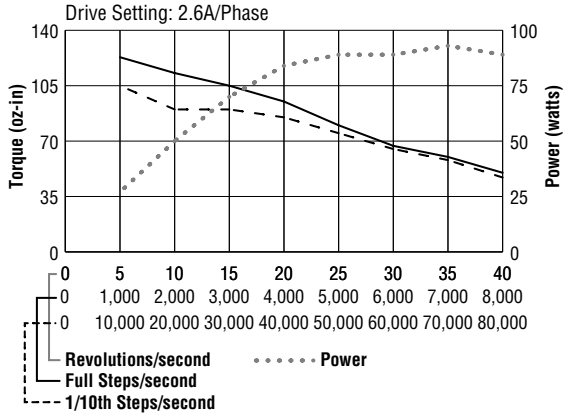
All data measured with 80 VDC power supply.

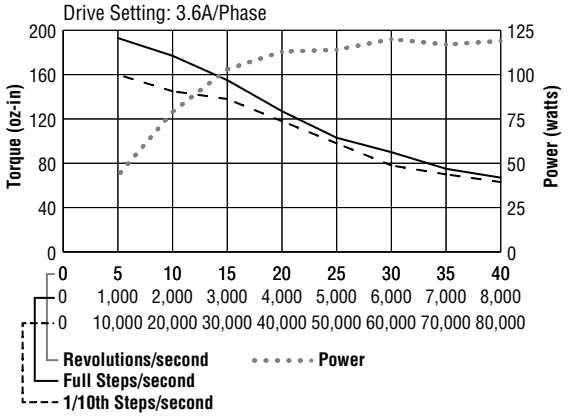
5023-123 MOTOR

Motor Connection: Parallel
Drive Setting: 2.6A/Phase



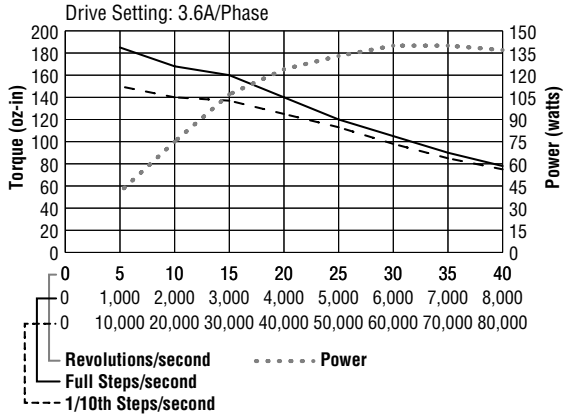
5023-124 MOTOR

Motor Connection: Parallel
Drive Setting: 3.6A/Phase



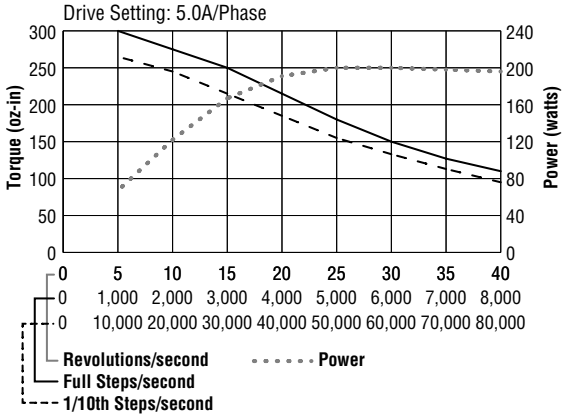
5034-348 MOTOR

Motor Connection: Parallel
Drive Setting: 3.6A/Phase



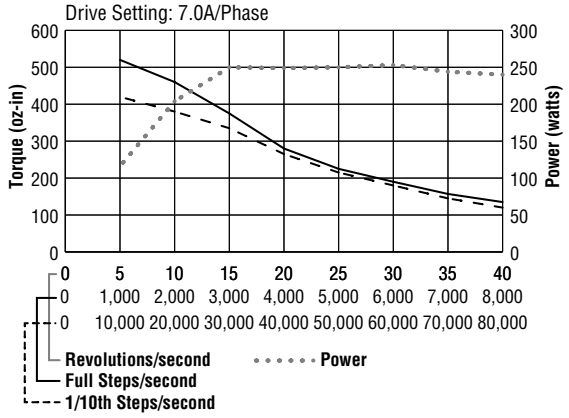
5034-349 MOTOR

Motor Connection: Parallel
Drive Setting: 5.0A/Phase



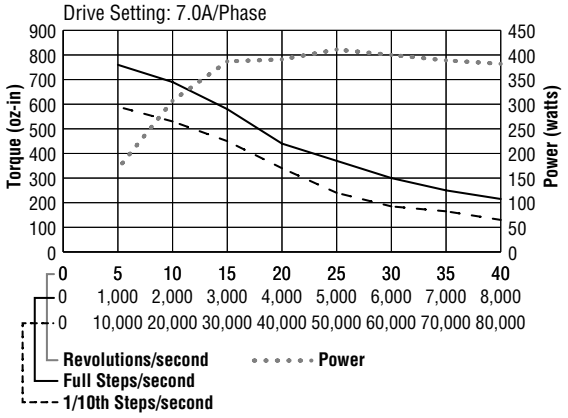
5034-350 MOTOR

Motor Connection: Parallel
Drive Setting: 7.0A/Phase



5042-022 MOTOR

Motor Connection: Parallel
Drive Setting: 7.0A/Phase



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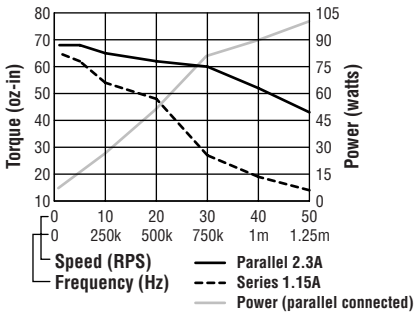
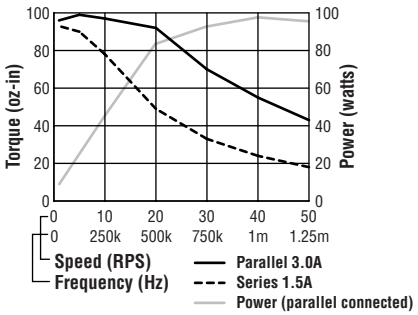
8400 Series Torque Curves

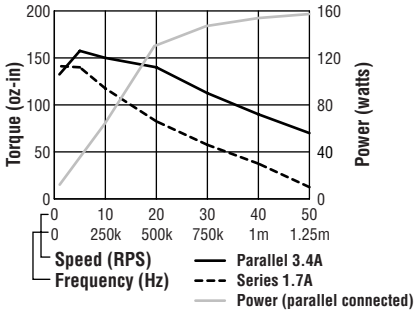
5023-365 MOTOR



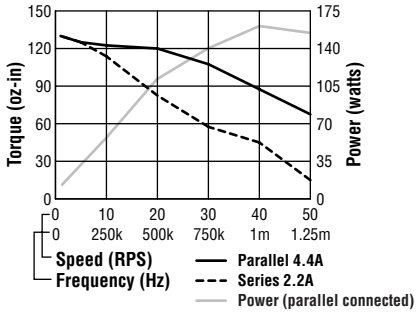
5023-366 MOTOR



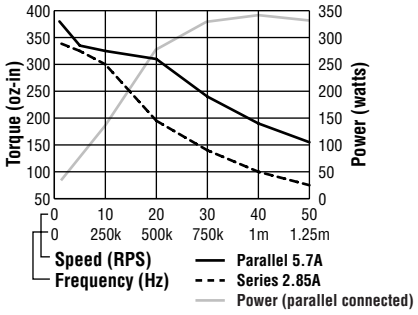
5023-367 MOTOR



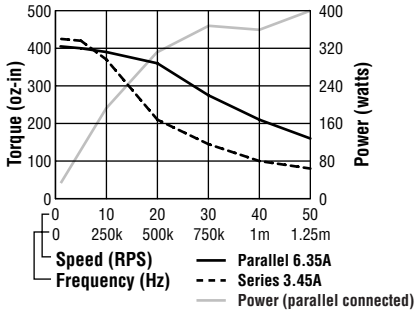
5034-413 MOTOR



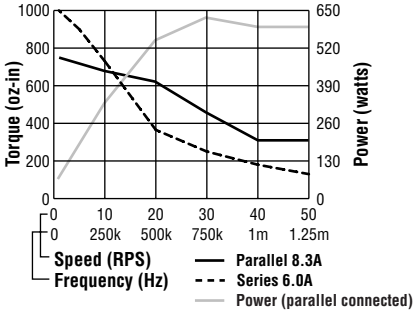
5034-414 MOTOR



5034-415 MOTOR



5042-036 MOTOR



Parallel connected motor, when operated above 5 RPS, should be limited to 50% duty cycle. When operated above 5 RPS with a duty cycle greater than 50%, the motor should be connected in series.

All curves measured at a resolution of 25,000 steps/rev.

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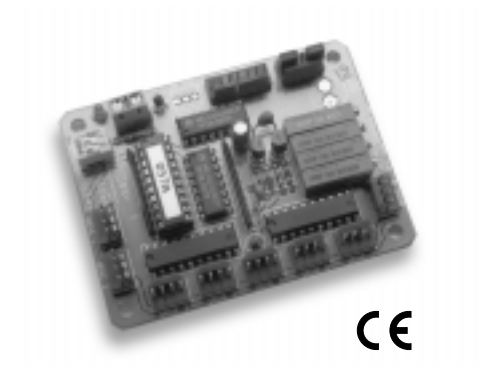

057A

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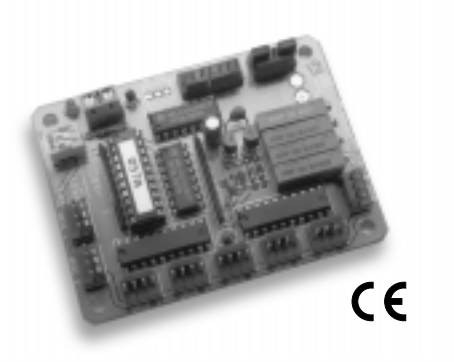
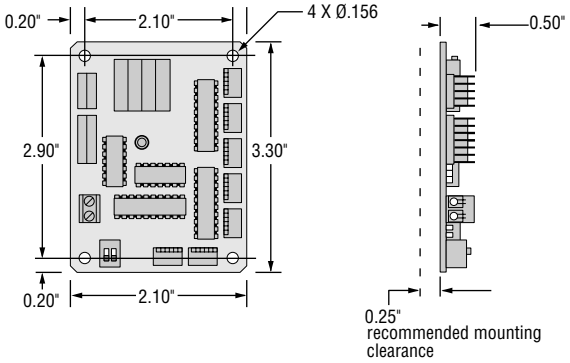
Step Motor Driver Interface

With oscillators and data selector

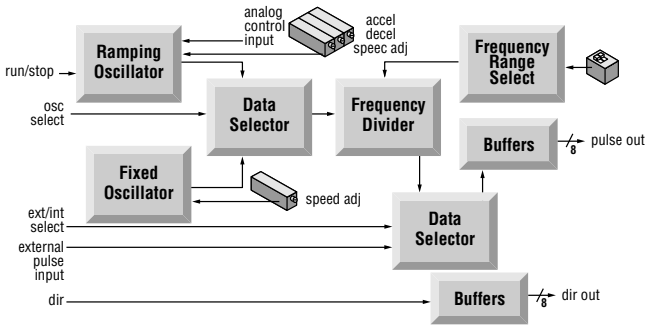
Features

- ramping pulse generator with individually adjustable slew speed, accel and decel rates
- 5–900 msec accel, decel time
- 2nd oscillator with adjustable speed
- frequency divider provides choice of 0–5 kHz, 0–20kHz, 0–80 kHz and 0–320 kHz speed ranges external pulse input
- data selector provides real time switching between ramping oscillator, fixed oscillator and external pulse input
- TTL compatible input signals with pull up resistors can be operated from programmable logic controller, PC parallel port, relays or mechanical switches
- controls up to eight pulse and direction motor drives and/or counters
- analog signal input allows remote control of ramping oscillator speed
- screw terminal power connector
- MTA-100 type locking headers for all signal connections
- compatible with all Applied Motion step motor drives
- requires 5 VDC logic supply, 100 mA
- CE compliant





MECHANICAL OUTLINE



BLOCK DIAGRAM

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CE

ACTUAL SIZE

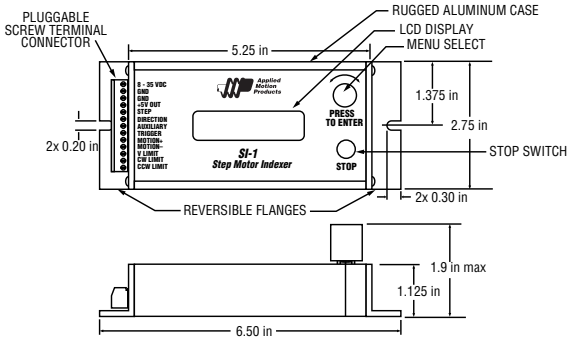
DESCRIPTION

The Si-1 Indexer is reliable, versatile and easy to use. The programming terminal is built-in to simplify wiring and set up. All configuration is menu driven—the user simply picks a program and the Si-1 will request the parameters it needs. The Si-1 is CE compliant.

Once configured, the Si-1 waits for a trigger pulse to begin the program. This pulse can come from a momentary contact switch or from a logic source like a computer, PLC or another Si-1.

The Si-1 can be programmed to seek a home position upon power up. Limit switches can be attached to prevent unwanted travel beyond designated limits. A built in stop button allows the operator to halt the motor at anytime.

MECHANICAL OUTLINE



OPTIONS:

110 volt AC wall transformer
P/N: WT-1

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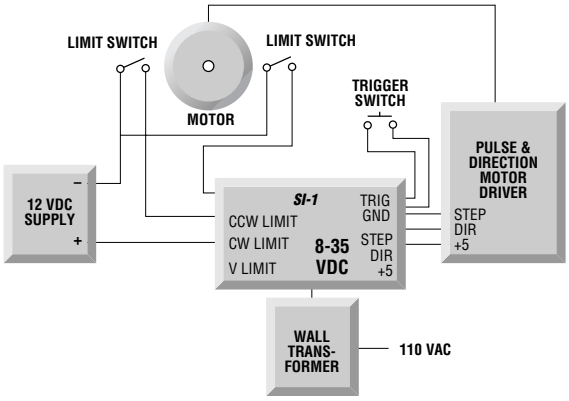
General Features

- Menu driven—no programming language to learn.
- Can connect to any pulse & direction step motor driver.
- Ideal for use with Applied Motion Products drive models 2035, PD2035, 3535, 3540 M, 5560, PD5580 and PD6300.
- Eight built-in programs:
  - Feed to Length moves a preset distance when TRIGGER is pulsed low (to 0 volts).
  - Feed & Jog also moves a preset distance. Jogs whenever AUX is held low.
  - Feed & Return moves a preset distance, then returns to the starting point.
  - Feed & Back Off moves a preset distance, then moves a second distance in either direction.
  - Feed to Sensor moves until the AUX changes state (can be set for rising or falling edge to accommodate most sensors).
  - Feed to Sensor & Return moves until AUX changes state, then returns to the start.
  - Register & Feed finds a registration mark, then moves preset distance.
  - Learn Speed allows user to adjust speed "on the fly," via the knob, then press to record new speed.
- Parameters can be entered in motor steps or custom units such as inches, revolutions or gallons.
- All programs can be executed between 1 and 255 times from a single trigger. Nonstop operation can also be specified.
- Limit switch inputs to protect from over travel in both directions.
- Nonvolatile memory saves your program and parameters during power down.
- Programmable distance from 1 to 8,000,000 steps.
- Programmable speed from 100 to 25,000 steps/second (100 steps/sec resolution).
- Return speed can be different than forward speed.
- Jog speed can be different than forward speed.
- Programmable time delay between trigger and move: 0 to 510 msec (2 msec resolution).
- Programmable time delay before returning: 0 to 25.5 seconds (0.1 sec resolution).
- Programmable time delay between moves: 0 to 25.5 seconds (0.1 sec resolution).
- Independently programmable acceleration and deceleration rates from 1000 to 250,000 steps/sec/sec.
- Pluggable, screw terminal connector.
- Built-in Stop switch allows user to interrupt motion.
- Fully enclosed in sturdy, black finish aluminum housing.
- Reversible flanges allow front or rear mounting.
- Built-in, fused 5 volt, 100 mA power supply for powering inputs of optoisolated motor drive.
- Can be powered by 8-35 VDC, 200 mA power supply or optional WT-1 wall transformer.
- Operator's access can be limited to specific parameters using a built-in password protection feature.

INPUT/OUTPUT:

- Two 5-24 volt optically isolated limit switch inputs, also used for power up homing feature.
- TRIGGER input to initiate motion.
- AUXILIARY input for sensor or jog control.
- Optically isolated MOTION output can signal "in motion" or "in position." "In position" pulse width is programmable, 0.1 - 25.5 msec.
- STEP and DIRECTION outputs to motor driver, open collector, 5-24 volts, 10 microsecond STEP pulse width.
- +5V output for motor driver optoisolators, filtered & fused.

Typical Application



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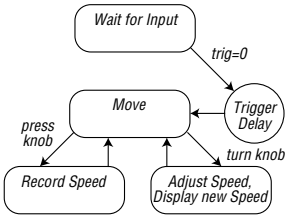
System Features

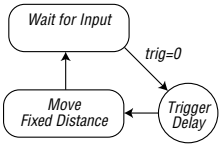
• Up to 255 moves per trigger can be selected by setting the Moves/Trigger parameter. Nonstop can also be selected.
• The SI-1 can seek a home position upon power up by setting the Home on Power Up parameter to clockwise or counterclockwise.
• User Units allow the user to work in units other than motor steps. Simply enter the number of motor steps per unit and name the unit (up to three characters.)
• Timing is adjustable on all programs. Delay can be added between the trigger pulse and the start of motion for system syncronization. On multiple moves per trigger, the delay between moves can be set. On moves that return (Feed & Return, Feed to Sensor & Return and Feed & Back Off) the delay between feeding and returning is adjustable.
• The MOTION output can be programmed to provide a signal edge at the start and finish of each move ("in motion"), or it can provide a pulse at the end of each move ("in position"). This allows maximum flexibility when coordinating the SI-1 with other equipment.
• Can be programmed to search for rising or falling edge of sensor, allowing many types of sensors to be easily configured.

Program Features

LEARN SPEED: Learn Speed allows the user to conveniently experiment with motor speeds. Like all the SI-1 programs, motion begins when the TRIGGER input goes low. The SI-1 accelerates the motor to the preset speed. Once the motor has reached speed, the speed is displayed. Turning the knob adjusts the velocity "on the fly," allowing the user to quickly observe the motor & load characteristics at different speeds. Pressing the knob records the currently displayed velocity, hence the name "Learn Speed."

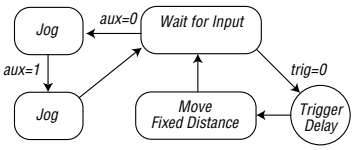


FEED TO LENGTH: Feed to Length is the simplest program. Each time the SI-1 is triggered, by taking the TRIGGER input to 0 volts, the SI-1 commands the driver to move the motor a fixed distance.



Feed to Length is commonly used for cut-to-length applications. The IN POSITION output is used to syncronize the SI-1 to the cutting knife.

FEED & JOG: Feed & Jog is similar to Feed to Length. Each time the SI-1 is triggered it commands the driver to move the motor a fixed distance.



If the AUX input is taken low, the SI-1 moves the motor according to the Jog paramaters (Jog Accel, Jog Dir, Jog Speed) until AUX returns to the high state.

The Jog feature is useful in material feeding applications when you need to clear the conveyor, load new material or re-align the system.

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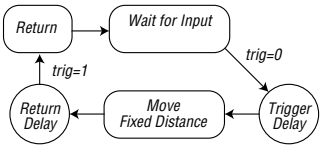
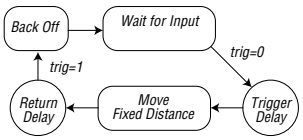
Program Features

FEED & RETURN: Feed & Return is used when you need to return to the starting position after each move. When the SI-1 is triggered, it commands the driver to move the motor a fixed distance, as specified by the Feed Distance parameter. Then the SI-1 returns the motor to the starting position. Delay can be added before returning. The Feed Speed and Return Speed are individually adjustable.



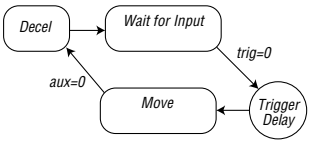
FEED & BACK OFF: Feed & Back Off is similar to Feed & Return, but the Feed Distance and Back Distance can be set independently. When the SI-1 is triggered, it commands the driver to move the motor a fixed distance, as specified by the Feed Distance parameter. Then the SI-1 moves the motor in either clockwise or counter clockwise direction, according to the Back Distance, Back Direction, and Back Speed parameters. Delay can be added before returning.

Feed & Back Off is commonly used to drive metering pumps, where the pump must be retracted slightly to prevent fluid from dripping out of the dispenser.

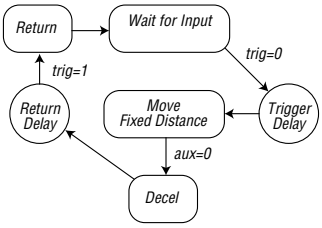


FEED TO SENSOR: Feed to Sensor begins moving when the TRIGGER input goes low. Normally a sensor is connected to the AUX input, signaling the correct position. Once AUX changes state, the SI-1 decelerates the motor to a stop. Since the SI-1 is a precise, digital controller, the decel distance is repeatable to one step.

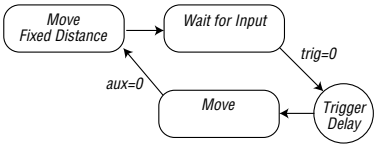
Feed to Sensor is useful for conveyor feeding applications, such as feeding bottles into a filling machine, or labels into a printer.



FEED TO SENSOR & RETURN: Feed to Sensor & Return is similar to Feed to Sensor, except that the motor is returned to the starting position after the sensor is tripped. The Return Speed and Feed Speed are independently adjustable.



REGISTER & FEED: Register & Feed begins moving when the TRIGGER input goes low. The SI-1 continues moving the motor until the AUX input changes state. Normally a sensor is connected to the AUX input, signaling that a registration mark has been found. Once AUX goes low, the SI-1 moves the feed distance, and stops. Register & Feed is useful for dispensing labels or feeding objects on a conveyer.



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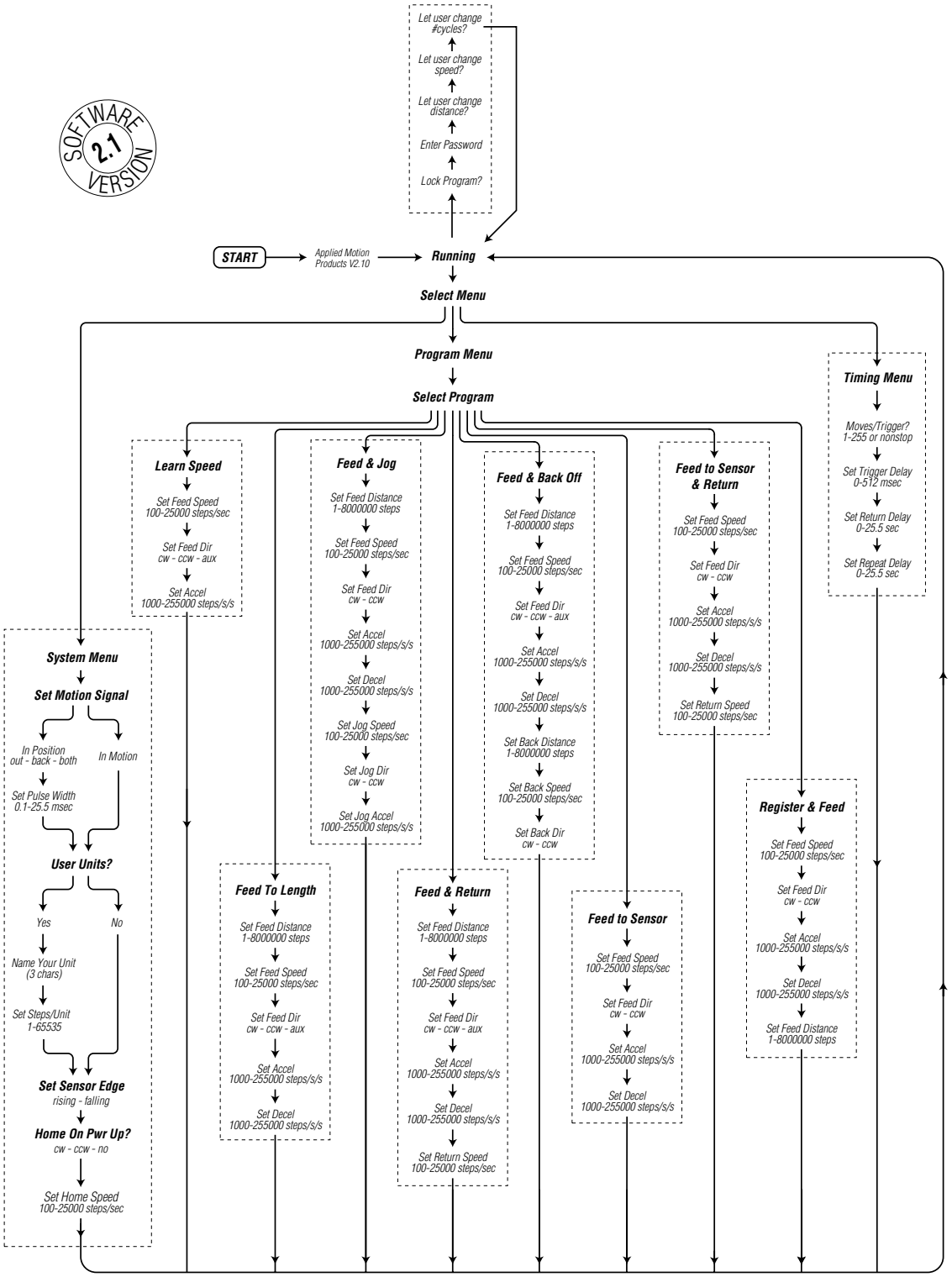
Si-1 Menu Tree



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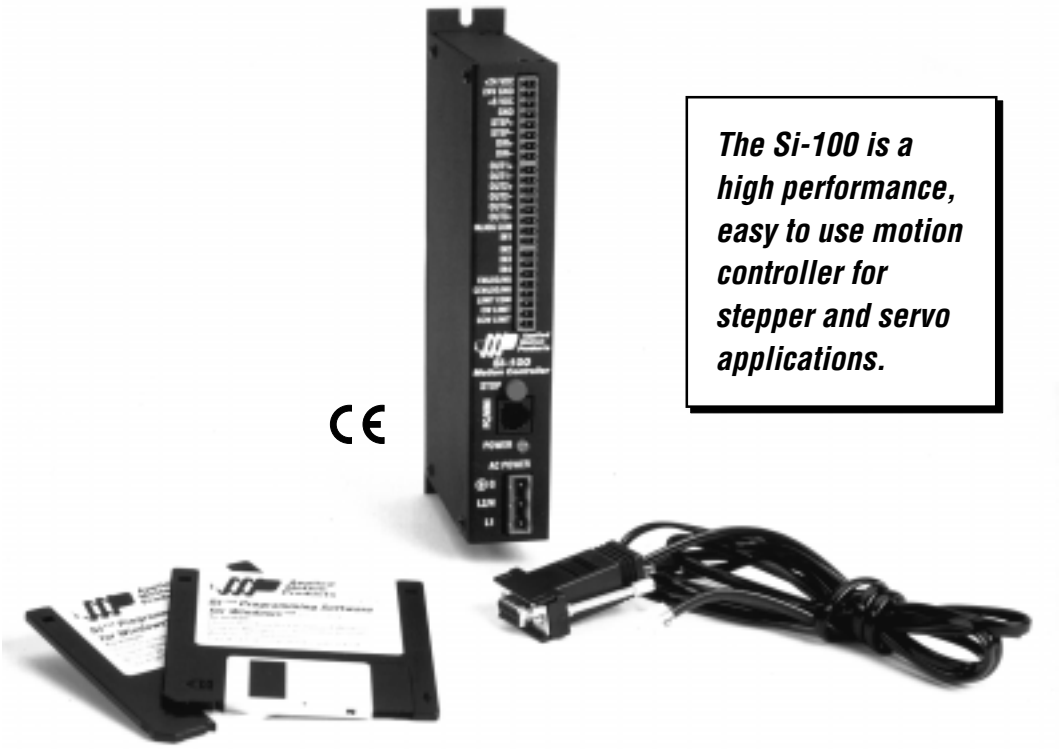
Si-100 Motion Controller

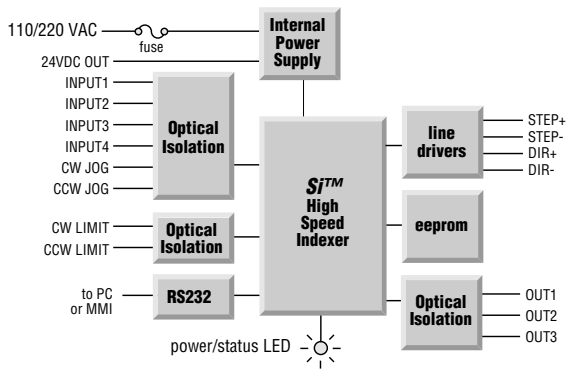


The Si-100 is a high performance, easy to use motion controller for stepper and servo applications.

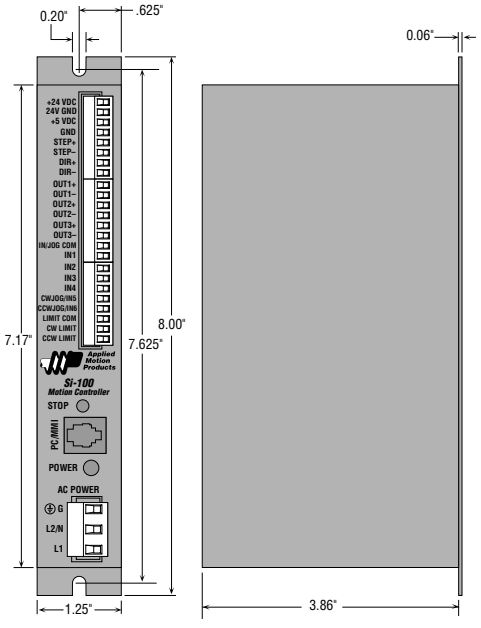
The Si-100 is a high performance programmable indexer that is easy to install and use. It features Applied Motion's "Simple Indexer Technology™" Windows™ graphical user interface for stand alone applications. No program language to learn, no software engineer to consult, no code to write. The system does the programming, you need only input the move parameters. If your single axis application requires the Si-100 to be operated by a host computer simply connect it to your PC or PLC and invoke our SiNet™ Command Language.

It interfaces easily to full, half and microstep motor drives and to pulse input servo motor drives. It can sense and control its external environment using optically isolated I/O. The Si-100 is CE compliant.

BLOCK DIAGRAM:



MECHANICAL OUTLINE:



Si-100 Motion Controller

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Technical Specifications

AC INPUT POWER	110 or 220 VAC (switch selectable), 50–60 Hz.
MOTOR RESOLUTION	16 resolutions. Steps per revolution with 1.8˚ motor: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800.
STEP AND DIRECTION OUTPUTS	2 sourcing outputs (step+ and dir+) and 2 sinking outputs (step– and dir–). Step+ and dir+ are 2.5min., 3.4V typ. with a 20na load. Step– and dir– are 8.5V max., 0.3V typ. with a 20ma load. The step frequency is 50Hz to 2.54MHz. The step duty cycle is 50% and the step rate is updated at 12,800Hz.
POWER SUPPLY OUTPUTS	5 and 24 VDC., 100ma max. The 24 VDC supply is isolated from the internal circuitry. The 5 VDC supply is not. Each supply is protected by a self resetting fuse.
SERIAL COMMUNICATION	RS-232 programming port.
STATUS LED'S	Two color, normal (green), limit (red).
INPUTS	8 inputs, 5–24 VDC, bidirectional, optically isolated. 2 dedicated limit switch inputs. 4 dedicated general purpose inputs (for triggering, sensing & program branching). 2 JOG inputs (cw and ccw) can be also used as general purpose inputs.
OUTPUTS	3 general purpose, optically isolated outputs for interfacing to other equipment. Can be set to a high or low voltage or programmed to send a pulse by the *Set Output* instruction.
PARAMETER RANGES	Distance: 1 to 16,000,000 steps. Speed: .025 to 50 revolutions per second (in any microstep resolution). Acceleration: 1 to 3,000 rev/sec/sec. Deceleration: 1 to 3,000 rev/sec/sec (set independently from acceleration). Time Delays: .01 to 300 seconds. Output Pulse Widths: 2 to 500 milliseconds. Iterations per loop: 1 to 65,535.
OPTIONAL OPERATOR INTERFACE (MMI)	NEMA 4X rated (splash proof & dust proof). 4 x 20 characters liquid crystal display (LCD). 20 key membrane keypad. Overall size: 4.9 x 4.9 x 1.42 inches.

SYSTEM SPECIFICATIONS:

OVERALL SIZE	1.25 x 4 x 8 inches. See mechanical outline.
CASE MATERIAL	Steel, finished with black textured paint and white silk screen.
WEIGHT	2 lbs.
AMBIENT TEMPERATURE	0˚ to 50˚C (32˚ to 122˚F).
HUMIDITY	Maximum of 90% non-condensing.
CONNECTORS	Screw terminal connectors for input power and I/O signals.
DRIVES	Indexer for step and direction compatible stepper and brushless DC drives.
AGENCY APPROVAL	CE & TUV.

Recommended Drivers

There are many step motor drivers available today, but none offer a better combination of price, performance and reliability than the Applied Motion Products drivers. The following chart summarizes the Applied Motion line. These units are usually available for same day or next day shipment.

In addition to the above, Applied Motion also makes *Si™* products that combine the indexer, drive and power supply.

MODEL	STEPS/REV	INPUT POWER	CURRENT	VOLTAGE	MAX. POWER
2035	200, 400	12–35 VDC	.125–2 A	12–35	70W
3535	200, 400	12–35 VDC	.4–3.5 A	12–35	122W
3540M	400–12,800	12–42 VDC	.4–3.5 A	12–42	147W
5560	200–12,800	24–60 VDC	1.0–5.5 A	24–60	330W
7080	200–50,800	24–80 VDC	0.8–7.0 A	24–80	560W
PD2035	200, 400	110/220 VAC	.125–2 A	35	70W
PD5580	200–50,800	110/220 VAC	0.5–5.5 A	80	440W
PD8400	200–50,800	110 VAC	0.1–8.4 A	160	1350W

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Multi-Axis Hub

Single RS-232 serial port

Description

The SiNet™ Hub-8 allows up to 8 indexer-drives to be controlled from a single RS-232 serial port of a PC or PLC.

Each indexer-drive acquires a unique address from the port to which it is connected. This simple addressing scheme minimizes the cost of the drives, and more importantly, the cost of configuring and/or replacing drives in your system. Connections are made with low cost, reliable telephone cabling.

Any of our popular, cost effective Si™ indexers or indexer-drives can be used with the SiNet™ Hub-8, including the stand alone Si-100 indexer, the DC input 7080i and 3540i indexer-drives, and the Si3540 and Si5580 indexer-drives with built-in power supply. By choosing the power level and features you need for each axis of your application, SiNet™ saves you money.

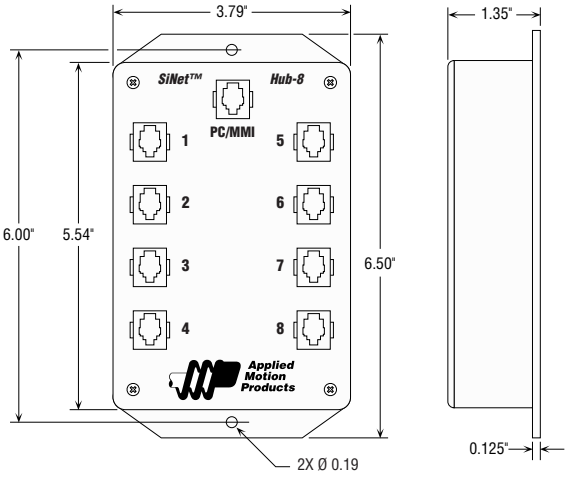
The SiNet™ Hub-8 is powered by the drive that's connected to port #1, saving you the cost and installation expense of a separate power supply.

Our SiNet™ Command Language consists of approximately 50 commands allowing a host PC or PLC to execute relative, absolute and homing moves, make status inquires, sample inputs, set outputs, and more.

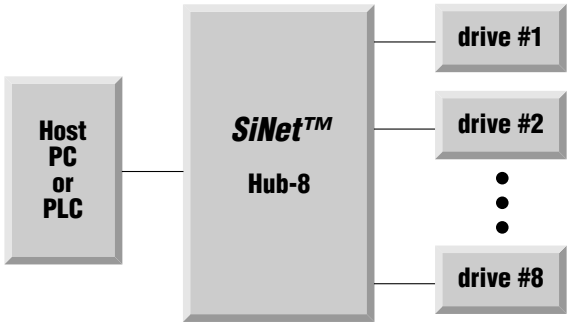
If your application requires just one indexer-drive to operate in "host mode", you can connect any of the above mentioned drives directly to your PC and invoke the SiNet™ Command Language by responding to a simple power up request from the drive.

Multi-Axis Stand Alone Mode

Our SiNet Programmer™ Windows software will allow you to create and store multi-axis motion control programs in the SiNet™ Hub-8 and run them without the PC. This new software brings the innovative ease of use and productivity of our Si Programmer™ single axis software to multi-axis applications. Call us for availability.



MECHANICAL OUTLINE



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MMI-01

The MMI-01 is an easy to use, flexible device that allows an operator to enter move speeds, move distances or repeat loop counts. Messages can also be displayed and the program can be paused until the user presses a key, such as ENTER, YES or NO. Program branching can be accomplished based on the response of YES or NO.

The MMI-01 is compact, easy to install and carries a NEMA 4/12 rating. (The 4 x 20 character display and 20 key membrane keypad are sealed.)

Connection to an Si5580 or 7080i indexer drive is accomplished by the standard programming cable that is supplied with every drive. This cable also supplies power to the MMI-01 so that no additional power supply or wiring is needed.

Setup and programming of the MMI-01 is fast and easy. The Si5580 and 7080i indexer drives are furnished with Applied Motion's Si™ Programmer software, which allows the user to easily program instructions for the terminal. Complex, confusing items like baud rate, parity and cursor positioning are handled automatically by the software.

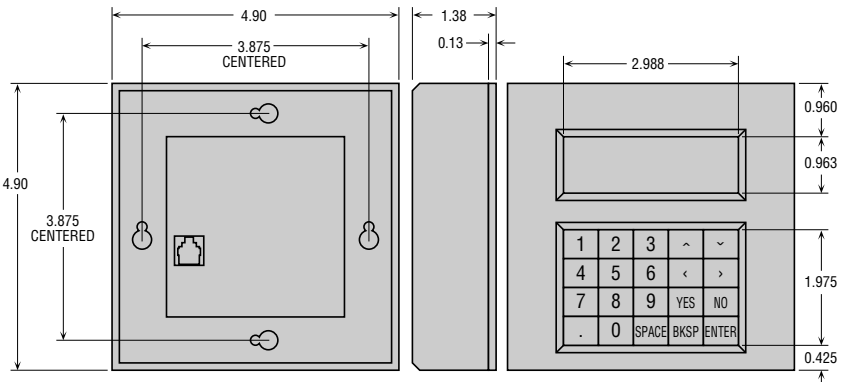
On screen emulation of the MMI-01 by the Si™ Programmer software allows a potential user to try the MMI before purchasing one.

Features

- Ideal operator interface for Si5580 and 7080i indexer drives.
- Connects directly to Si5580 and 7080i indexer drives using the standard programming cable. No special wiring required.
- Power is supplied by the drive - no additional power supply required.
- Easy to program using Si™ Programmer software.
- Can also be used with MC8400 machine controller/drive.
- 4 line, 20 character/line LCD display
- 20 key keypad
- NEMA 4/12 rating (dustproof and drip proof when properly mounted)
- Can be surfaced mounted or flush mounted (NEMA 4/12 rating for flush mounting only)

Programming from Si5580 or 7080i

- Easy to program using Si™ Programmer software, running on Windows 3.1 or Windows 95.
- Six functions are available: 1) Display a message, up to 60 characters 2) Display a message and pause program until operator presses ENTER key. 3) Display a message, wait for operator to press YES or NO key. branch program on YES. 4) Display message, allow operator to enter a loop count. 5) Display message, allow operator to enter a speed 6) Display message, allow operator to enter a distance
- Speeds, distances and loop counts entered by the operator can be stored in any of eight nonvolatile memory locations for use in repeat loops and motor moves.



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Mounting the Optional MMI-01

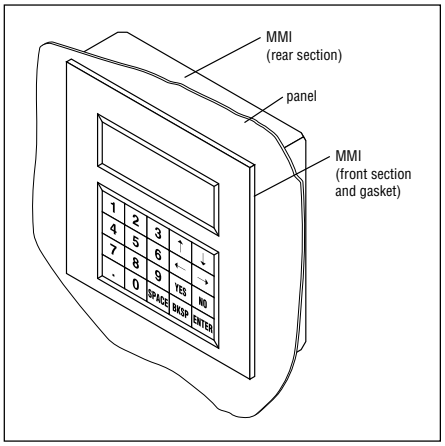
There are two ways to mount the MMI-01 in your application. No matter which method you choose, you'll need to connect the MMI-01 to your indexer-drive with the programming cable. You will not, however, need the adapter plug. The MMI-01 has the same telephone style connector as the 7080i and Si5580 drives.

Depending on how you mount the MMI-01 and cable in your application, you may find that it is difficult to remove the cable from the back of the MMI-01. If this is the case, and you need to reprogram the 7080i, you can use any telephone line cord as a programming cable. They are available at most supermarkets and discount stores. Please be careful not to lose the adapter plug that connects the telephone cord to the COM port of your PC. The adapter is a custom made part and is only available from Applied Motion.

FLUSH MOUNTING When you remove the MMI-01 from the shipping carton, you will notice that it has two parts. The first is a fairly thin section that contains the keypad, display and some circuit boards. The other part is thicker and contains the telephone jack and a cable that connects to the thin part.

When you flush mount the MMI-01 in a panel, only the thin section will stick out from your panel—the large portion mounts behind your panel. You'll need to cut a precise section from your panel. There is a cardboard template in your box for this purpose.

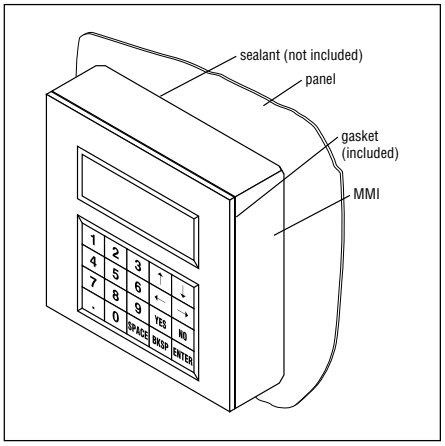
If you want the MMI-01 to be dust proof and watertight, you must place the black rubber gasket between the thin art of the MMI-01 and your panel. Assemble the two halves using the eight small screws.



SURFACE MOUNTING An easier way to mount the MMI-01 is to bolt the two halves together ahead of time, using the eight small screws. If you want the MMI-01 to be dust proof and watertight, put the black rubber gasket between the two halves before screwing them together.

Then cut a hole in your panel for the cable that runs between the MMI-01 and the drive. The hole must be at least 5/8" in diameter for the connector to fit through. You will also need two holes that line up with the big mounting holes in the MMI-01. The mechanical outline on page 96 shows the location of the big mounting holes.

When you mount the MMI-01 to your panel, you will need to use some kind of sealant to keep dust and liquid out. Silicone or latex caulking is okay, or you can make your own gasket from a sheet of compliant material rubber or RTV.



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PS430

Power Supply

4A 30VDC

Features

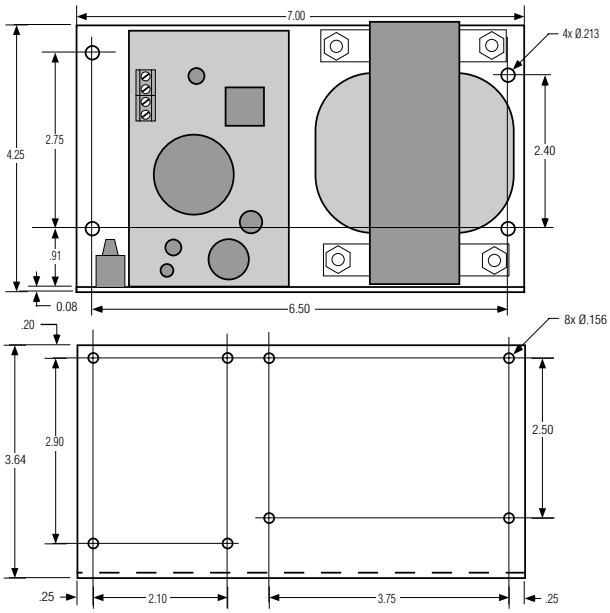
- 30 VDC 4 amp unregulated motor supply
- 5 VDC ±5% 500 mA regulated logic power supply
- fuse protected outputs
- screw terminal AC input connector
- 120 or 240 VAC, 50-60 Hz
- power on LEDs
- screw terminal connectors
- made in USA
- ideal for use with A.M.P. step motor drives: 1335, 2035, 2035 O, 3535, 3535 O, 3540 M, 3540 MO
- includes mounting holes for 057A oscillator/interface and one 2035, 2035 O, 3535, 3535 O, 3540 M or 3540 MO drive on side panel

Description

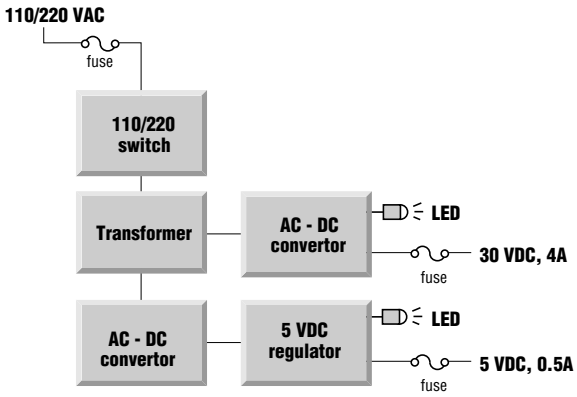
The PS430 is a linear, unregulated DC power supply designed for use with Applied Motion's step motor chopper drives model numbers 2035, 2035 0, 3535, 3535 0, 3540 M and 3540 MO. The PS430 can also be used with the 5560, 7080 or 7080i drive in applications not requiring maximum power.

The PS430 provides the user with a precise, well-regulated 5 VDC power source for logic circuitry.

This power supply is available as a PC board and transformer mounted on an aluminum angle chassis.



MECHANICAL OUTLINE



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PS1050

Power Supply

10A 50VDC

Features

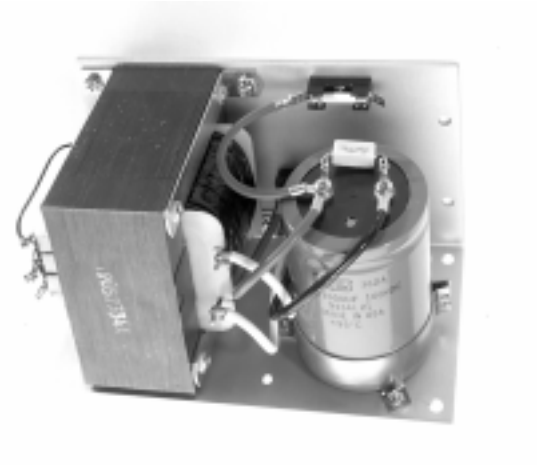
- Input Voltage: 108–264 VAC
- Output Voltage: 50 VDC nominal
- Typical Output Voltage:
  - 56.6V no load
  - 52.8V at 5 amps
  - 48.8V at 10 amps
- Output Current: 10 amps max, continuous
- Input Frequency: 47–63 Hz
- Max Ambient Temp: 55°C
- Filter Capacitor: computer grade (long life)
- Rectifier Bridge: 50 amp, 200 volt
- Output Voltage Ripple: 3% rms max at nominal AC line voltage
- Weight: 19 pounds
- Made in USA

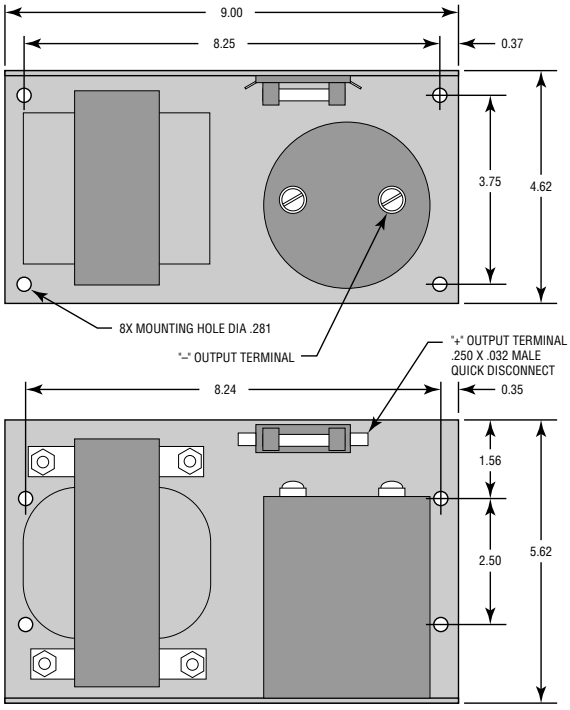
Description

The PS1050 is a heavy duty linear, unregulated power supply. It is an ideal power source for Applied Motion's 5560, 7080 and 7080i series step motor drives, combining over 500 watts of output power and outstanding reliability.

The PS1050 provides isolation from the AC line and is fused for safety.

The PS1050 is constructed on an open frame aluminum chassis.





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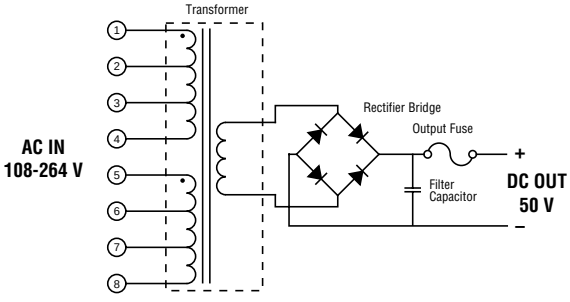

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Visual Load Positioner

Description

The CNC Handwheel accessory works with the Hand Wheel instruction. With a hand crank and 100 detents per revolution, the CNC Hand wheel provides an operator with a fast, yet highly precise method of visually positioning a load. Programmable electronic gearing allows you get just the right "feel" for your application. Once in position, the Hand Wheel instruction can be terminated by an input signal or by the ENTER key on the optional MMI-01 Man Machine Interface allowing your program to perform other tasks.

The CNC Handwheel connects to Inputs 1 & 2 of any Si™ Indexer or Indexer-drive, and is powered by 24 VDC.