

CATALOG

motors

FLM Series

Stepper Motors and Control Packages



numatics®

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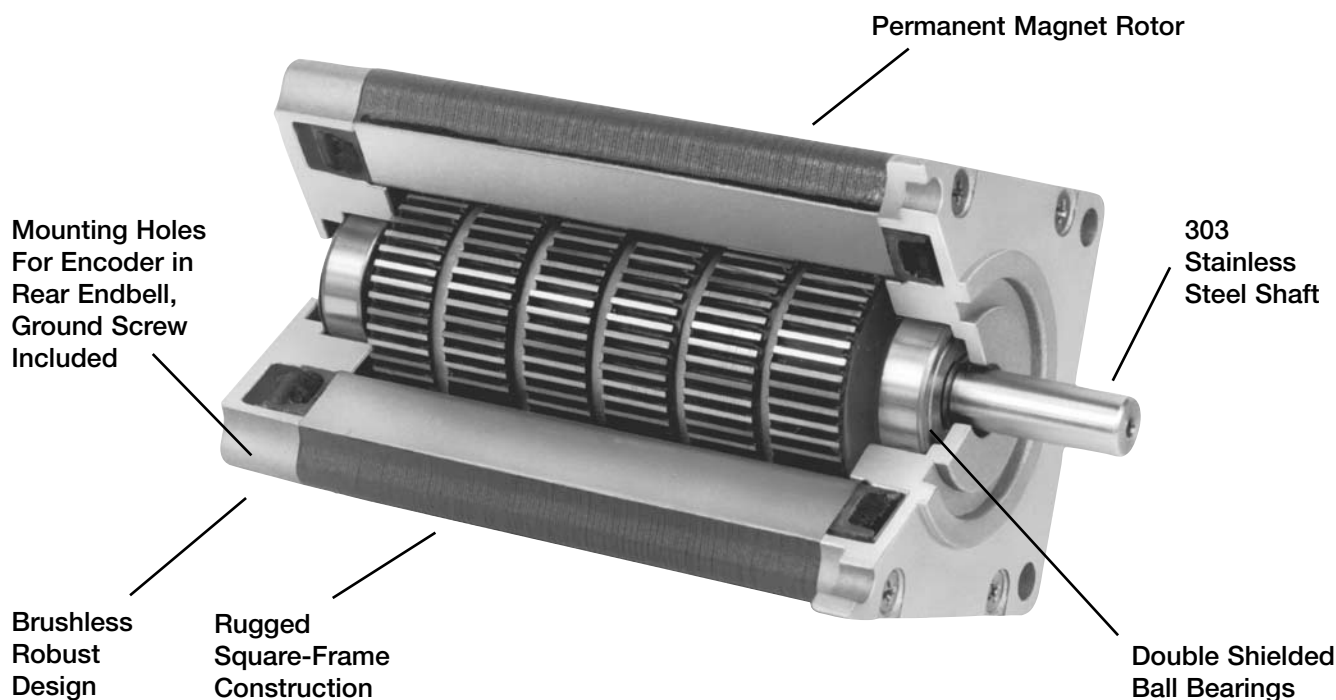
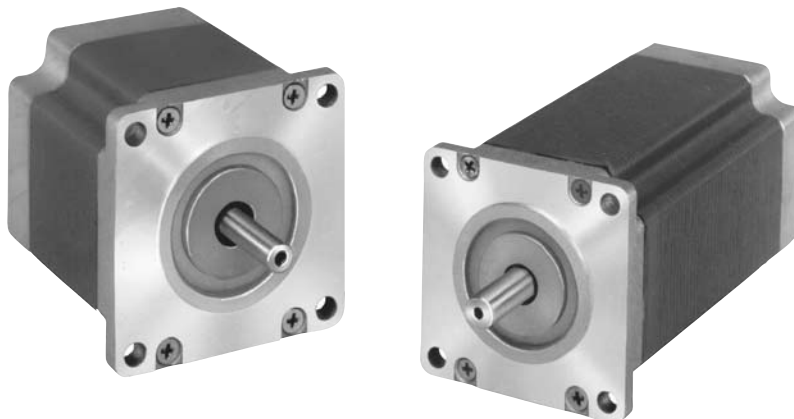


FLM Series High Torque Brushless Stepper Motors

The FLM Series stepper motors are available in both NEMA 23 and 34 frame sizes. Winding configurations increase motor compatibility with most step motor drives. The FLM Series are also compatible for most full, half and micro-stepping applications.

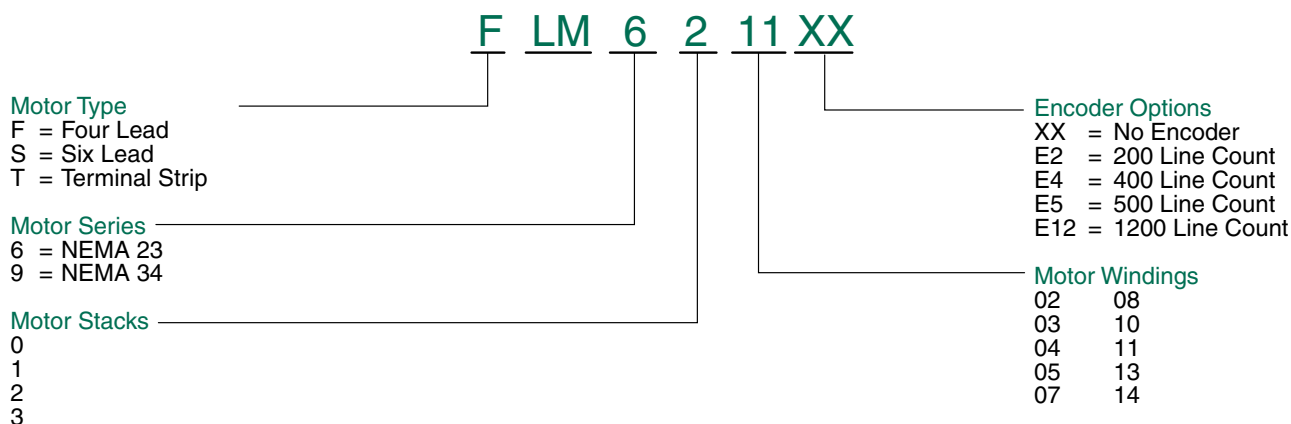
Features

- 7 sizes with holding torque ratings from 68 to 1155 oz-in (48 to 816 Ncm)
- NEMA 23 and 34 frame sizes available
- $\pm 2\%$ typical step accuracy
- Operate in full-step (1.8°) or half-step (0.9°) increments
- Can be microstepped to achieve increments as small as $.0072^\circ$
- Can operate at rates to 20,000 steps per second (6000 rpm)
- UL and Canadian Recognized
- CE certification
- Up to 200% rated torque reserve capacity for peak performance (limited duty cycle)
- Can withstand over 2 times rated current without demagnetization
- Motors available with optional encoder for closed loop applications
- Wide range of windings available with 4 or 6 connections for use with bipolar or unipolar drives
- Rugged construction to provide long life
- Optional cast terminal box available





How to Order



Example order:

Part Number: FLM6211XX*

Part Description: Four leaded, NEMA 23 size motor with 2 stacks and standard motor windings, without encoder.

* When entering an order, DO NOT use spaces or dashes.

Stepper Motor Cable Assemblies

Stepper Motor to Drive Cable 16 AWG, Both Ends Unterminated

P/N	DESCRIPTION
MC 010	10 Foot Length
MC 025	25 Foot Length
MC 050	50 Foot Length

* For longer lengths, contact factory

Stepper Motor Encoder Cable 9 Pin "D" Male Connector One End, Unterminated Other End

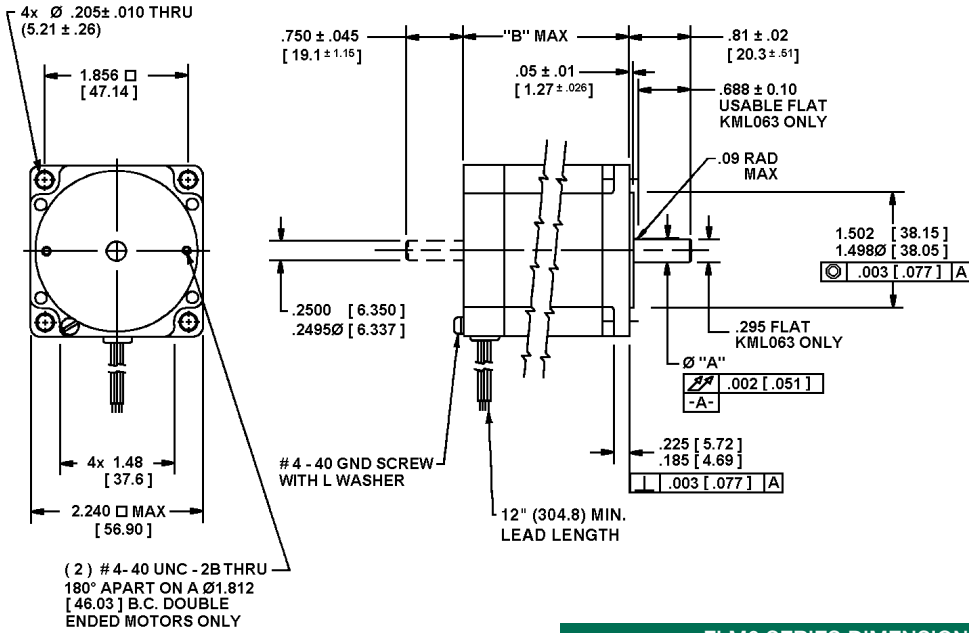
P/N	DESCRIPTION
MEC 010	10 Foot Length
MEC 025	25 Foot Length



Dimensions

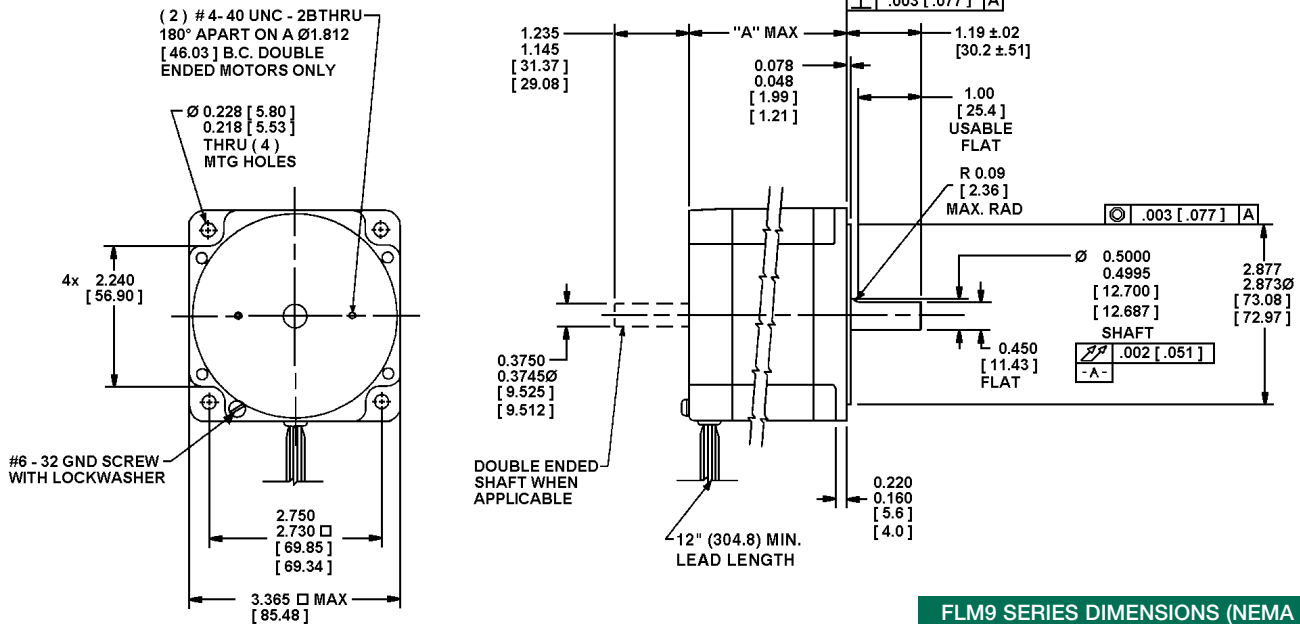
top dimensions = inches

bottom dimensions (in parenthesis) = millimeters



FLM6 SERIES DIMENSIONS (NEMA 23)

Motor Series	A. (max)	B. (max)
FLM 60	0.2500/0.2495 (6.350/6.337)	1.64 (44.7)
FLM 61	0.2500/0.2495 (6.350/6.337)	2.21 (56.2)
FLM 62	0.2500/0.2495 (6.350/6.337)	3.06 (77.8)
FLM 63	0.3125/0.3120 (7.938/7.924)	4.06 (103.2)



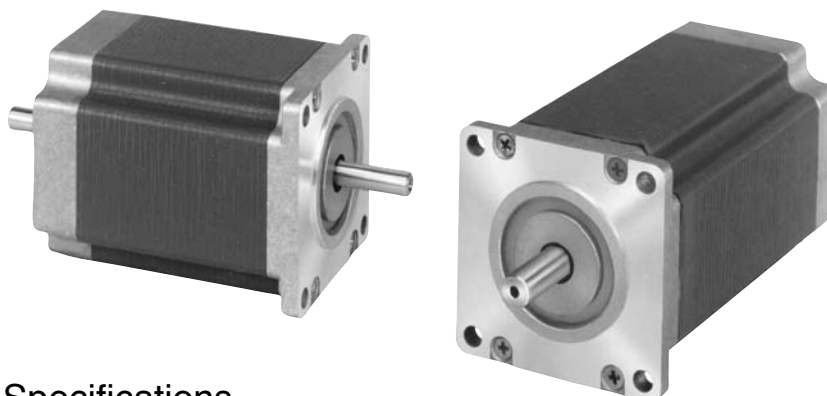
FLM9 SERIES DIMENSIONS (NEMA 34)

Motor Series	A. (max)
FLM 91	2.57 (65.3)
FLM 92	3.77 (95.3)
FLM 93	4.97 (126.3)



High Torque Step Brushless Motor Specifications

MOTOR SERIES	HOLDING TORQUE AT RATED CURRENT (MINIMUM) OZ-IN (NCM)		INERTIA OZ-IN-SEC2 (KG-CM2)	ROTOR OVERHANG LOAD LBS (KG)	MAXIMUM THRUST LOAD LBS (KG)	MAXIMUM TORQUE (TYPICAL) OZ-IN (NCM)	RESIDUAL MOTOR WEIGHT LBS (KG)
	UNIPOLAR	BIPOLAR					
FLM 60	54 (38)	68 (48)	0.00154 (.108)	15 (6.81)	25 (11.35)	2 (1.41)	1.03 (.47)
FLM 61	128 (90)	170 (120)	0.0034 (.24)	15 (6.81)	25 (11.35)	3 (2.11)	1.6 (0.73)
FLM 62	188 (134)	250 (177)	0.0056 (.395)	15 (6.81)	25 (11.35)	6 (4.24)	2.3 (1.04)
FLM 63	263 (186)	350 (247)	0.0084 (.593)	15 (6.81)	25 (11.35)	7 (4.94)	3.2 (1.45)
FLM 91	305 (215)	385 (272)	0.016 (1.13)	25 (11.35)	50 (22.7)	10 (7.06)	3.8 (1.73)
FLM 92	610 (431)	770 (544)	0.031 (2.19)	25 (11.35)	50 (22.7)	15 (10.6)	6.2 (2.82)
FLM 93	915 (646)	1155 (816)	0.047 (3.32)	25 (11.35)	50 (22.7)	23 (16.2)	8.7 (3.95)



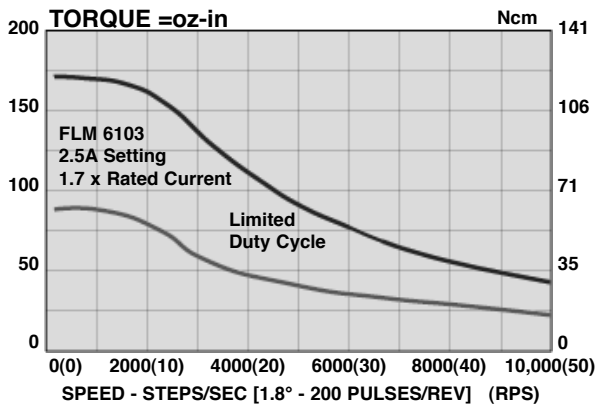
Stepper Motor Specifications

MOTOR TYPE	NUMBER OF LEADS	CURRENT IN AMPS	VOLTAGE (VDC)	RESISTANCE (OHMS)	INDUCTANCE (MH)
FLM 6002	4	1.05	3.76	3.58	15.80
FLM 6005	4	2.70	1.71	0.636	2.53
FLM6008	4	4.00	1.11	0.277	1.00
FLM6011	4	5.30	0.98	0.186	0.63
FLM 6103	4	1.40	4.19	3.00	15.50
FLM 6105	4	2.70	2.30	0.851	5.07
FLM 6111	4	5.40	1.34	0.248	1.14
FLM 6203	4	1.50	4.40	2.93	16.90
FLM 6207	4	3.30	2.48	0.75	3.38
FLM 6213	4	6.60	1.40	0.212	0.847
FLM 6304	4	1.80	5.00	2.75	17.00
FLM 6307	4	3.30	3.29	0.997	5.20
FLM 6313	4	6.60	1.85	0.280	1.54
FLM 9105	4	2.70	3.00	1.11	11.40
FLM 9107	4	3.30	2.52	0.764	7.52
FLM 9113	4	6.60	1.26	0.191	1.88
FLM 9207	4	3.25	3.48	1.07	11.20
FLM 9213	4	6.50	1.74	0.268	2.86
FLM 9307	4	3.40	4.90	1.44	17.90
FLM 9308	4	4.00	3.95	0.988	12.80
FLM 9310	4	5.10	3.21	0.629	8.31
FLM 9314	4	6.80	2.45	0.36	4.48

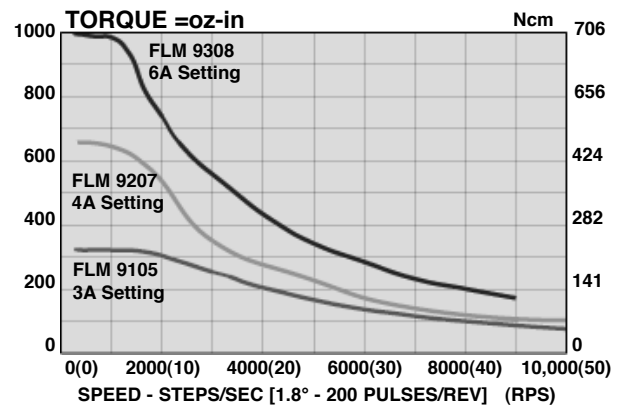


Stepper Motor Specifications (continued)

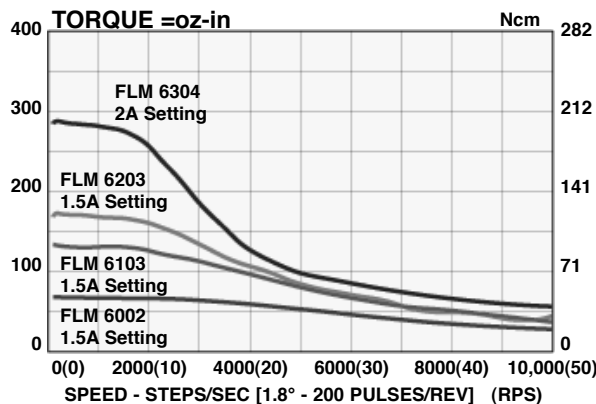
Temperature Rise	80 C (176 F) or less as measured by the change in resistance method when both phases are energized with constant rated current
Motor Case Temperature	100 C (212 F) max.
Ambient Temperature Range	-40 C to +65 C (-40 F to 149 F)
Dielectric Strength	sufficient to withstand 500 Vrms @ 60 Hz applied winding to winding and 1200 Vrms applied winding to the frame for one second min.
Insulation Resistance	100 Megaohms or more with 500 Vdc applied between the winding and the frame



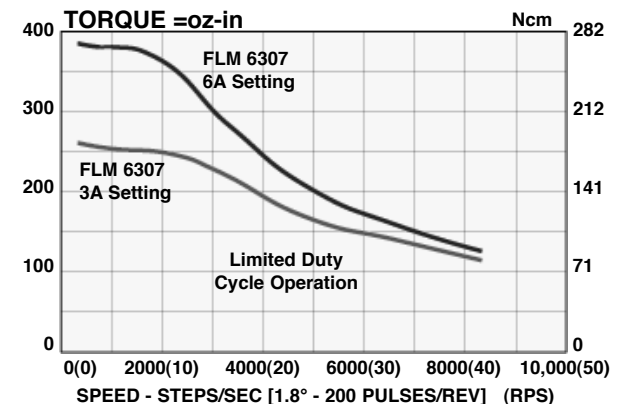
FLM 61 Motor with NSDP6C Drive



FLM 90 Series Motors with NSDP6C Drive

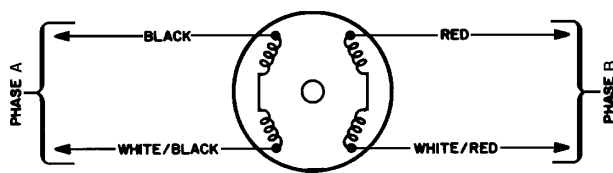


FLM Series Motors with NSDP6C Drive



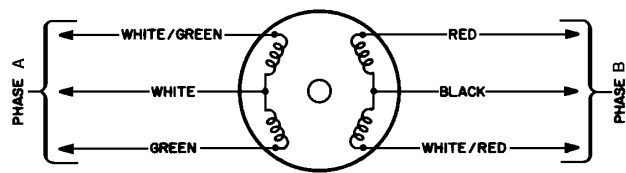
FLM 6307 vs FLM 6307 with 2X Boost, NSDP6C Drive

Wiring Diagrams



4-LEAD MOTORS

Bipolar Configuration



6 - LEAD MOTORS

Optional Unipolar Configuration



Step Motor Drive Component and Packages



3.

1. Depending upon the application, a power supply may be required. The PS-Series power supply supplies unregulated power to the various drives. Each power supply is capable of converting 120V or 240V AC power to low voltage DC power.
2. NMC's NSMD-Series modular drives deliver up to 8 amperes of output current. The modular drive unit develops the maximum torque performance from Numatics FLM-Series stepper motors. Each modular drive will require a power supply to provide the required input current.
3. The NSMC Series is a programmable motion controller utilizing a very basic Windows based programming language. The NSMC has 16 inputs (8 isolated and 8 non-isolated) and 8 outputs (4 isolated and 4 non-isolated).

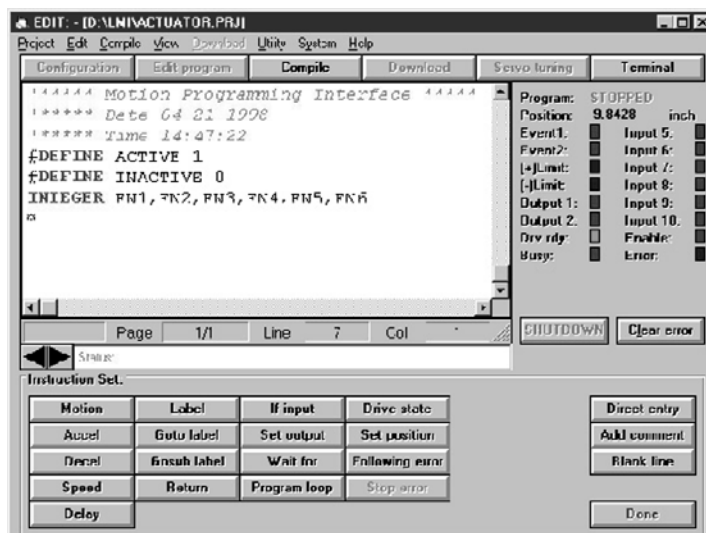


2.

4. NMC's controller packages offer greater flexibility and convenience. The controller package includes the power supply, driver and controller in one unit which provides less space requirements, less wiring and less headaches.
5. DMP software is used across all Numatics controllers. This Windows® based software is point and click, simple and easy with no special programming codes to memorize.



4.

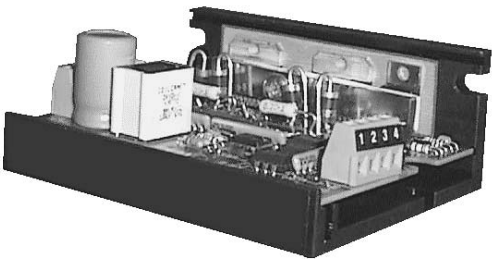


5.



NSMD4 Modular Drive

This modular bipolar chopping drive is designed to provide up to 3.5 amps of current which develops maximum speed and torque performance from the Numatics Motion Control FLM Series stepper motors. The NSMD4 is a full and half step drive. It is capable of 400 steps per revolution, ideal for limited frequency controller pulse rates. The NSMD4 is designed to operate at reduced temperatures. Therefore, an additional heat sink is not required in most applications. We recommend the drive package to be mounted flat to the system enclosure.



Features:

- Full and half stepping
- Multiple mounting surfaces
- Advanced control circuitry
- Switch selectable current levels to 3.5 amps
- 40 Vdc
- Bi-polar switching four phase step motor drive
- Over-voltage protection
- Full short circuit protection
- Optically isolated inputs
- Windings OFF function
- Easy access screw clamp terminals
- Efficient thermal design for longer life
- MOSFET power devices
- LED fault light

Specifications:

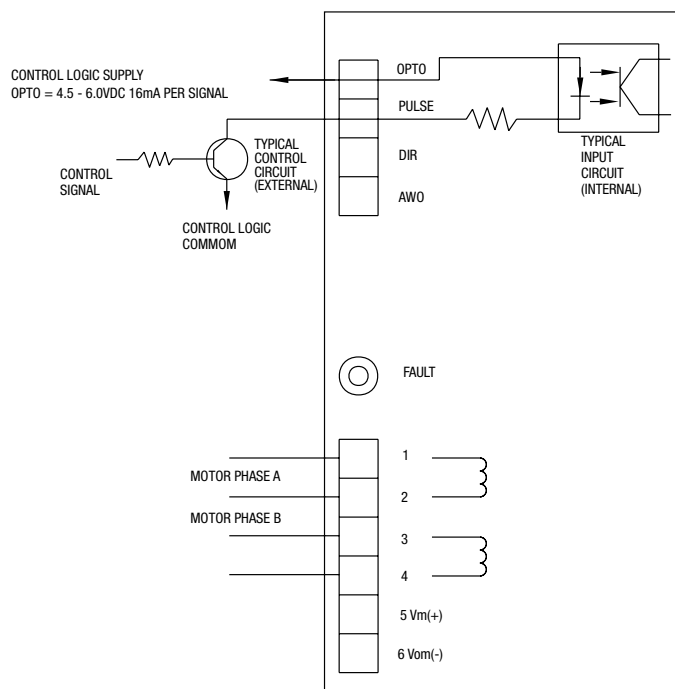
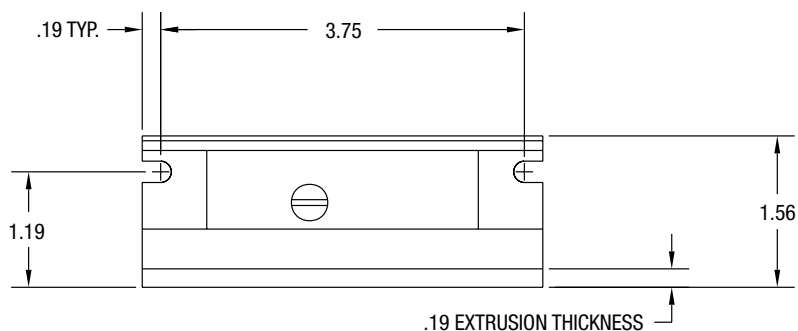
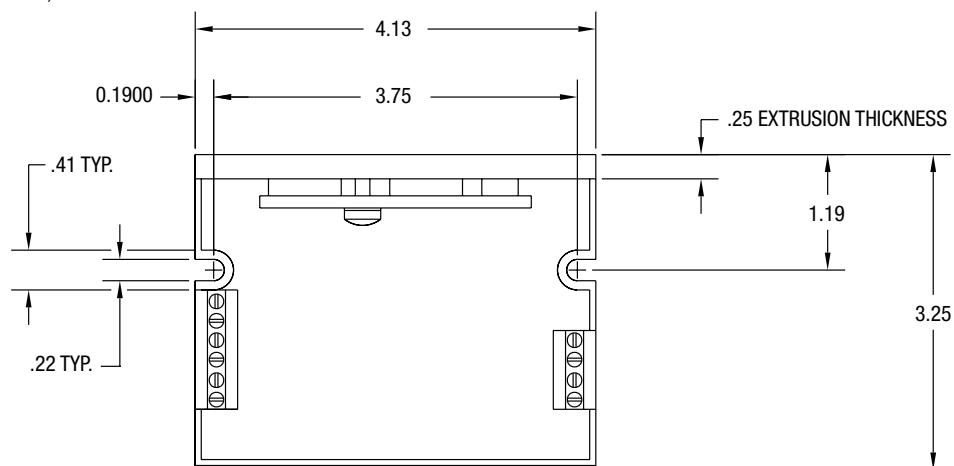
Input Power Required.	24 Vdc unregulated power supply
Max Drive Dissipation.	35 watts
Recommended Power Supply	Numatics Motion Control # PS30VDC5A
Drive Type	modular dc power input bipolar chopping drive
Chop Frequency.	20Kz minimum (above audible range)
Output Device Type	FET
Phases	Two phases
Output Current	.5 to 3.5 amps by .5 amp increments
Output Resolution.	full step @ 200 ppr half step @ 400 ppr
Pulse Input	input type – sinking, high speed optocoupler max rise time – 1 microsecond max fall time – 1 microsecond signal active (steps) on low-high transition (.2mA to 16 mA sink)
All Other Inputs.	input type – sinking, opto-coupler delay time < 25 microseconds
Short Circuited Protected.	phase to phase & ground to ground
Unbalanced Phase Protection	Yes (ground)
Under Voltage Protection	Yes
Transient Over Voltage Protection	Yes
Operating Temperature	+32°F to 122°F (0 to 50°C)
Max Heat Sink Temperature.	158°F (70°C)
Storage Temperature	-40°F to 167°F (-40°C to +75°C)
Humidity	95% max. non-condensing
Altitude	10,000 feet (3048 m) above sea level
Motor Series.	Numatics Motion Control FLM-Series
Minimum Phase Inductance.	.5mH
Maximum Phase Resistance (including leads)	Rmax = .25 x Vdc supply/I setting



NSMD4 Dimension and Wiring Diagram

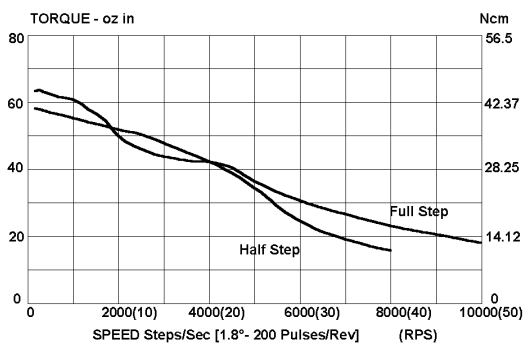
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bottom dimensions (in parenthesis) = millimeters

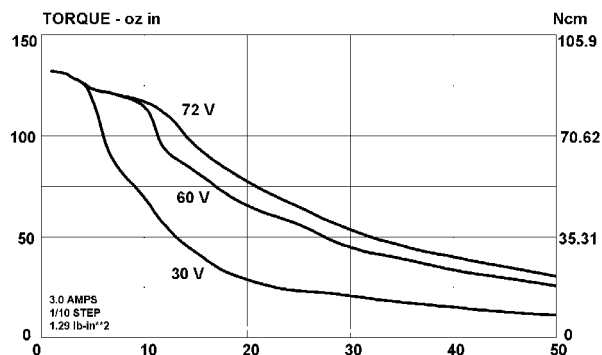




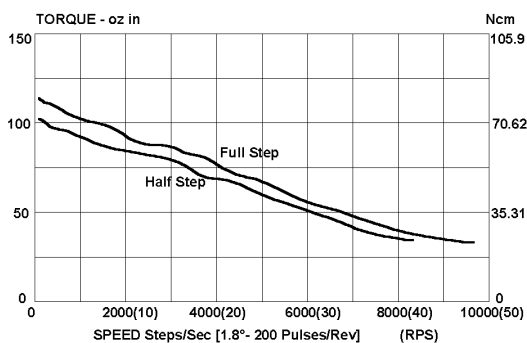
NSMD4 Motor Torque Curves



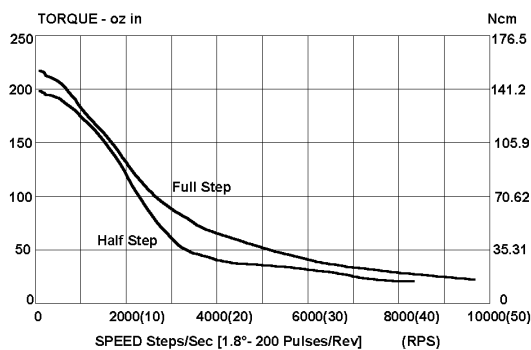
FLM6005, 2.5 AMP, 36 V BUS



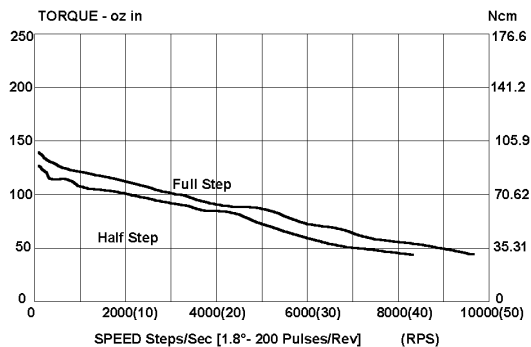
FLM6105, 2.5 AMP, 36 V BUS



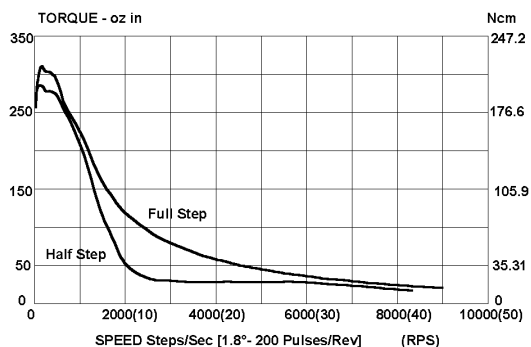
FLM6111, 3.5 AMP, 36 V BUS



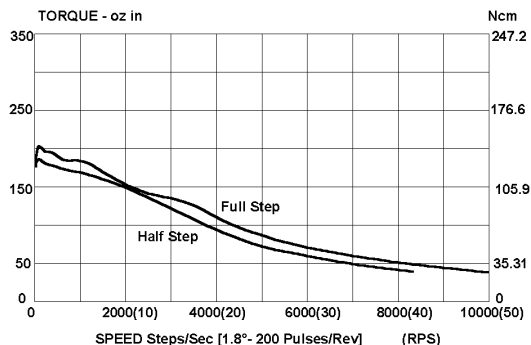
FLM6207, 3.0 AMP, 36 V BUS



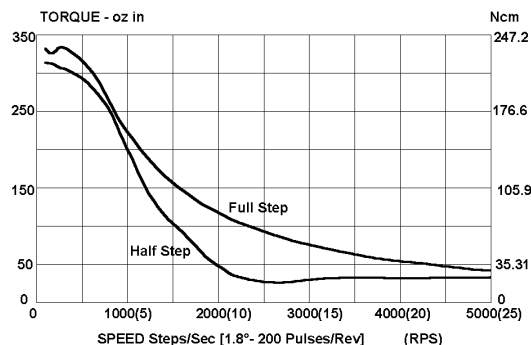
FLM6213, 3.5 AMP, 36 V BUS



FLM6307, 3.0 AMP, 36 V BUS



FLM6313, 3.5 AMP, 36 V BUS



FLM9107, 3.0 AMP, 36 V BUS



NSMD8 Modular Translator Drive

This modular bi-polar PWM drive is designed to provide up to 8 amps of current which develops maximum speed and torque performance from the Numatics Motion Control FLM Series stepper motors. The NSMD8 is a full and half step drive providing up to 20,000 micro steps per revolution for smooth slow speed operation. The NSMD8 is designed to operate at reduced temperatures. If motor current is rated at 4 amps or above a heat sink will be required. Reference NMC Part Number HSMD8.



Features:

- Full, half and micro stepping to 20,000 steps
- Multiple mounting surfaces
- Switch selectable current levels 3 to 8 amps
- Single input voltage 20 to 80 VDC
- Bipolar switching four phase step motor drive
- Over-voltage protection
- Full short circuit protection
- Optically isolated inputs
- Windings OFF and Reduced Current inputs
- Easy access screw clamp terminals
- Auto Reduce Motor Current at standstill selectable
- MOSFET power devices
- LED fault light

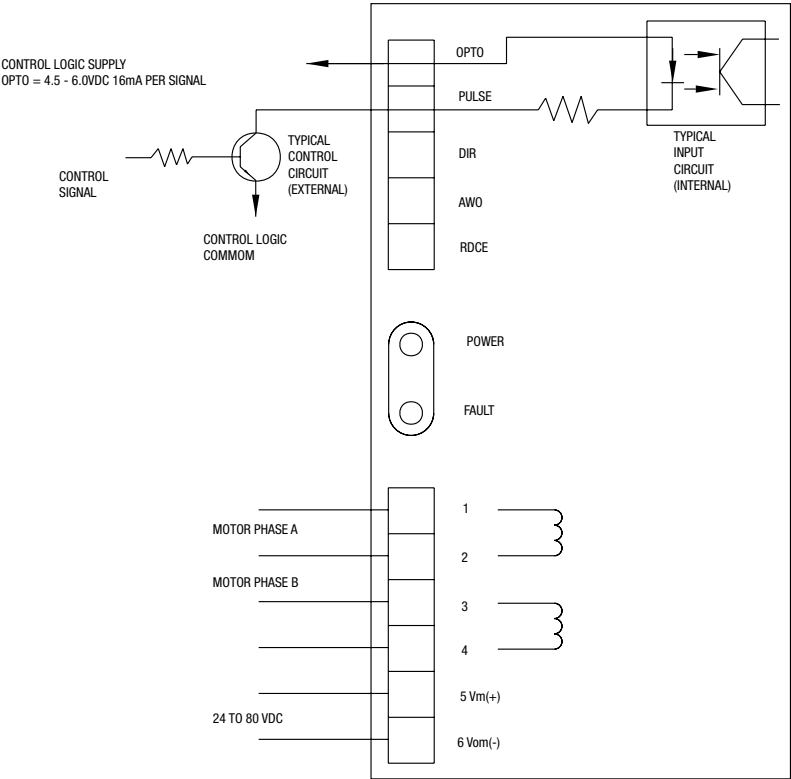
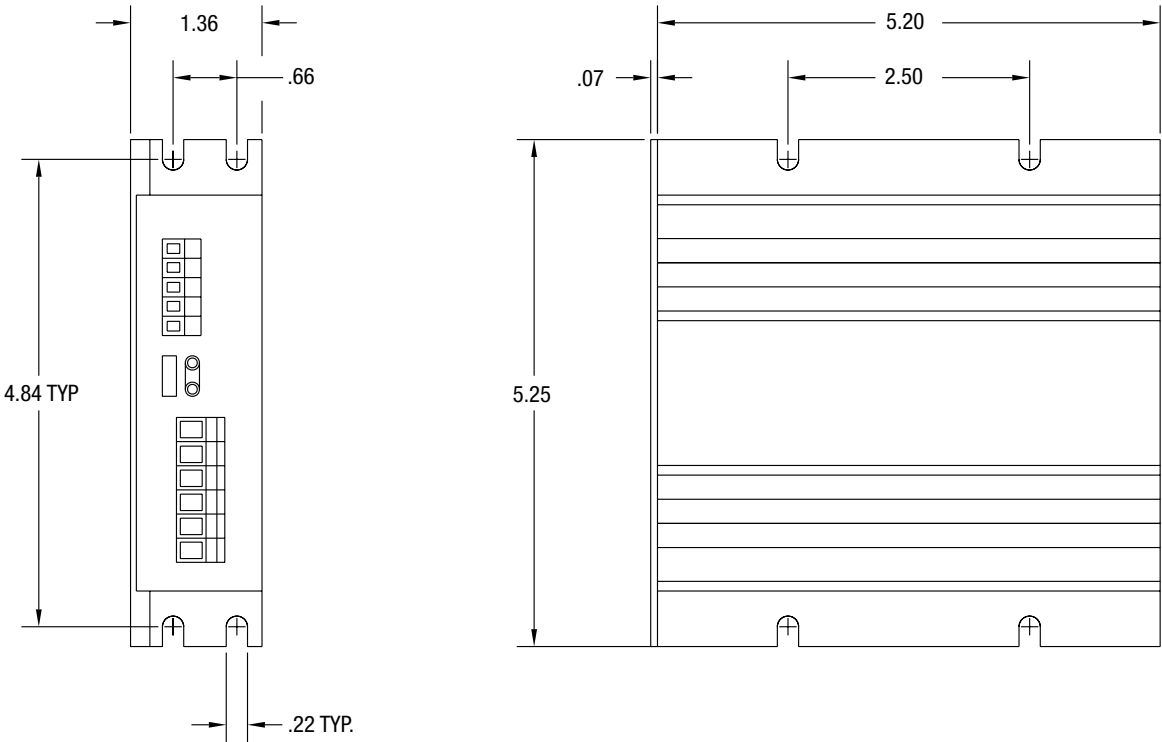
Specifications:

Input Power Required.....	20 to 80 Vdc unregulated power supply
Max Drive Dissipation.....	40 watts
Recommended Power Supply	Numatics Motion Control # PS55VDC7A
Drive Type	modular DC power input bipolar chopping drive
Chop Frequency.....	24Kz minimum (above audible range)
Output Device Type	MOSFET
Phases	two phase micro stepping output
Output Current	3 to 8 amps by 1 amp increments
Output Resolution.....	full step @ 200 ppr, 1/2 (400 ppr)
	1/5 (1,000 ppr) 1/10 (2,000 ppr)
	1/20 (4,000 ppr) 1/25 (5,000 ppr)
	1/50 (10,000 ppr) 1/100 (20,000 ppr)
Pulse Input	input type – sinking, high speed optocoupler
	max rise time – 1 microsecond
	max fall time – 1 microsecond
	signal active steps on low-high transition (.2mA to 16 mA sink)
All Other Inputs.....	delay time < 50 microseconds
Direction Input	delay time < 5 microseconds
Short Circuited Protected.....	phase to phase & ground to ground
Unbalanced Phase Protection	Yes (ground)
Over Voltage Protection	Yes
Transient Over Voltage Protection	Yes
Over Temperature Protection.....	Yes
Operating Temperature	+32°F to 122°F (0° to 50°C)
Max Heat Sink Temperature.....	158°F (70°C)
Storage Temperature	-40°F to 167°F (-40°C to +75°C)
Humidity	85% max. non-condensing
Altitude	6,600 feet (2,000 m) above sea level
Motor Series.....	Numatics Motion Control FLM-Series
Minimum Phase Inductance.....	.5mH
Maximum Phase Resistance (including leads)	Rmax= .25 x Vdc supply/I setting



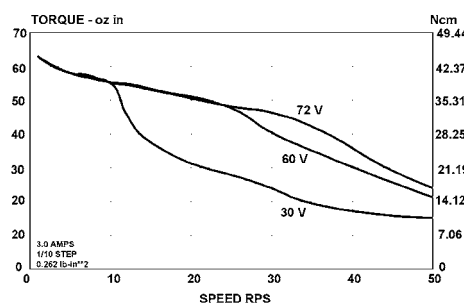
NSMD8 Dimensions and Wiring Diagram

top dimensions = inches
bottom dimensions (in parenthesis) = millimeters

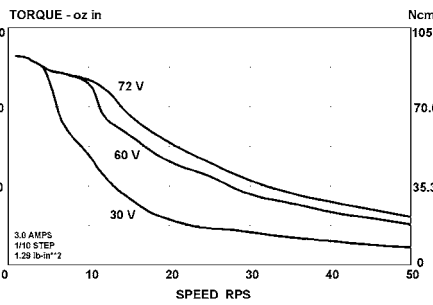




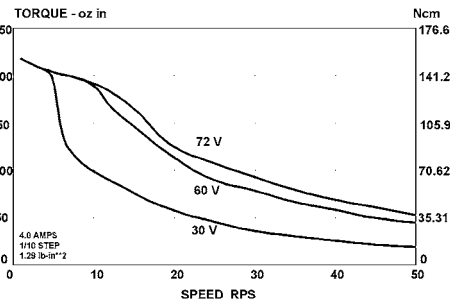
NSMD8 Motor Torque Curves



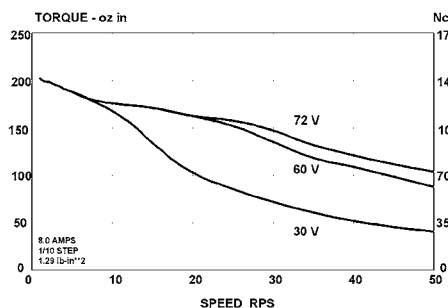
FLM6005 Motor, 3.0 Amp



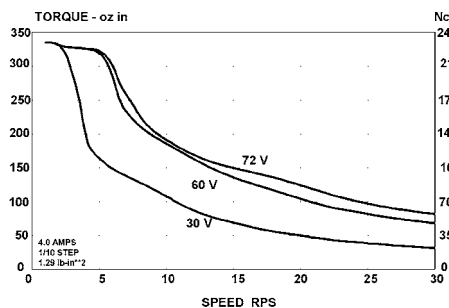
FLM6105 Motor, 3.0 Amp



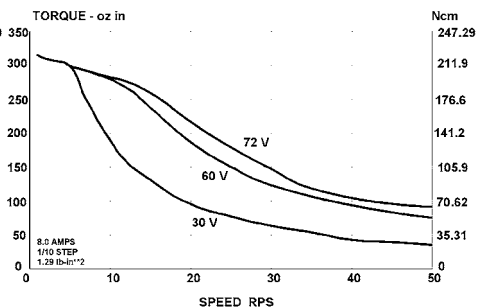
FLM6207 Motor, 4.0 Amp



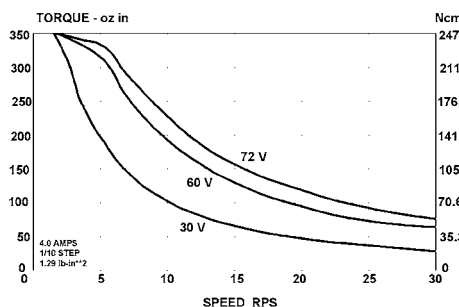
FLM6213 Motor, 8.0 Amp



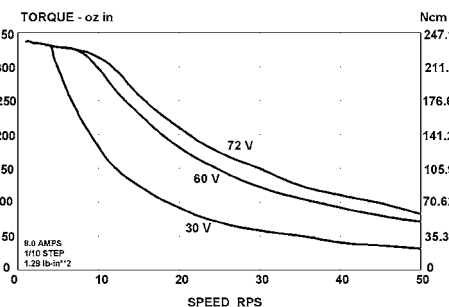
FLM6307 Motor, 4.0 Amp



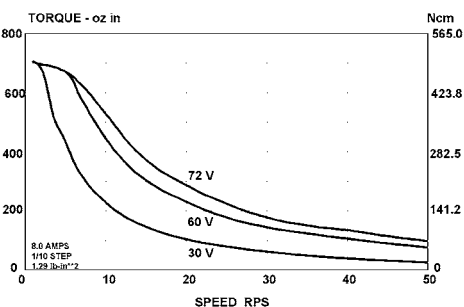
FLM6313 Motor, 8.0 Amp



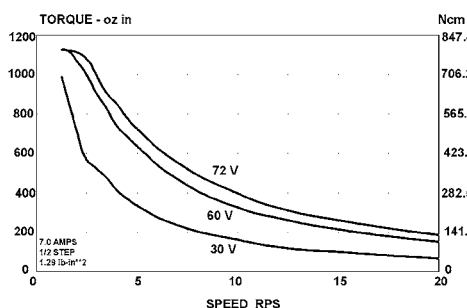
FLM9107 Motor, 4.0 Amp



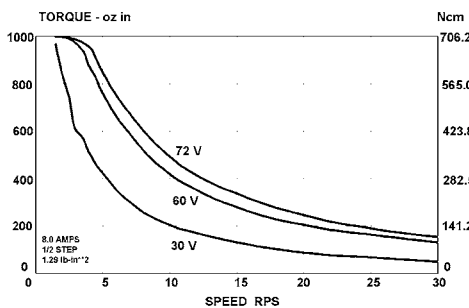
FLM9113 Motor, 8.0 Amp



FLM9213 Motor, 8.0 Amp



FLM9310 Motor, 7.0 Amp



FLM9314 Motor, 8.0 Amp



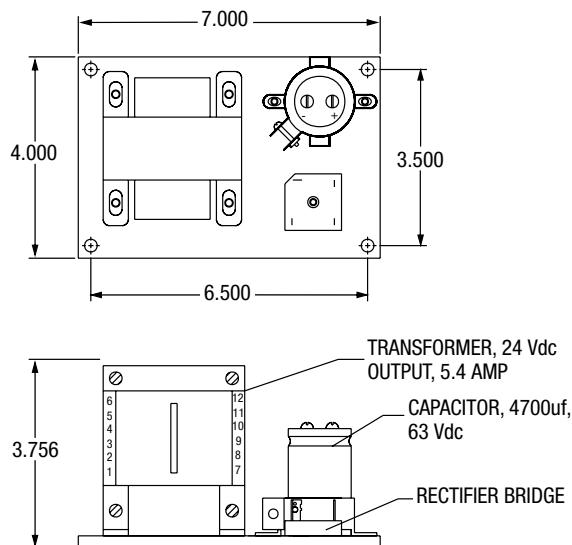
PS30VDC5A Power Supply

Is an easy solution to supply unregulated power to the NSMD4 Translator Drive. This assembly includes all components for a 30 Vdc unregulated power supply. This power supply is capable of converting 120 Vac and 240 Vac, at 50/60 Hz.

User must provide hook up connections using a minimum of 16 AWG wire. NMC also recommends that the customer supply a 2 amp time delay, 250 V fuse to be added to the AC input power circuit if another fuse is not already in place.

The PS30VDC5A power supply is an open chassis design for proper airflow. All components are mounted on an aluminum plate. The plate has four holes for mounting, 1/4 inch screws are recommended.

The following diagrams give details on how to wire the power supply for both 120 V and 240V input supply.



PS55VDC7A Power Supply

Is an easy solution to provide unregulated power to the NSMD8 Translator Drive. This assembly includes all components for a 55.5 Vdc unregulated power supply. This power supply is capable of converting 120 Vac and 240 Vac at 55/60 Hz. The PS55VDC7A power supply utilizes a toroidal transformer for compact size and low EMI/RFI radiation.

The PS55VDC7A is an open frame, bulkhead mount unit with front facing terminal strip and fuse position for easy access. The power supply can be mounted vertically or horizontally. DO NOT mount unit upside down.

AC Input Connections:

Before connecting AC power to the power supply, input voltage needs to be identified, 120 Vac or 240 Vac. The input voltage will determine which terminals will be used. The chart below will identify the corresponding terminals.

120 Vac Input:

Terminal 1	HOT
Terminal 2	COMMON
Terminal 4	CHASSIS GROUND

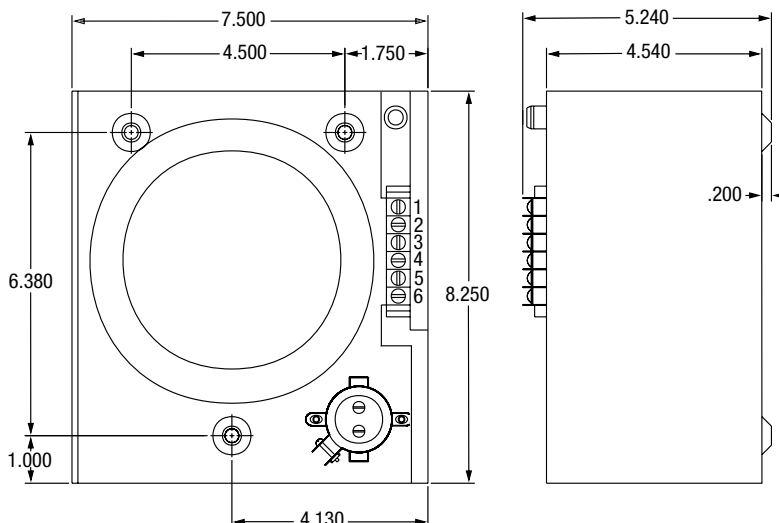
240 Vac Input:

Terminal 1	HOT
Terminal 3	COMMON
Terminal 4	CHASSIS GROUND

NOTE: Terminal 4, CHASSIS GROUND should always be connected to the AC system ground for safe operation.

DC Output Connections:

Connections for the DC output are terminals 5 (+) and 6 (-) on the terminal strip. Keep the wiring between the drive and the motor as short as possible. Twist the two wires together using approximately six twists per foot.





Model NSMC Motion Controller

The NSMC is designed with 8 inputs and 4 outputs, both optically isolated and 8 inputs and 4 output, non optically isolated. For applications utilizing digital encoder feedback (to indicate motor position to controller) the NSMC has an encoder input for closed loop operation, differential or single ended.

The NSMC also includes two methods of serial communication. Port 1 is the HOST port, configurable for RS-232 or RS-485. Port 2 is used for differential RS485 four wire user communications.



Input Power Required.....	95 to 265 Vac, 50/60 Hz
Power Dissipation.....	10 watts
AC Current.....	0.5 amperes
Fuse Rating.....	250 Volts, 2 amperes
Isolated Digital I/O.....	12 Vdc internal
	I/O power 11.5 to 14 Vdc @ 100 mA
	or user supplied 5 to 24 Vdc

Sink Mode.....	on stage voltage range (+Vopto = 12Vdc) 0V to + 6Vdc	input current (Vin = 0V) 6 mA
Source Mode.....	on stage voltage range (-Vopto = 0V) 4.5V to 24V	input current (Vin = 12Vdc) 6mA
Response Time (sink or source).....	opto turn on delay: 10μS typical	opto turn off delay: 75μS typical

OUT1 through OUT4 continuous current rating per output: 250mA max.
maximum collector voltage: 25V
on stage voltage @ 250mA: 1.5V max.

Power Supply Input	5Vdc	±5%	@ 100mA current
Power Supply Output	5Vdc	±5%	@ 100mA current
Signal Inputs	TTL level, single ended or differential channels A and B in phase quadrature		
Input Current	A+, A-, B+, B-, Z+, Z- @ ±5mA min.		

Voltage Range	0 to 10 V reference to GND
Resolution	10 bits or 9.77mV
Absolute Accuracy	±0.3V worst case
Sample Rate	500 Hz min.
Bandwidth	100 Hz max.

Operating Temperature	+32°F to +122°F (0°C to +50°C)
Storage Temperature	-40°F to +167°F (-40°C to +75°C)
Humidity	95% maximum, non condensing
Altitude	10,000 feet (3,048 meters) max.

These inputs may be used with open collector outputs without an external supply by connecting the output device common (ground) to signal ground on the unit, and the open collector to the input pin. An internal resistor to +5Vdc is provided.

Logic High Input Level	$25V > V_{source} > 4.5V$, or open circuit
Logic Low Input Level	1.2V max.
Logic Low Current With Input @ GND	-1mA max.

OUT5 through OUT8: These are open collector, sink only TTL outputs, and are NOT isolated from the unit's +5V logic supply. Proper care must be taken to ensure noise is not injected onto these signals. The user I/O supply must be referenced to GND on the controller.

Active Output Current	0.6V max. @ 20mA
Permissible Output Current	20mA
Permissible Output Voltage	24Vdc

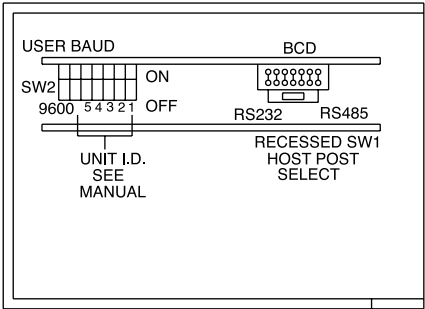
Features:

- 110 to 240V $\pm 10\%$ AC input
- 12Vdc I/O power supply
- 16 bit microprocessor
- Windows based programming
- Additional I/O
- Optically Isolated I/O
 - 8 inputs and 4 outputs
- Non-optically isolated I/O
 - 8 inputs and 4 outputs
- One 0 to 10V analog input (10 bits)
- 2-Serial ports RS232 & RS485 up to 38k baud
- Built-in AC line filter and MOV's
- Closed loop modes for stall detection, position verification and correction
- LED fault lights
- IEC 1000-4-4 standards for electrical noise compliance
- UL recognized and CE pending

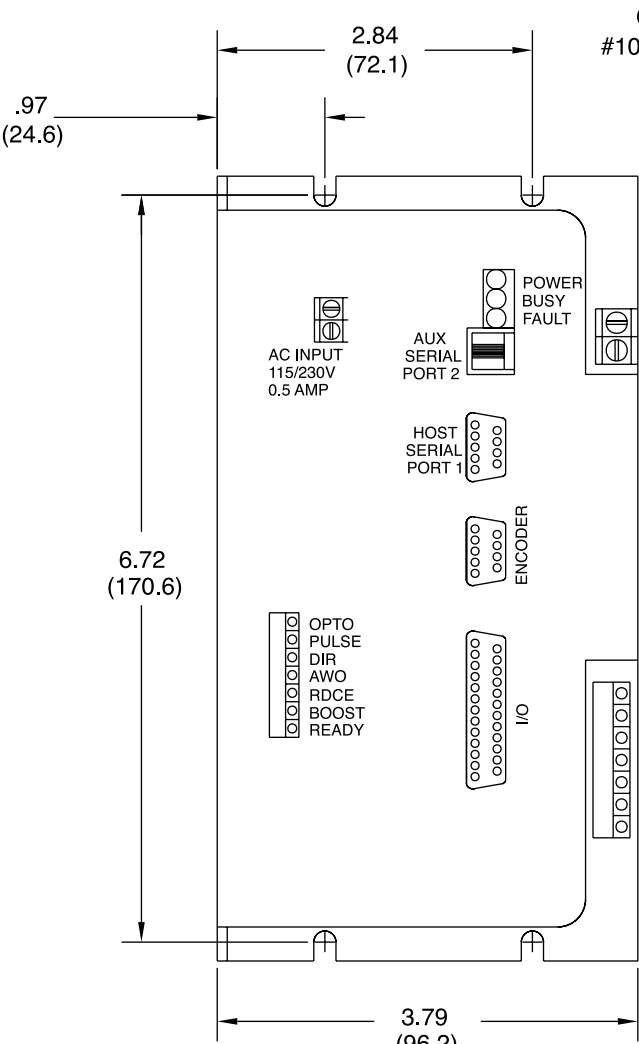


NSMC Dimensions and Wiring Diagram

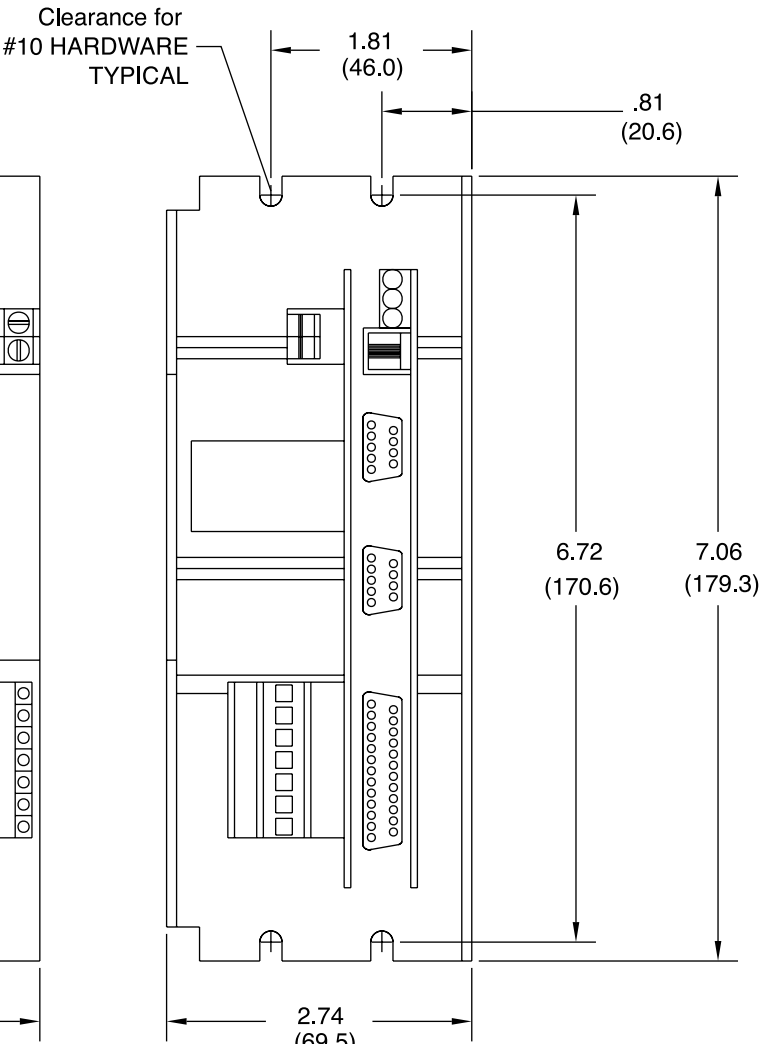
top dimensions = inches
bottom dimensions (in parenthesis) = millimeters



TOP VIEW



SIDE VIEW



FRONT VIEW



NSDP6 Motor Drive Package

The NSDP6 Motor Drive is a packaged drive system which includes the driver and power supply in one device. The package concept eliminates individual components, reduces control cabinet space and eliminates hard wiring of an independent power supply. The line operated high voltage dc bus (180V) develops high speed and high torque. The NSDP6 is designed with switch selected current control. Current control is selectable from 1 to 6 amps, eliminating the need for a current sense resistor while facilitating simple drive to motor matching.

The NSDP6 is a flexible drive package with a capable range of 200 full steps to 50,000 micro-steps per revolution. This provides for smooth low speed operation.



Features:

- Full, Half and Micro-stepping
- 6 amp packaged drive selectable from 1 to 6 amps
- Bipolar chopper design 4 phase stepper drive
- Switch selectable micro stepping
- Optically isolated inputs
- Boost, Reduce and Windings Off functions
- Drive ready output
- Push to test, self test function
- LED fault lights
- Meets IEC 801-4 (level 3) standard for immunity against electrical interference (noise) in industrial applications
- UL recognized for use in US and Canada

Specifications:

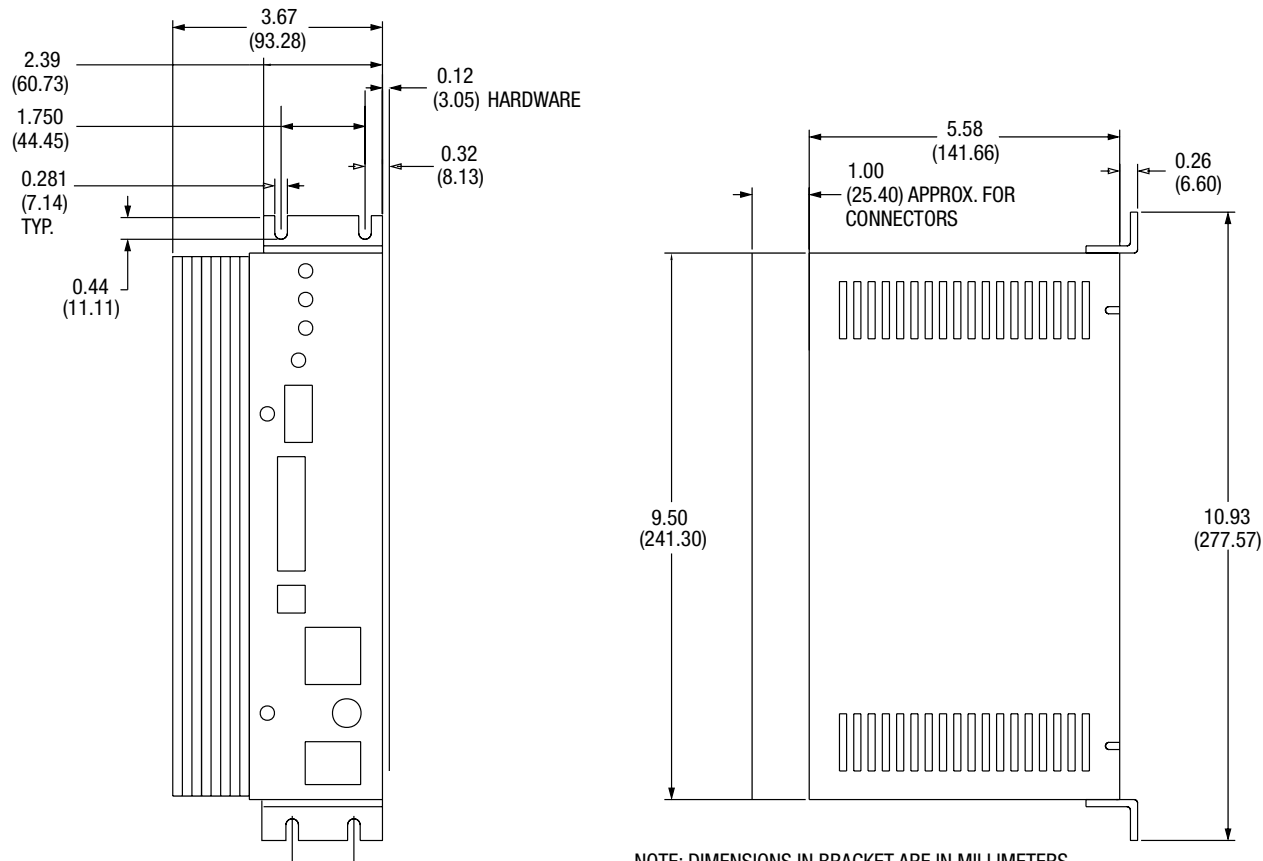
Input Power Required.	90 to 135 Vac, 50/60 Hz
Max Drive Dissipation.	50 watts
Drive Type	packaged line operated bipolar chopper drive
Chop Frequency.	40 KHz typical (above audible range)
Output Device Type	MOSFET and IGBT
Number of Phases	two phase output, full, half and microstep
Output Current	1 to 6 amps in 1/2 and 1 amp increments
Output Resolution.	full step (200 ppr), half step (400ppr), 1/5 (1,000ppr), 1/10 (2,000 ppr), 1/16 (3,200 ppr) 1/36 (7,200 ppr) 1/50 (10,000 ppr), 1/100 (20,000 ppr), 1/125 (25,000 ppr) and 1/250 (50,000 ppr)
Pulse Inputs	input type sinking high speed optocoupler max frequency – 1 megahertz max rise time – 1 microsecond max fall time – 1 microsecond signal active steps on low to high transition (.2mA to 16 mA sink)
All Other Inputs.	input type – Sinking, optocoupler delay time - < 50 microseconds
Short Circuit Protection	Yes
Unbalanced Phase Protection (ground).....	Yes
Over Voltage Protection.....	Yes
Over Temperature Protection.....	Yes
Operating Temperature	+32° F to +122° F (0° C to + 50°C)
Maximum Heat Sink Temperature	+158°F (+70°C)
Storage Temperature	-40° F to +167° F (-40° C to +75°C)
Humidity	95% maximum, noncondensing
Altitude	10,000 feet (3,048) max. above sea level
Motor Series	Numatics Motion Control FLM-Series
Phase Inductance Range.....	8 mH to 64 mH
Max Phase Resistance	20 ohms at 6 amps setting (including motor leads)



NSDP6 Motor Drive Package

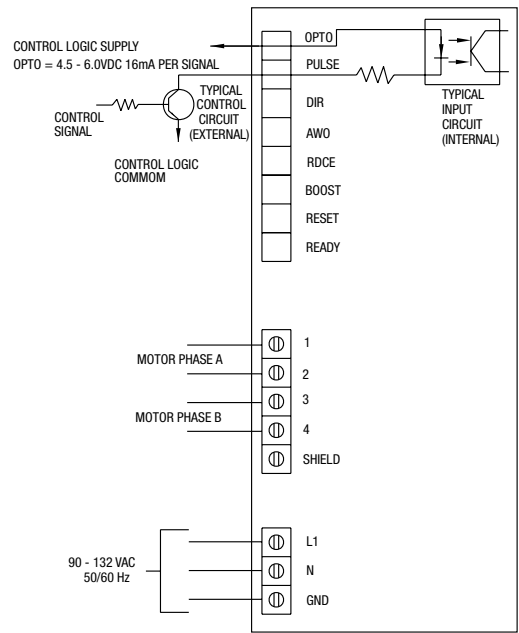
Dimensions

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bottom dimensions (in parenthesis) = millimeters



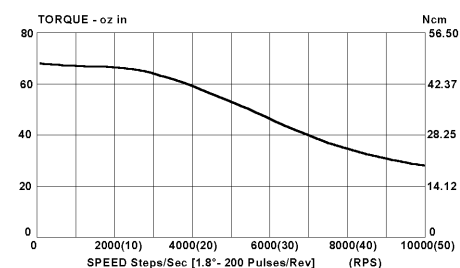
NOTE: DIMENSIONS IN BRACKET ARE IN MILLIMETERS
ALLOW SPACE FOR AIRFLOW – SEE MANUAL

External Connections

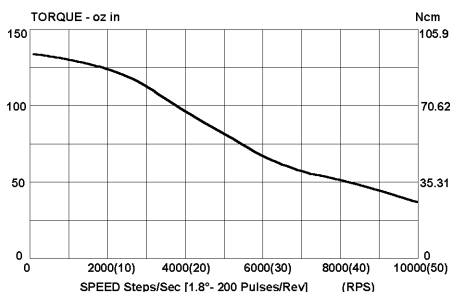




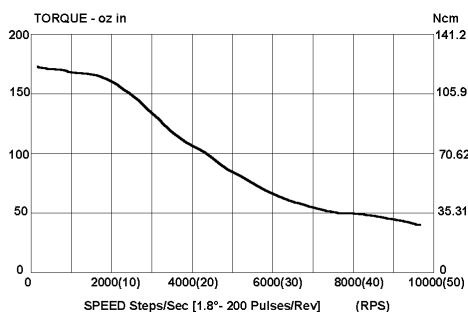
NSDP6 Motor Torque Curves



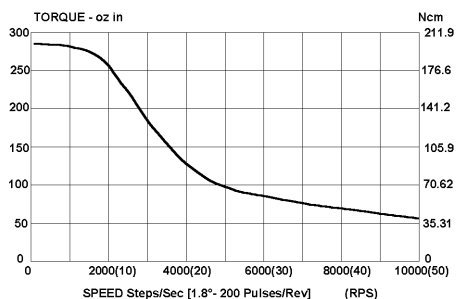
FLM6002 Motor, 1.5 Amp



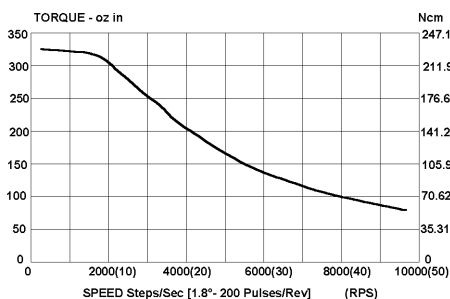
FLM6103 Motor, 1.5 Amp



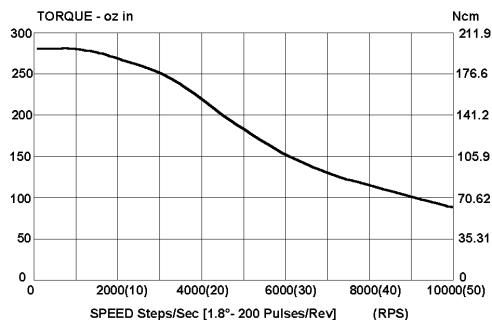
FLM6203 Motor, 1.5 Amp



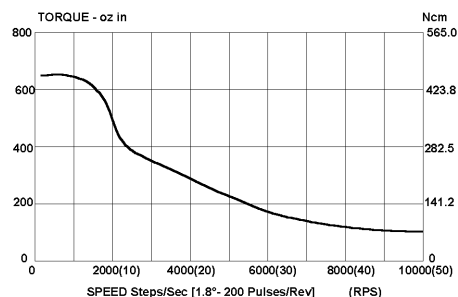
FLM6304 Motor, 2.0 Amp



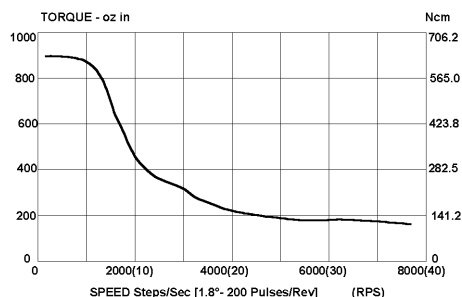
FLM9105 Motor, 3.0 Amp



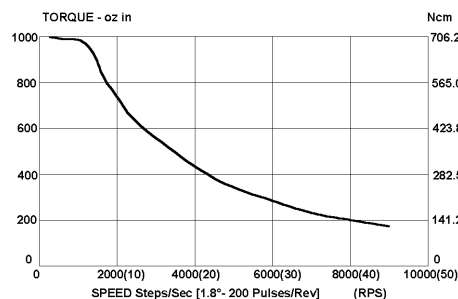
FLM9107 Motor, 3.0 Amp



FLM9207 Motor, 4.0 Amp



FLM9308 Motor, 4.0 Amp



FLM9310 Motor, 6.0 Amp



NSDP6C Motor Drive Controller Package

The NSDP6C Controller Motor Drive Package is a complete controller system, which includes a controller, driver and power supply in one device. The NSDP6C is the same as the NSDP6 drive package except the NSDP6C has a built-in 16 bit micro processor controller. The package concept eliminates individual components, reduces control cabinet space and eliminates hard wiring between components. The NSDP6C is designed with switch selected current control. Current control is selectable from 1 to 6 amps, eliminating the need for a current sense resistor while facilitating simple drive to motor matching.

The NSDP6C comes standard with SUB D connectors. However, an external wiring card (NMC Part Number WC-6C) is available for terminated wire connections, as shown in photograph.



Features:

- 8 Inputs and 4 Outputs, Optically Isolated
- 8 Inputs and 4 Outputs, Non-Isolated
- 1 Input, 0-10V Analog
- 12V DC I/O Power Supply
- Encoded Input for Closed Loop Operation
- 6 amp packaged drive selectable from 1 to 6 amps
- Boost, Reduce and Windings Off functions
- Drive ready output
- Push to test, self test function
- LED fault lights
- Meets IEC 1000-4-4 Standards for electrical noise compliance
- UL recognized for use in US and Canada

Specifications:

Input Power Required.....	90 to 132 Vac, 50/60 Hz
AC Current.....	7 amperes
Max Drive Dissipation.....	50 watts
Fuse Rating.....	250 volts, 8 amperes
Number of Phases.....	Two phase output, full, half and microstep
Output Resolution.....	Preset to 1/64 of a step or 12,800 microsteps/rev.
Isolated Digital I/O.....	12Vdc internal power (11.5 to 14 Vdc @ 100 mA) If user supplied 5 - 24 Vdc
Inputs (IN1 - IN8).....	Sink Mode (+Vopto = 12Vdc) On stage voltage range (Vin) 0V to +6Vdc Input current (Vin = 0V) -6mA
Source Mode.....	On stage voltage range (Vin) 4.5V - +24Vdc Input current (Vin = 12Vdc) 6mA
Response Time Both Sink or Source.....	Opto Turn On Delay 10μS typical Opto Turn Off Delay 75μS typical
Programmable Outputs Sink Mode (OUT1 - OUT4).....	Continuous current rating per output 250mA max Maximum collector voltage 25V max On stage voltage @ 250mA 1.5V max
Non-Isolated I/O	
Inputs (IN9 - IN16).....	These inputs may be used with open collector outputs without an external supply by connecting the output device common (ground) to signal ground on the unit, and the open collector to the input pin. An internal pullup resistor to + 5V is provided.
Logic High Input Level.....	25V > Vsource > 4.5V, or open circuit
Logic Low Input Level.....	1.2V max
Logic Low Current with Input @ GND.....	-1mA max
Outputs (OUT5 - OUT8).....	These are open collector, sink only TTL outputs. They are not isolated from the units +5V logic supply. Proper care must be taken to ensure noise is not injected into these signals. The user I/O supply must be referenced to GND on the collector.
Active Output Voltage.....	0.6 V max @ 20mA
Permissible Output Current.....	20mA
Permissible Output Voltage.....	24Vdc
Serial Communications	
Port 1.....	Configurable for RS232 or RS485 four wire communications via a switch. Port 1 is designated as the HOST communications port and can be used to daisy chain up to 32 units in RS485 mode.
Port 2.....	Serial port 2 is used for differential RS485 four wire USER communications.
Encoder Connection.....	Provide power and inputs for a digital encoder interface to indicate motor position to the controller.
Encoder +5Vdc.....	Power Supply Output +5Vdc (±5%) @ 100mA current
Encoder Signal Inputs TTL Level Single ended or differential; channels.....	A and B in phase quadrant
Input Current.....	A+, A-, B+, B-, Z+, Z- ±5mA min



Stepper Systems

Analog Input

Voltage Range	0 to 10V reference to ground
Resolution	10 bits or 9.77mV
Absolute Accuracy	±0.3V worst case
Sample Rate	500 Hz min
Band width	100 Hz max

Pulse Inputs 1

Short Circuit Protection Yes

Unbalanced Phase Protection (ground) Yes

Over Voltage Protection Yes

Over Temperature Protection Yes

Operating Temperature +32°F to +122°F (0°C to + 50°C)

Maximum Heat Sink Temperature +158°F (+70°C)

Storage Temperature -40°F to +167°F (-40°C to + 75°C)

Humidity 95% Maximum, noncondensing

Altitude 10,000 feet (3,048) max. above sea level

Motor Series NMC FLM-Series

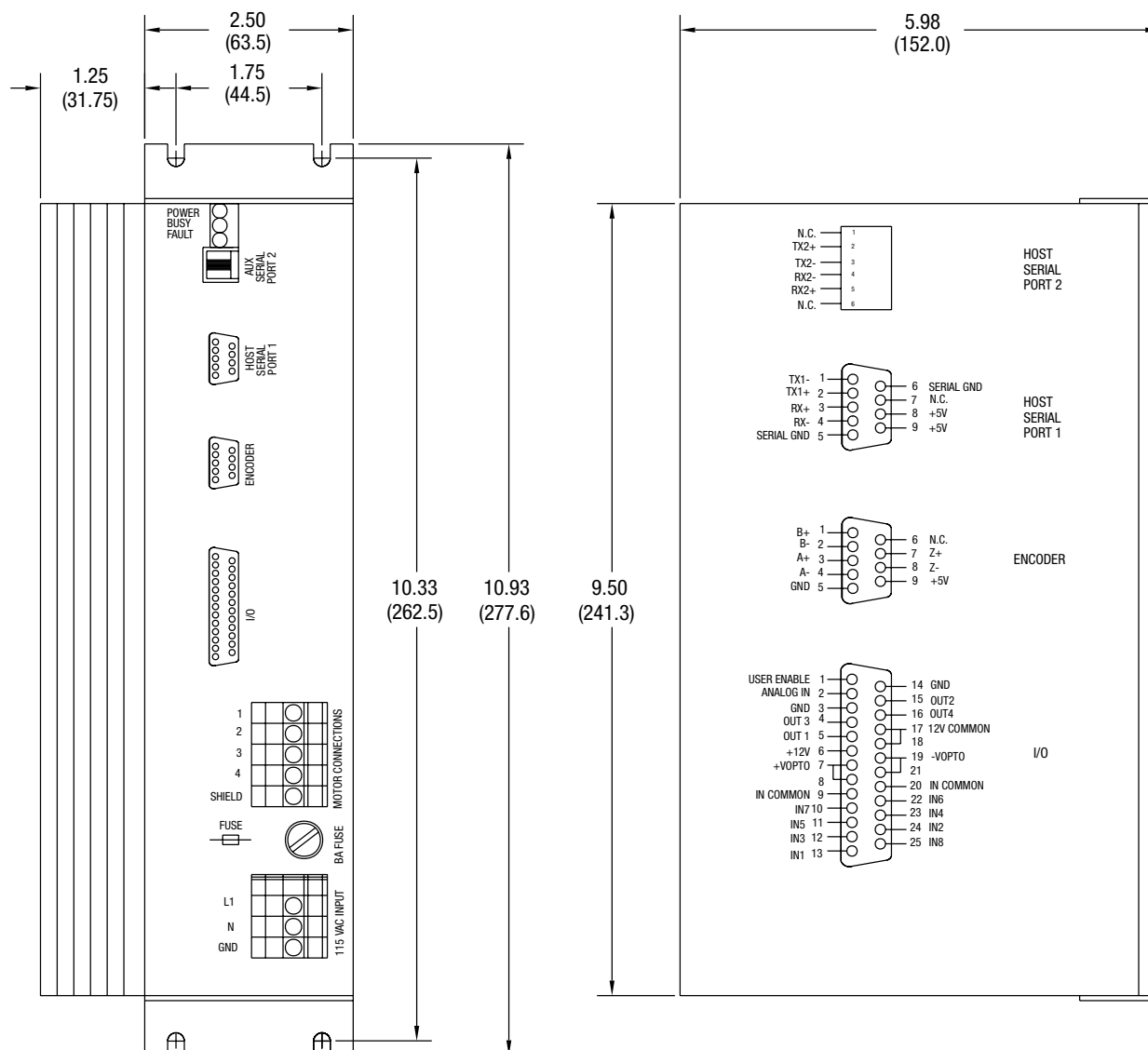
Phase Inductance Range 8 mH to 64 mH

Max Phase Resistance 20 ohms at 6 amps setting (including motor leads)

Dimensions

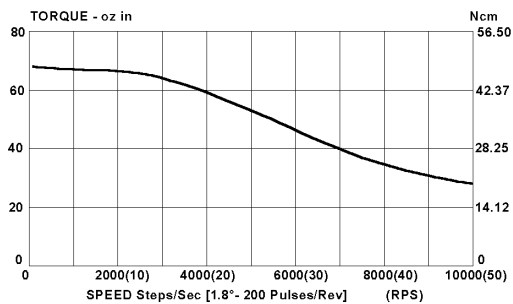
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bottom dimensions (in parenthesis) = millimeters

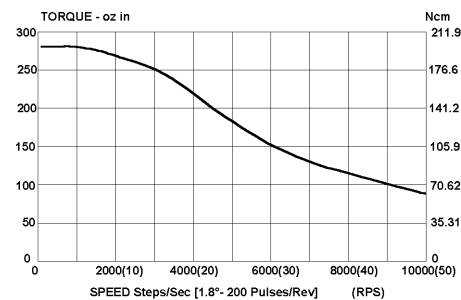




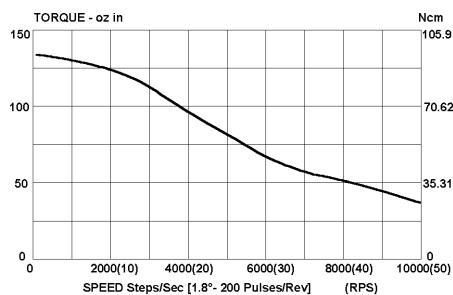
NSDP6C Motor Torque Curves



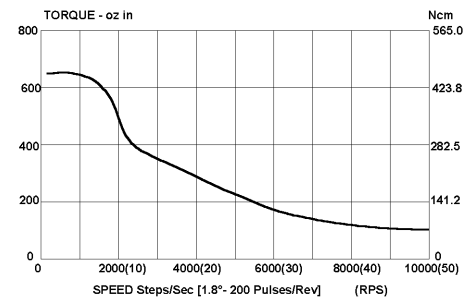
FLM6002 Motor, 1.5 Amp



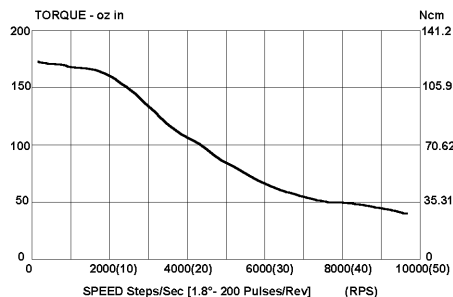
FLM9107 Motor, 3.0 Amp



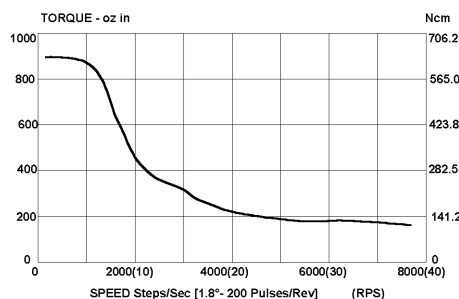
FLM6103 Motor, 1.5 Amp



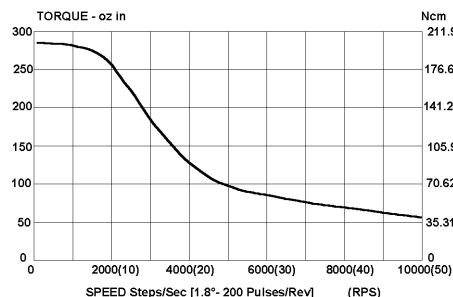
FLM9207 Motor, 4.0 Amp



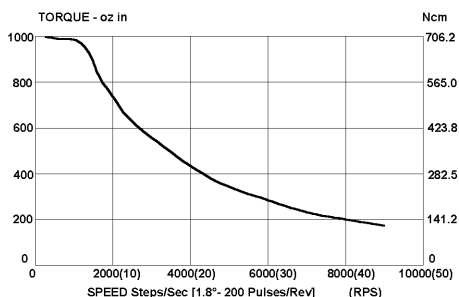
FLM6203 Motor, 1.5 Amp



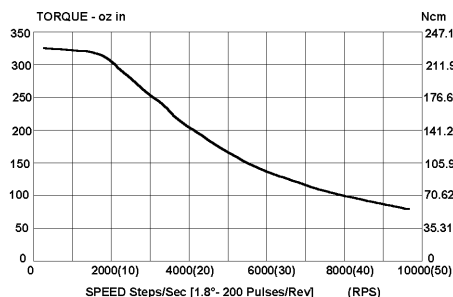
FLM9308 Motor, 4.0 Amp



FLM6304 Motor, 2.0 Amp



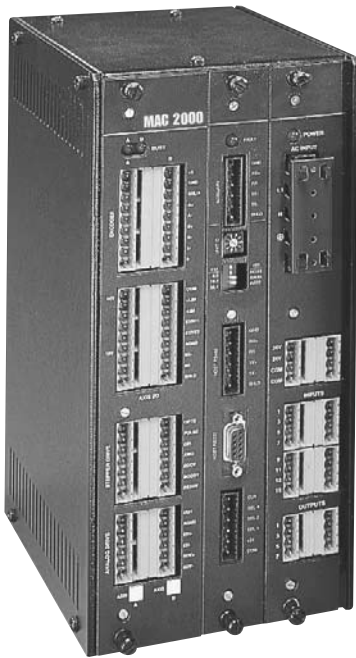
FLM9310 Motor, 6.0 Amp



FLM9105 Motor, 3.0 Amp



Mac Programmable Multi-Axis Motion Controller



This fully programmable, powerful DSP-based motion controller features its own built-in power supply and, in most cases, can serve as the only controller necessary even in complex and sophisticated machine control systems.

Depending on which model you choose, the MAC2000 can simultaneously operate up to 8 step motor or servo axes while performing up to 7 concurrent tasks. It has been designed for use with all step motor drives (up to 50,000 micro-steps per revolution) and any analog or digital servo amplifier.

The MAC2000 Windows®-based software simplifies programming from a host computer through a serial data port. The software contains numerous screens so you can quickly and easily establish your system parameters. Plus, with built-in subroutine and looping (nestable up to 16 levels), your programming flexibility is greatly enhanced.

For ease of communication with the controller, two serial ports are provided. The host port is switch-

selectable for RS232 or RS485 protocol. There's also an auxiliary serial port that's factory set for RS232, and is jumper configurable for RS485.

With full servo and following capabilities, the MAC2000 facilitates easy-to-program servo gains and on-screen servo tuning while providing a complete selection of following commands.

The high performance, built-in power supply is AC line operated with a built-in line filter and MOV, and features flexible input power from 90 to 265 VAC, 50/60 Hz.

MAC2000 optional input/output boards are available to suit your specific applications.

- Digital Input/Output Board – This board features a “bulletproof” design while providing 24 optically isolated and filtered inputs along with 16 short circuits proof outputs. Sinking or sourcing operation is switch-selectable, and the board provides terminal strip access to the system's isolated, built-in 24Vdc power supply.
 - Expansion Input/ Output BCD Board – Two 50-pin headers allow you to connect up to 48 industry standard, high powered, OPTO-22 style input or output modules. Each header also can accommodate up to 4 BCD switch banks.
 - Dual-Axis Interface Board – For your increased operating efficiency, the Dual-Axis board signals for most stepper drives and servo amplifiers along with inputs for two incremental encoders. This board also provides two sets of connections for limit, home, and mark registration sensors.
- Full coordinated motion control including linear interpolation of up to 8 axes, circular interpolation and polynomial splining among any two axes.
 - Programmable using Windows® based BASIC-like coding software (included) or one of the optional software utilities, Motion Workbench or CAD-to-Motion.
 - Full math functions including Trig, Logs, and Square roots.
 - Subroutine capability (up to 16 nested levels)
 - Multi-tasking of up to 7 concurrent tasks.
 - Up to 8 axes of stepper pulse and direction outputs, with Boost and Reduce.
 - Up to 8 axes of Encoder inputs and analog I/O.
 - Optical isolation, with built-in 24Vdc 0.75 amp power supply for I/O power.
 - Up to 352 I/O points available using optional boards.
 - Easy to connect removable screw clamp terminations.
 - Flash memory enhances ease of programming and firmware updates.
 - 2 serial ports, operating at up to 38 Kbaud.
 - Flexible 90-265 Vac 50/60 hertz input including built in line filter with MOV.
 - MAC2000-2A and MAC2000-6A Units UL Recognized.

When you need flexible performance with reliability, MAC 2000 controllers are your best choice.

Features



General

Processor	Texas Instruments TMS 320C31, 32 bit, Floating Point, Digital Signal Processor
Speed	33 Mhz
Flash EPROM	4Mbit (512K x 8 bit), 2Mbit (256K x 8 bit) available for user programs
RAM	4Mbit (128K x 32 bit), zero wait state, volatile
Mutli-Tasking	Up to 7 concurrent Tasks

Physical Characteristics

MAC2000-2A	Size (Inches)	5.34 wide x 7.48 deep x 10.63 high
	Size (mm)	163 wide x 190 deep x 270 high
	Weight	8.25 lbs (3.75 kg)
MAC2000-6A	Size (Inches)	9.34W x 10.63H x 7.54D
	Size (mm)	237.3W x 270H x 190D
	Weight	11.0 lbs (5.0 kg)
MAC2000-8A	Size (Inches)	19.0W x 10.63H x 7.54D
	Size (mm)	482.6W x 270H x 191.6D
	Weight	12.0 lbs (5.45 kg)

Input power

MAC2000-2A,-6A	Power Requirement	90-265 VAC, 50/60 Hertz
	Current	<0.5 Ampere at 115 VAC
	Fuse	2A (normal blow), 250 VAC, 3AG type (2 required)
MAC2000-8A	Power Requirement	90-132 VAC or 175-264 VAC, 50/60 Hz.
	Current	<3 A at 115 VAC
	Fuse	3A (slow blow), 250 VAC

Analog Output

Output Range	-10 Vdc to +10 Vdc	
Output Loading	5 milliamps maximum (2 Kohm)	
Resolution	12 bits	
Accuracy	Zero Output Error	+/- 0.03 Vdc
	Full Scale Output Error	+/- 0.11 Vdc

Axis Inputs

Sink Input	On-State Voltage	0-3 Vdc
	On-State Current	10.5mA with Vin=0
	Off-State Voltage	24 Vdc
Source Input	On-State Voltage	12-24 Vdc
	On-State Current	10.5 mA with Vin=24 Vdc
	Off-State Voltage	0-3 Vdc
Analog Inputs	Resolution	12 bits
	Sample Rate	1950 samples/sec.
	Voltage Range	-10 to +10 Vdc
	Input Impedance (IN=/IN- to AGND)	20 Kohm
	Full Scale Input Accuracy	+/- 0.1 Vdc



Stepper Drive Interface

Output Signals	Open Collector Drivers (TTL types 7406 or 7407)
	Off-State Voltage Rating 30 Vdc
Input Signal (Ready)	On-State Current Rating 40 mA
	Input Signal Loading 10 Kohm
	High Level Input Voltage 3.5 to 5.0 Vdc
	Low Level Input Voltage 0.0 to 0.9 Vdc

Encoder Interface

High Level Current	7.3 mA typ. at Vin = 5 Vdc	(A+, B+, I+)
	0.0 mA typ. at Vin = 0 Vdc	(A-, B-, I-)
Low Level Current	-7.3 mA typ. at Vin = 0 Vdc	

Expansion I/O BCD Port (MAC2000-2A AND MAC2000-6A)

Input Characteristics	On-State Input Voltage	0 – 1.5 Vdc
	On-State Input Current	1 mA max. (Vin=0)
Output Characteristics	Input Voltage	2.9 –30 Vdc or open circuit
	Load Voltage	30 Vdc maximum
	On-State Voltage	0.5 Vdc (15 mA load current)
	On-State Current	15mA maximum

Digital I/O Port (MAC2000-2A AND MAC2000-6A)

Input Signals (Sinking)	On-State Voltage Range	0-12 Vdc
	Input Current @ 12V	2.3 mA
	Input Current @ 0V	6.5 mA
(Sourcing)	On-State Voltage Range	10-24 Vdc
	Input Current @ 10V	2.3 mA
	Input Current @ 24V	6.5 mA
Output Signals (Sink)	Load Power Supply	Built-in 24Vdc or External 12-24 Vdc
	Current Rating	50 mA
	Voltage Rating	24 Vdc
(Source)	On State Voltage @ 50 mA	2.0 Vdc maximum
	Off State Leakage @ 24 Vdc	0.6 mA maximum
	Current Rating	50 mA
	On State Voltage @ 50 mA	20 Vdc maximum
	Off State Leakage @ 24 Vdc	0.6 mA maximum

Environmental Constraints

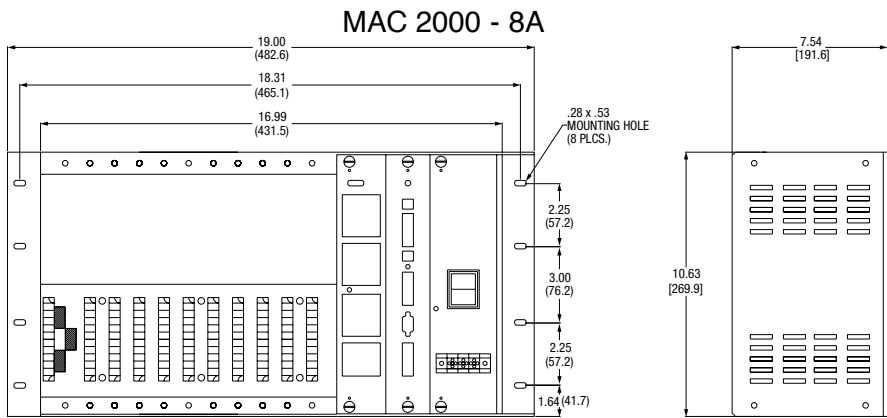
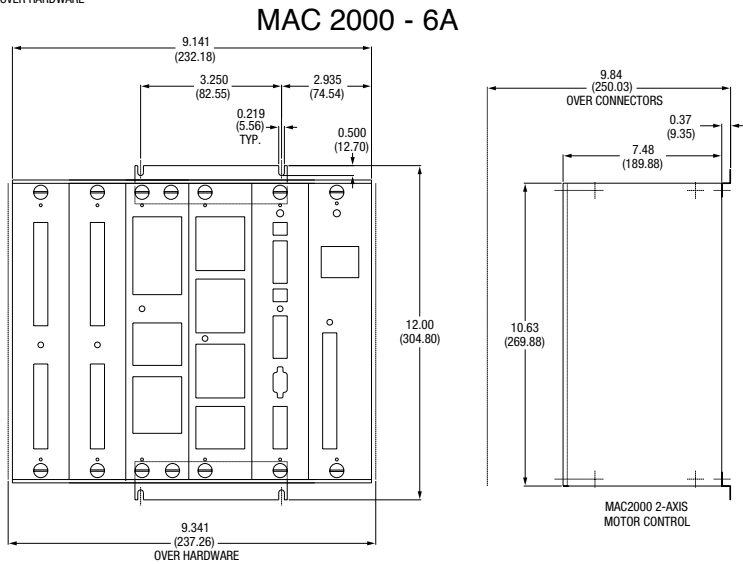
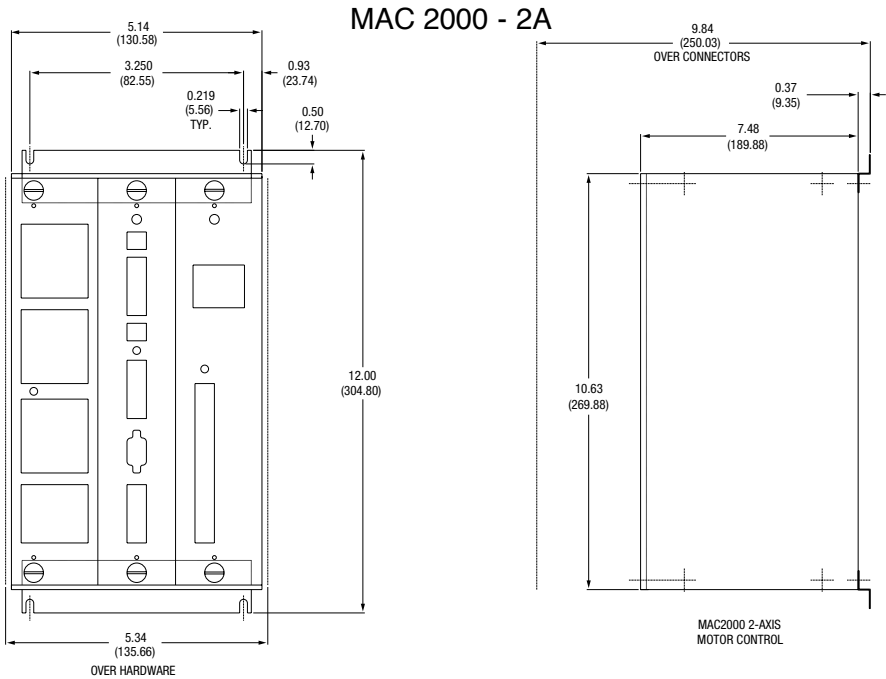
Operating Temp	+32 deg. F to +122 deg F (0 to +50 deg C)
Storage Temp Rating	-40 deg F to +167 deg F (-40 deg C to +75 deg C)
Humidity	95% maximum, noncondensing
Altitude	10,000 Feet (3048m) above sea level

Design Features

- Wall Mountable
- Removable printed circuit boards
- Removable clamp terminations
- Advanced programming capability
- Input/Output Expansion – BCD port
- Advanced DSP- based Machine control circuitry
- Expansion capability in the MAC2000-6A and MAC2000-8A
- Optional I/O boards available for MAC2000-6A and MAC2000-8A

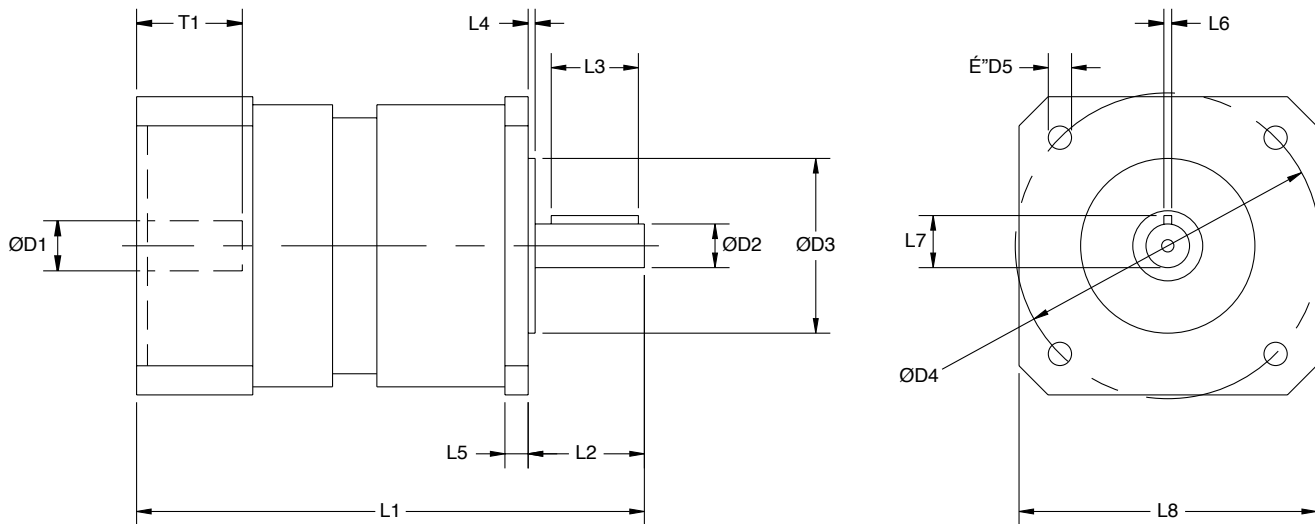


Multi Axis Control





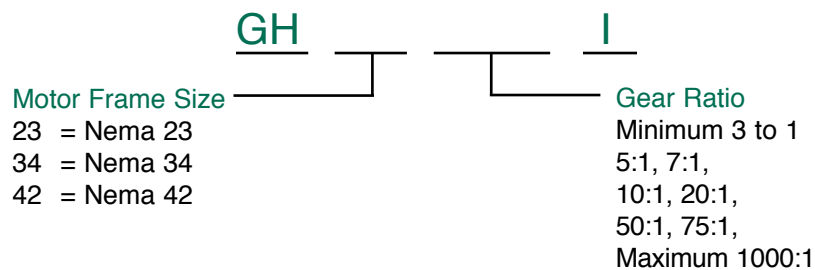
Inline Gearboxes



NEMA Series	NEMA 23		NEMA 34		NEMA 42	
	mm	(in)	mm	(in)	mm	(in)
L1 1-STAGE*	111	(4.37)	147	(5.79)	185	(7.28)
L1 2-STAGE*	133	((5.24)	180	(7.09)	225.5	(8.88)
L1 3-STAGE*	155	(6.10)	213	(8.39)	266	(10.47)
L2	25.4	(1.00)	31.8	(1.25)	38.1	(1.50)
L3	19	(0.75)	27	(1.06)	29	(1.14)
L4	1.6	(0.06)	1.7	(0.07)	2.4	(0.09)
L5	5	(0.20)	10	(0.39)	13	(0.51)
L6	-	(-)	3.2	(0.125)	4.8	(0.1875)
L7	-	(-)	14.3	(0.5625)	18.26	(0.7188)
L8	65	(2.56)	90	(3.54)	120	(4.72)
D1max	11	(0.43)	19	(0.75)	24	(0.94)
D2	9.252	(0.375)	12.7	(0.500)	15.875	(0.625)
D3	38.1	(1.500)	73	(2.875)	55.55	(2.185)
D4	66.7	(2.625)	98.4	(3.875)	125.7	(4.95)
D5	5	(0.20)	5.5	(0.22)	7.1	(0.28)
T1*	23	(0.91)	30	(1.18)	40	(1.57)

*Value can vary depending on the motor

How to Order





NEMA Series			NEMA 23	NEMA 34	NEMA 42
Rating	Symbol	Unit	Ratio		
Nominal Output Torque	T2n	Nm (lb-in)	i=3	18 (159)	40 (354)
			i=4,5,7	18 (159)	54 (478)
			i=10	14 (124)	40 (354)
			i=100,1000	16 (142)	60 (531)
			i=all other ratios	18 (159)	60 (531)
Maximum Output Torque	T2n	Nm (lb-in)		18 (159)	60 (531)
Max. Input Speed	n1n	RPM		6000	5000
Nominal Input Speed	n1n	RPM		3000	3000
Standard Output Backlash	j	arcmin	1- stage	< 10	< 10
			2-stage	< 15	< 15
			3- stage	< 20	< 20
Weight	m	kg (lb)	1- stage	1 (2.2)	2.3 (5)
			2- stage	1.3 (2.9)	3.1 (7)
			3- stage	1.6 (3.5)	3.9 (9)
Mass Moment of Inertia	J1	kgcm2 (lb-in2)	i=3	0.176 (0.06)	0.542 (0.18)
			i=4	0.159 (0.05)	0.424 (0.14)
			i=5	0.15 (0.05)	0.379 (0.13)
			i=7,10	0.138 (0.05)	0.332 (0.11)
			i=12-35	0.156 (0.05)	0.407 (0.14)
			i=40-1000	0.136 (0.05)	0.327 (0.11)

Ratios Available

Efficiency at Maximum Loading

Service Life

Operating Temperature Range

1-stage: 3/4/5/7/10 2-stage: 12/16/20/25/35/40/50/70/100 3-stage: 120/160/200/250/350/490/700/1000

1-stage:90% 2-stage: 85% 3-stage: 80%

>20,000 hours

-20°C to 90°C

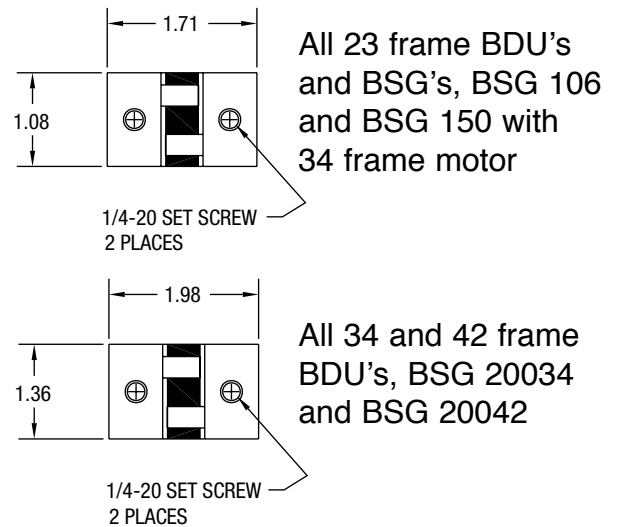


Shaft Coupler Ordering

Product	NEMA 23*	NEMA 34**	NEMA 42
BSG106	SCP10623*	SCP10634	—
BSG150	SCP15023*	SCP15034	—
BSG200	—	SCP20034	SCP20042
BDU50	SCP5023*	SCP5034	—
BDU55	SCP5523	SCP5534	—
BDU75	—	SCP7534	SCP7542
BDU90	—	SCP9034	SCP9042
BDU100	—	SCP10034	SCP10042

*NOTE: Add suffix "A" for all NEMA 23, 3 Stack Motors
Example: SCP5023A

** Add suffix "B" for LTS 342 and 344 motors



Accessory Items

RS232 Programming Cable for NSMC Controller and NSDP6C Motor Drive Controller

Part Number PC232 10 foot length

RS232 Programming Cable for SAC300-8A

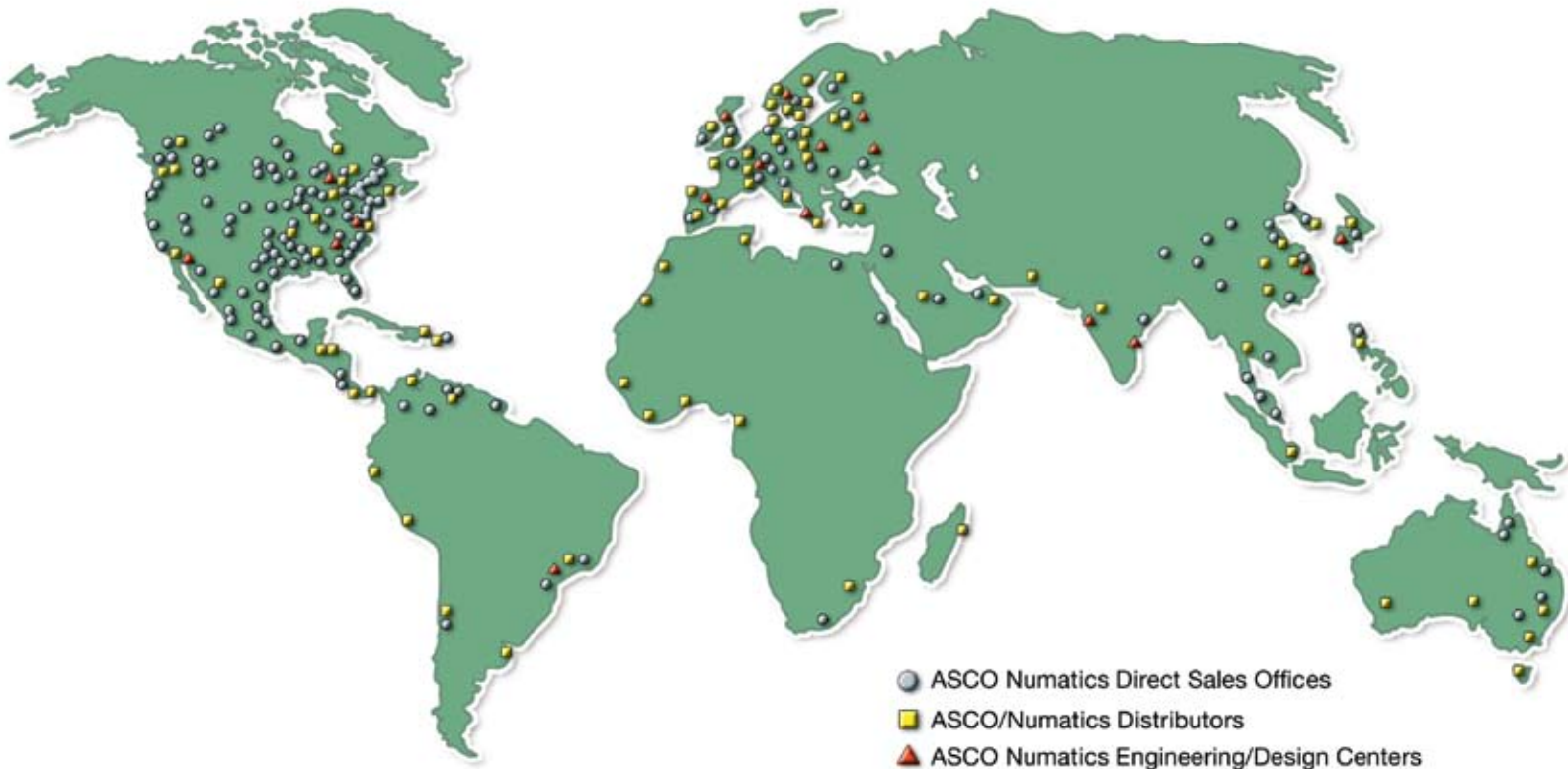
Part Number PCS232 5 foot length

RS232 to RS485 Converter

Part Number C232-485

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