



## MOTION CONTROL

[with optional CANopen]

### FEATURES

- Highly Integrated, High Performance Microstepping Driver and Motion Controller
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +75 VDC
- Low Cost
- Compact Package
- High Output Current up to 5 Amps RMS, 7 Amps Peak (Per Phase)
- Auxiliary Logic Power Supply Input
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- Open or Optional Closed Loop Control
- Programmable Motor Run and Hold Currents
- One 10 Bit Analog Input Selectable: 0 to +10VDC, 0 to +5VDC, 0-20mA, 4-20mA
- 0 to 5MHz Step Clock Rate Selectable in 0.59Hz Increments
- RS-422/485 or Optional CANopen\* Communications
- 62 Software Addresses for Multi-Drop Communications
- Simple 1 to 2 Character Instructions
- 8 I/O Lines, +24 VDC Tolerant, Sourcing or Sinking, Inputs and Outputs
- Electronic Gearing
- Open Loop or Optional External/Remote Encoder for Closed Loop Control
- High Speed Position Capture Input or Trip Output
- Dual Mounting Configurations
- Pluggable Locking Wire Crimp Interface

### DESCRIPTION

The **Motion Control MForce PowerDrive** offers system designers a low cost, high performance microstepping driver integrated with an intelligent, programmable motion controller.

The unsurpassed smoothness and performance delivered by MForce PowerDrives are achieved through IMS's advanced 2nd generation current control. By applying innovative techniques to control current flow through the motor, resonance is significantly dampened over the entire speed range and audible noise is reduced.

Motion Control MForce PowerDrives accept a broad input voltage range from +12 to +75 VDC, delivering enhanced performance and speed. Oversized input capacitors are used to minimize power line surges, reducing problems that can occur with long runs and multiple drive systems. An extended operating range of -40° to +85°C provides long life, trouble free service in demanding environments.

A high, per phase output current of up to 5 Amps RMS, 7 Amps Peak, allows the compact MForce PowerDrive to control a broad array of motors from size 23 to size 42.

Standard features include eight +5 to +24 volt general purpose I/O lines and the capability of electronic gearing by following a rotary or linear axis at an electronically controlled ratio, or an output clock can be generated fixed to the internal step clock. Also included are one 10 bit analog input, 0 to 5MHz step clock rate, 20 microstep resolutions up to 51,200 steps per revolution, and full featured easy-to-program instruction set.

MForce PowerDrives are available with optional closed loop control. This increases functionality by adding stall detection, position maintenance and find index mark. The closed loop configuration offers an expanded choice of line counts and resolutions by interfacing to a remotely mounted user-supplied external encoder.

Motion Control MForce PowerDrives communicate over RS-422/485 which allows for point-to-point or multiple unit configurations utilizing one communication port. Addressing and hardware support up to 62 uniquely addressed units communicating over a single line. Baud rate is selectable from 4.8 to 115.2kpbs.

Optional communication protocols include CANopen. The CAN bus is 2.0B active (11 and/or 29 bit) and is capable of all standard frequencies from 10kHz to 1MHz. CANopen features include node guarding, heartbeat producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.\*

The versatile Motion Control MForce PowerDrive comes with dual mounting configurations to fit various system needs. All interface connections are accomplished using pluggable locking wire crimp connectors, with the exception of the CANopen option which uses a DB9 connector.

MForce connectivity has never been easier with options ranging from **all-inclusive QuickStart Kits** to **individual interfacing cables** and **mating connector kits** to build your own cables.

See pg 4.

\*CANopen may not support some objects.

# MForce PowerDrive – MOTION CONTROL

## STANDARD SPECIFICATIONS

<b>INPUT VOLTAGE (+V)</b>	Range	+12 to +75 VDC		
<b>AUX. LOGIC INPUT VOLTAGE</b>	Range	+12 to +24 VDC <i>Maintains power to control and feedback circuits (only) when input voltage is removed.</i>		
<b>OUTPUT CURRENT</b>	RMS (Max)	5 Amps		
	Peak (Per Phase)	7 Amps		
<b>ANALOG INPUT</b>	Resolution	10 Bit		
	Voltage Range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA		
<b>GENERAL PURPOSE I/O</b>	Number/Type	8 Sourcing or Sinking Outputs/Inputs		
	Logic Range	Sourcing Outputs +12 to +24 VDC, Inputs and Sinking Outputs Tolerant to +24 VDC, Inputs TTL Level Compatible		
	Output Sink Current	Up to 600 mA per Channel		
	Protection	Over Temp, Short Circuit, Transient Over Voltage, Over Voltage, Inductive Clamp		
<b>COMMUNICATION</b>	Type (Standard)	RS-422/485		
	Baud Rate	4.8 to 115.2kbps		
	Type (Optional)	CANopen DSP-402 (V2.0), DS-301 (V3.0), 2.OB Active		
	ID	11 and/or 29 Bit		
	Isolation	Galvanic		
	Features	Node Guarding, Heartbeat, SDOs, PDOs (Variable Mapping)		
<b>MOTION</b>	Open Loop Configuration or Optional Closed Loop Configuration	Number of Settings	20	
		Steps Per Revolution	200, 400, 800, 1000, 1600, 2000, 3200, 5000, 6400, 10000, 12800, 20000, 25000, 25600, 40000, 50000, 51200, 36000 (0.01 deg/μstep), 21600 (1 arc minute/μstep), 25400 (0.001mm/μstep)	
	Optional Remote Encoder Closed Loop Configuration	Type	User-Supplied Differential Encoder	
		Resolution	User-Defined Note: μstep/rev 2X the encoder count/rev minimum	
	Counters	Type	Position, Encoder/32 Bit	
		Edge Rate (Max)	5 MHz	
	Velocity	Range	+/- 5,000,000 Steps Per Second	
		Resolution	0.5961 Steps Per Second	
	Accel/Decel	Range	1.5 x 10 <sup>9</sup> Steps Per Second <sup>2</sup>	
		Resolution	90.9 Steps Per Second <sup>2</sup>	
	Electronic Gearing	Range <sup>‡</sup> /Resolution/Threshold (External Clock In)	0.001 to 2.000/32 Bit/TTL	
		Input Filter Range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	
		Range <sup>‡</sup> (Secondary Clock Out)	1 to 1	
High Speed I/O	Position Capture	Input Filter Range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	
		Resolution	32 Bit	
	Trip Output – Speed/Resolution/Threshold	150 nS/32 Bit/TTL		
<b>SOFTWARE</b>	Program Storage	Type/Size	Flash/6384 Bytes	
	User Registers	(4) 32 Bit		
	User Program Labels and Variables	192		
	Math Functions	+, -, ×, ÷, >, <, =, <=, >=, AND, OR, XOR, NOT		
	Branch Functions	Branch & Call		
	General Purpose I/O Functions	Inputs	Home, Limit Plus, Limit Minus, Go, Stop, Pause, Jog Plus, Jog Minus, Analog In, General Purpose	
		Outputs	Moving, Fault, Stall, Velocity Change, General Purpose	
	Trip Functions	Trip on Input, Trip on Position, Trip on Time, Trip Capture		
	Party Mode Addresses	62		
Encoder Functions	Stall Detection, Position Maintenance, Find Index			
<b>THERMAL</b>	Heat Sink Temperature	-40° to +85°C		

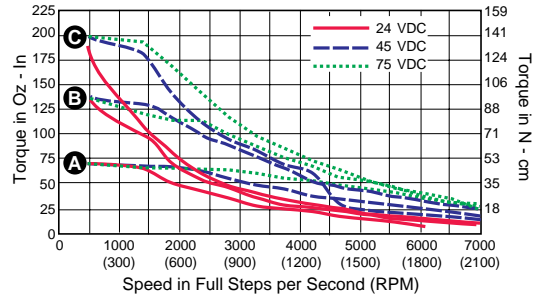
<sup>‡</sup> Adjusting the microstep resolution can increase the range.

## MOTOR RECOMMENDATIONS

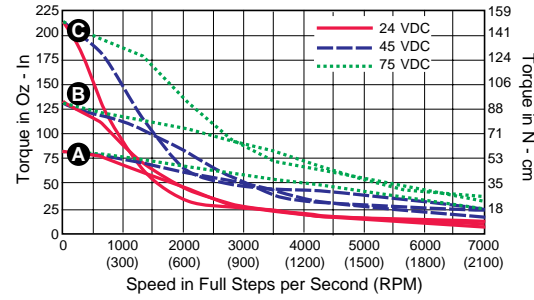
IMS PART NUMBERS	Size 23 (2.4 Amps)	Size 23 (3.0 Amps)	Size 23 (6.0 Amps)	Size 34 (6.4 Amps)
<b>SINGLE LENGTH</b>	M-2218-2.4	M-2218-3.0	M-2218-6.0	M-3424-6.3
<b>DOUBLE LENGTH</b>	M-2222-2.4	M-2222-3.0	M-2222-6.0	M-3431-6.3
<b>TRIPLE LENGTH</b>	M-2231-2.4	M-2231-3.0	M-2231-6.0	M-3447-6.3

## MOTOR PERFORMANCE — Speed-Torque

**NEMA 23 — 2.4 Amps RMS**

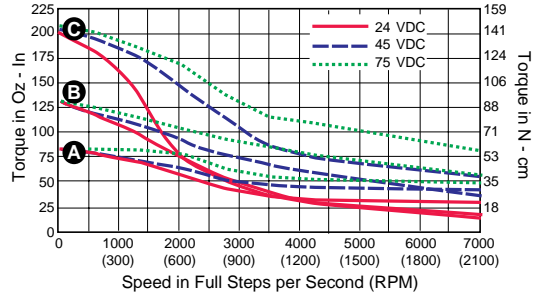


**NEMA 23 — 3.0 Amps RMS**

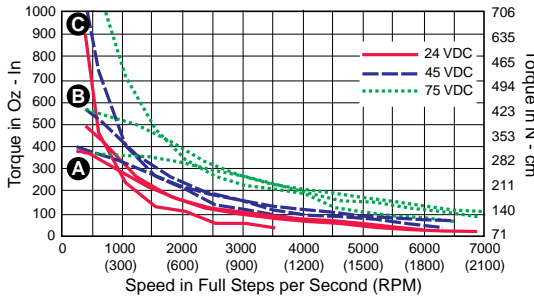


- A** Single Stack
- B** Double Stack
- C** Triple Stack

**NEMA 23 — 6.0 Amps RMS**



**NEMA 34 — 6.3 Amps RMS**



## PIN ASSIGNMENTS

P1: I/O CONNECTOR		
Pluggable Locking Wire Crimp	Function	
	Standard	With Optional Remote Encoder Closed Loop Control
Pin 1	I/O Power	I/O Power
Pin 2	I/O Ground	I/O Ground
Pin 3	I/O 1	I/O 1
Pin 4	I/O 2	I/O 2
Pin 5	I/O 3	I/O 3
Pin 6	I/O 4	I/O 4
Pin 7	I/O 9	I/O 9
Pin 8	I/O 10	I/O 10
Pin 9	I/O 11	I/O 11
Pin 10	I/O 12	I/O 12
Pin 11	Capture/Trip I/O	Capture/Trip I/O
Pin 12	Analog In	Analog In
Pin 13	Step/Clock I/O	Step/Clock I/O
Pin 14	Direction/Clock I/O	Direction/Clock I/O
Pin 15	not applicable	Channel A +
Pin 16		Channel A -
Pin 17		Channel B +
Pin 18		Channel B -
Pin 19		Index +
Pin 20		Index -

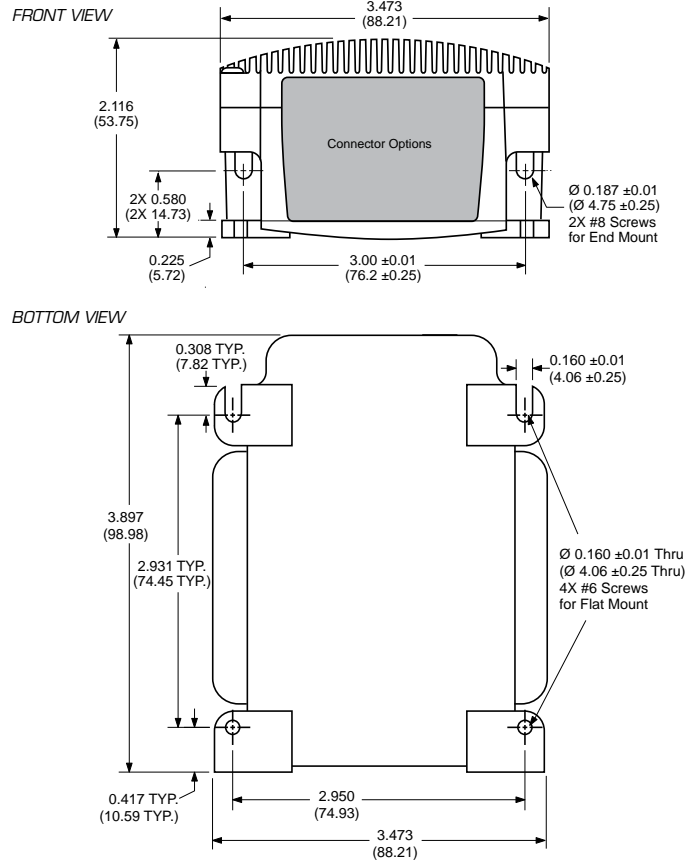
P2: COMM CONNECTOR			
RS-422/485		CANopen	
Friction Lock Wire Crimp	Function	DB9	Function
Pin 1	TX +	Pin 1	No Connect
Pin 2	Comm Ground	Pin 2	CAN Low
Pin 3	RX -	Pin 3	CAN -V
Pin 4	TX -	Pin 4	Aux Power
Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	RX +	Pin 6	CAN -V
Pin 7	RX +	Pin 7	CAN High
Pin 8	RX -	Pin 8	No Connect
Pin 9	TX +	Pin 9	CAN +V
Pin 10	TX -		

P3: POWER CONNECTOR	
Wire Crimp	Function
Pin 1	+V (+12 to +75 VDC)
Pin 2	Power/Aux Ground

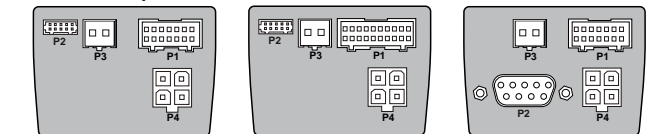
P4: MOTOR CONNECTOR	
Wire Crimp	Function
Pin 1	Phase A
Pin 2	Phase /A
Pin 3	Phase B
Pin 4	Phase /B

## MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)



### Connector Options



Pluggable Locking Wire Crimp    Remote Encoder Option    CANopen with DB9

# MFORCE POWER DRIVE MOTION CONTROL

## CONNECTIVITY

**new** QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits have communication converter, prototype development cables, instructions and CD for MForce initial functional setup and system testing.

**new** Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MForce via a PC's USB port. Length 12.0' (3.6m).

*Mates to connector:*

- 10-Pin Wire Crimp ..... MD-CC402-001
- DB9 CANopen ..... MD-CC500-000\*

\*Requires mating connector adapter and power supply, not supplied.

**Prototype Development Cables**

Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).

*Mates to connector:*

- 10-Pin Wire Crimp ..... PD10-1434-FL3
- 2-Pin Wire Crimp ..... PDO2-3400-FL3
- 14-Pin Wire Crimp ..... PD14-2334-FL3
- 20-Pin Wire Crimp ..... PD20-3400-FL3
- 4-Pin Wire Crimp ..... PDO4-MF34-FL3

**new** Mating Connector Kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.

*Mates to connector:*

- 10-Pin Wire Crimp ..... CK-02
- 2-Pin Wire Crimp ..... CK-05
- 14-Pin Wire Crimp ..... CK-09
- 20-Pin Wire Crimp ..... CK-11
- 4-Pin Wire Crimp ..... CK-07

## OPTIONS

**Motors**

IMS offers a wide range of motors, and their accessories, recommended for interface with the Motion Control MForce PowerDrive. For complete specifications on these products, please visit [www.imshome.com](http://www.imshome.com).

**Power Supplies**

IMS recommends the following power supplies for operating the MForce PowerDrive: IP804, IP806, ISP300-7. Complete power supply specifications at [www.imshome.com](http://www.imshome.com).

Connectivity details: [www.imshome.com/cables\\_cordsets.html](http://www.imshome.com/cables_cordsets.html)

## ORDER INFORMATION

**MFI3C** **34N7** - **OPTION EE**

*QuickStart Kit details above*

**P2: Communications**  
RL = RS-422/485 with 10-Pin Friction Lock Wire Crimp  
CB = CANopen with DB9 Connector

**P3: Power**  
2-Pin Locking Wire Crimp

**P1: I/O**  
14-Pin Locking Wire Crimp  
(20-Pin with Remote Encoder)

**P4: Motor Interface**  
4-Pin Locking Wire Crimp

**OPTION EE**  
Remote Encoder Interface  
For Closed Loop Control  
(Encoder Not Supplied)

**Example:** Part Number **MFI3CRL34N7** is a Motion Control MForce PowerDrive with 14-pin I/O interface, 2-pin power interface, RS-422/485 communications with 10-pin friction lock wire crimp connector and 4-pin motor interface.

**Option:** Include -EE to part number for optional interface to remote encoder (not supplied).

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