



## MDRIVE 42™ MOTOR+DRIVER *AC Plus2* MOTION CONTROL

### FEATURES

- Highly Integrated Microstepping Driver/Motion Controller with Optional Encoder/NEMA 42 Brushless High Torque Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: 120 or 240 VAC
- Low Cost
- Extremely Compact
- High Positioning Accuracy
- No Tuning Required
- Stable at Low Speeds
- No Dithering at Zero Speed
- High Starting Torque
- Allows for Greater Inertia Mismatch
- Built-in Regeneration Circuitry
- Available Options:
  - Integral Optical Encoder for Closed Loop Control
  - External/Remote Encoder (not supplied) for Closed Loop Control
  - Control Knob for Manual Positioning
  - Integrated Planetary Gearbox
  - IP65 Sealed Configuration\*
- Two Motor Lengths Available
- Auxiliary Logic Power Supply Input
- Up to 5 MHz Step Clock Rate
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- Open or Optional Closed Loop Control
- Programmable Motor Current
- Up to Eight +24 VDC Tolerant I/O Lines, Sourcing or Sinking
- One 10 Bit Analog Input Selectable: 0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA
- RS-422/485 or Optional CANopen\* Communications
- 62 Software Addresses for Multi-Drop Communications
- High Speed Position Capture Input or Trip Output
- Electronic Gearing

\* Consult Factory for Availability.

### DESCRIPTION

The MDrive42AC Plus<sup>2</sup> Motion Control system offers designers a low cost, intelligent motion controller integrated with a NEMA 42 high torque brushless motor and microstepping drive operating at 120 or 240 VAC.

Unsurpassed smoothness and performance delivered by the MDrive42AC 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.

The MDrive42AC accepts a broad input voltage range from 95 to 264 VAC, 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.

The MDrive42AC Plus<sup>2</sup> Motion Control system adds a versatile array of functions by combining a complete programmable motion controller with our compact and cost effective MDrive42AC Microstepping Driver, adding little cost and no increase in size. Standard offerings include up to 8 general purpose I/O lines (sourcing or sinking) that operate to +24 VDC, one 10 bit analog input, electronic gearing, high speed position capture input/trip output, microstep resolutions up to 51,200 steps per revolution, 0 to 5 MHz step clock rate, and a full featured easy-to-program instruction set.

The MDrive42AC Plus<sup>2</sup> Motion Control system communicates over RS-422/485 which allows for point-to-point or multiple unit configurations utilizing one communication port. Addressing and hardware support multiple uniquely addressed units communicating over a single line.

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 10 kHz to 1 MHz. CANopen features include node guarding, heartbeat, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.\*

The MDrive42AC Plus<sup>2</sup> Motion Control is available with optional closed loop control. This increases functionality by adding stall detection, position maintenance and find index mark.

The closed loop configuration is added via a 512 line (2048 edge) optical encoder with index mark, internal to the MDrive42AC so there is no increase in length. Or, for an expanded choice of line counts and resolutions, closed loop control is available with an interface to a remotely mounted user-supplied external encoder.

In addition to the encoder options, the MDrive42AC Plus<sup>2</sup> Motion Control has 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.

A sealed\* version designed to meet IP65 specifications is also available. The sealed assembly allows the MDrive42AC to be used in environments where exposure to chemical, dust and liquids may occur.

Available motor configurations include two motor lengths, an optional rear control knob for manual positioning and an integrated planetary gearbox. Interface connections are accomplished using standard industrial connectors.

# MDrive42AC Plus2 MOTION CONTROL

## GENERAL SPECIFICATIONS

<b>INPUT VOLTAGE</b>	Range	120 V MDrive – 95 to 132 VAC @ 50/60 Hz 240 V MDrive – 95 to 264 VAC @ 50/60 Hz		
<b>AUX. LOGIC INPUT VOLTAGE</b>	Range	+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.		
<b>ANALOG INPUT</b>	Resolution	10 Bit		
	Voltage Range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA or 4-20 mA		
<b>GENERAL PURPOSE I/O</b>	Number/Type	8 Sourcing or Sinking (or 4 when External Encoder Option is Selected)		
	Logic Range	+5 to +24 VDC – Inputs and Sinking Outputs; Inputs TTL Level Compatible +12 to +24 VDC – Sourcing Outputs		
	Output Sink/Source Current	Up to 600 mA per Channel		
<b>COMMUNICATION</b>	Protection	Over Temp, Short Circuit, Transient Over Voltage, Over Voltage, Inductive Clamp		
	Type (Standard)	RS-422/485		
	Baud Rate	4800 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		
<b>MOTION</b>	Features	Node Guarding, Heartbeat, SDOs, PDOs (Variable Mapping)		
		Number of Settings	20	
	Open Loop Configuration	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)	
		Closed Loop Configuration (Optional)	Internal Encoder	Type
	Steps Per Revolution			51200
	Remote Encoder		Resolution	512 Lines/2048 Edges Per Rev
			Type	User-Supplied Differential Encoder
	Counters	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)	
		Resolution	User-Defined Note: μstep/rev 2X the encoder count/rev minimum	
	Velocity	Type	Position, Encoder/32 Bit	
		Edge Rate (Max)	5 MHz	
	Accel/Decel	Range	+/- 5,000,000 Steps Per Second	
		Resolution	0.5961 Steps Per Second	
	Electronic Gearing	Range	1.5 x 10 <sup>9</sup> Steps Per Second <sup>2</sup>	
		Resolution	90.9 Steps Per Second <sup>2</sup>	
Range ‡/Resolution/Threshold (External Clock In)		0.001 to 2.000/32 Bit/TTL		
High Speed I/O	Input Filter Range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)		
	Range ‡ (Secondary Clock Out)	1 to 1		
	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	+, -, x, ÷, >, <, =, <=, >=, 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>	Operating Temperature	-40° to +85°C		
	Ambient Temperature	50°C (maximum at full current and 100% duty cycle)*		
<b>PROTECTION</b>	Type	Thermal, Internal Fuse †		

\* Adequate mounting is required to assure that the motor temperature does not exceed 100°C.

† Designed for line-neutral systems.

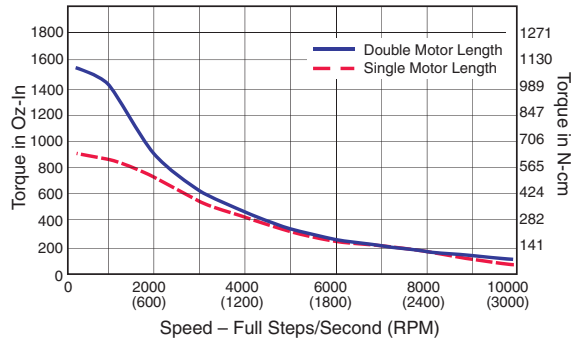
‡ Adjusting the microstep resolution can increase the range.

## MOTOR SPECIFICATIONS

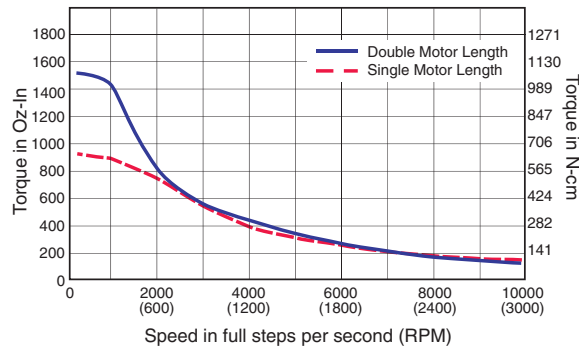
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
<b>SINGLE LENGTH</b>	1147 oz-in / 810 N-cm	35 oz-in / 25 N-cm	0.0917 oz-in-sec <sup>2</sup> / 6.5 kg-cm <sup>2</sup>	14.07 lb / 6.38 kg
<b>DOUBLE LENGTH</b>	2294 oz-in / 1620 N-cm	84 oz-in / 59 N-cm	0.1833 oz-in-sec <sup>2</sup> / 13.0 kg-cm <sup>2</sup>	21.25 lb / 9.64 kg

## SPEED-TORQUE

### MDrive42AC – 120VAC



### MDrive42AC – 240VAC



## PIN ASSIGNMENTS

P1: I/O CONNECTOR		
M23 Circular (Male)	Function	
	Expanded I/O	Remote Encoder Closed Loop Control
Pin 1	I/O 9	Channel A +
Pin 2	I/O 11	Channel B +
Pin 3	Step/Clock I/O	Index +
Pin 4	I/O 1	I/O 1
Pin 5	Direction/Clock I/O	Index -
Pin 6	No Connect	No Connect
Pin 7	Aux-Logic (+12 to +24 VDC)	Aux-Logic (+12 to +24 VDC)
Pin 8	Aux-Ground	Aux-Ground
Pin 9	I/O 3	I/O 3
Pin 10	I/O Ground	I/O Ground
Pin 11	I/O Power	I/O Power
Pin 12	Earth Ground	Earth Ground
Pin 13	I/O 12	Channel B -
Pin 14	Capture/Trip I/O	Capture/Trip I/O
Pin 15	Analog In	Analog In
Pin 16	I/O 2	I/O 2
Pin 17	I/O 4	I/O 4
Pin 18	I/O 10	Channel A -
Pin 19	No Connect	No Connect

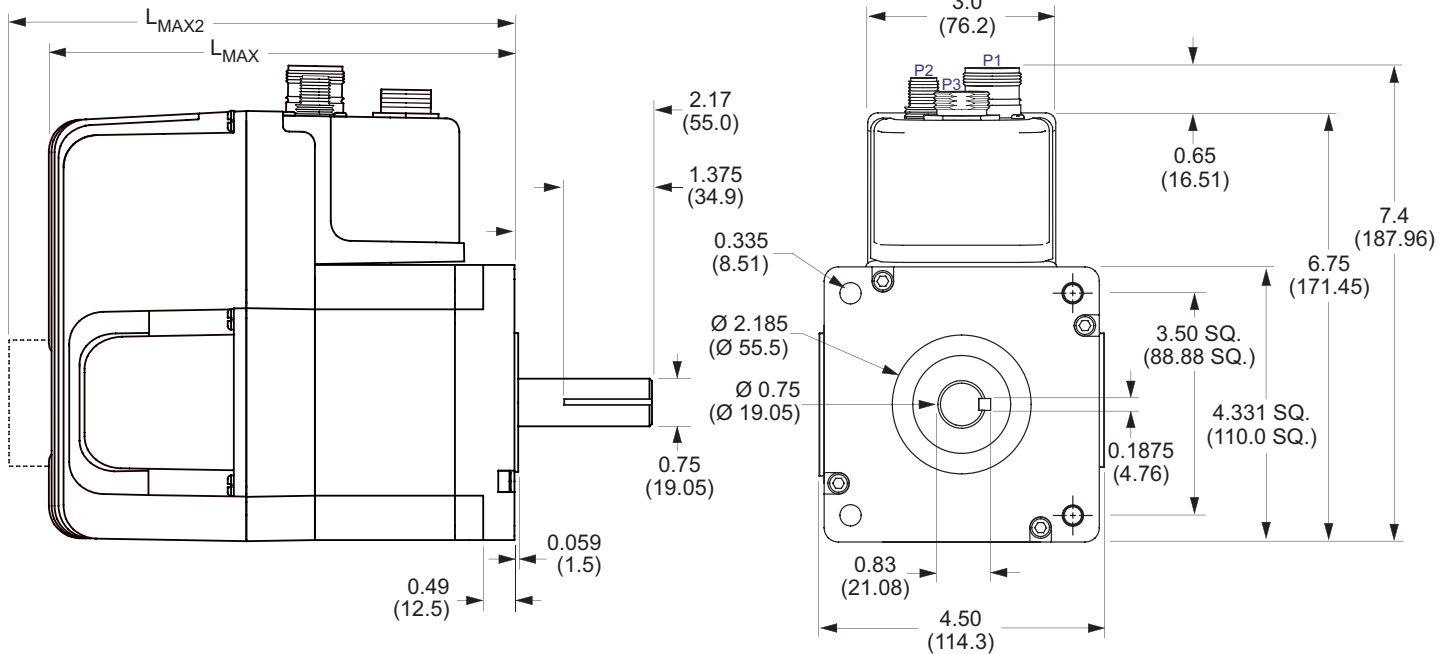
P2: COMM CONNECTOR			
RS-422/485		CANopen	
M12 Circular (Female)	Function	M12 Circular (Male)	Function
Pin 1	TX -	Pin 1	Shield
Pin 2	TX +	Pin 2	CAN +V
Pin 3	RX +	Pin 3	CAN -V
Pin 4	RX -	Pin 4	CAN High
Pin 5	Comm Ground	Pin 5	CAN Low

P3: POWER CONNECTOR	
Euro AC (Male)	Function
Pin 1	Chassis Ground
Pin 2	AC Power Line
Pin 3	AC Power Neutral

## MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

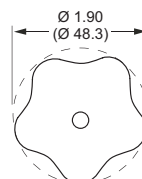
### MDrive42AC Plus<sup>2</sup>



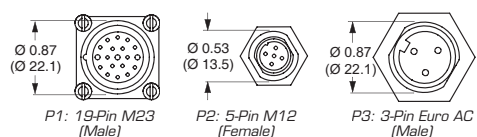
### MDrive Lengths Inches (mm)

Motor Length	LMAX	LMAX2
	SINGLE SHAFT or ENCODER VERSION	CONTROL KNOB VERSION
Single	7.4 (187.96)	9.4 (238.76)
Double	8.4 (213.36)	10.4 (264.16)

### Control Knob



### Connectors



## OPTIONS

### Internal Encoder

The MDrive42AC Plus<sup>2</sup> Motion Control is available with an internal 512-line (2048 count) differential optical encoder with index mark.

### Remote Encoder

The MDrive42AC Plus<sup>2</sup> Motion Control is available with differential encoder inputs for use with a remote encoder (not supplied).

### Control Knob (non-sealed versions only)

The MDrive42AC is available with a factory-mounted rear control knob for manual shaft positioning.

### Planetary Gearbox\*

Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive42AC. Contact factory for information.

\*Consult Factory for Availability.

## ACCESSORIES

### Communications Converter Cable

This convenient 12.0' (3.6m) accessory cable connects a PC's USB Port to the MDrive's 5-pin M12 Connector. An in-line RS-422 converter enables parameter setting to a single MDrive Motion Control. Purchase recommended with first orders.

USB to 5-Pin M12 ..... MD-CC401-000

### Cordsets – Prototype Development

19-pin M23 single-ended cordsets are offered to speed prototyping of the MDrive42AC. Measuring 13.0' (4.0m) long, either straight or right angle termination is available. PVC jacketed cables come with a foil shield and unconnected drain wire.


Straight Termination ..... MD-CS100-000  
Right Angle Termination ..... MD-CS101-000

### Cordsets – Power Interface

3-pin Euro AC single-ended cordsets are offered for power interface to the MDrive42AC. Measuring 13.0' (4.0m) long, either straight or right angle termination is available. PVC jacketed cables are IP68, NEMA 6P rated.

Straight Termination ..... MD-CS200-000  
Right Angle Termination ..... MD-CS201-000

## ORDER INFORMATION – MDrive42AC Plus<sup>2</sup> Motion Control



**Plus<sup>2</sup> & Plus<sup>2</sup>-65\***

**MDI M Q42 – OPTION**

MDrive Version  
3 = Plus<sup>2</sup> (non-sealed)  
4 = Plus<sup>2</sup>-65 (sealed)

Communications  
R = RS-422/485  
C = CANopen\*

Motor Lengths  
A = Single Length  
B = Double Length

Input Voltage  
1 = 120 Volt  
2 = 240 Volt

**Example #1:** Part Number **MDI3MRQ42B2** is an MDrive42AC Plus<sup>2</sup> Motion Control with 19-pin M23 circular I/O interface, RS-422/485 communications with 5-pin M12 circular connector, NEMA 42 double length motor and 240 input voltage.

\*Consult Factory for Availability.

OPTIONS	
<b>Internal Encoder</b>	<b>–EQ</b>
Example: <b>MDI3MRQ42B2–EQ</b> adds a 512-line internal optical encoder with index mark to example #1.	
<b>Remote Encoder</b>	<b>–EE</b>
Example: <b>MDI3MRQ42B2–EE</b> adds differential encoder inputs for use with remote encoder (not supplied). <i>May not be combined with internal encoder option.</i>	
<b>Control Knob</b>	<b>–N</b>
Example: <b>MDI3MRQ42B2–N</b> adds a rear control knob to example #1. <i>Not available with sealed –65 versions.</i>	



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