

## MDRIVE 34™ MOTOR+DRIVER *Plus* MOTION CONTROL

### STANDARD FEATURES

- Highly Integrated Microstepping Driver, Motion Controller and NEMA 34 High Torque Brushless Motor
- *Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness*
- *Single Supply: +12 to +75 VDC*
- Low Cost
- Extremely Compact
- Available Options:
  - Long Life Linear Actuator\*
  - Internal Optical Encoder for Closed Loop Control
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
- Three Rotary Motor Lengths Available
- *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
- Four +5 to +24 VDC I/O Lines *Accept Sourcing or Sinking Outputs*
- 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
- Interface Options:
  - 12.0" (30.5cm) Flying Leads

### EXPANDED PLUS<sup>2</sup> FEATURES

- *8 I/O Lines, +24 VDC Tolerant Sourcing or Sinking, Inputs and Outputs*
- *Electronic Gearing*
- *Optional External/Remote Encoder for Closed Loop Control*
- *High Speed Position Capture Input or Trip Output*
- *Pluggable Locking Wire Crimp Interface*

### DESCRIPTION

The MDrive34Plus Motion Control offers system designers a low cost, intelligent motion controller integrated with a NEMA 34 high torque brushless motor and a *+12 to +75* volt microstepping driver.

*The unsurpassed smoothness and performance delivered by the MDrive34Plus Motion Control 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 MDrive34Plus accepts 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.*

Standard features available in the MDrive34Plus Motion Control include four +5 to +24 volt general purpose I/O lines, 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.

*Expanded features in the MDrive34Plus<sup>2</sup> version 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.*

All MDrive34Plus Motion Control are 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 unit so there is no increase in length. *Or, for an expanded choice of line counts and resolutions with MDrive34Plus<sup>2</sup> versions only, closed loop control is available with an interface to a remotely mounted user-supplied external encoder.*

The MDrive communicates 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 115.2kbps.

*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, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.\**

Available motor configurations include a single shaft rotary motor and a linear actuator with long life Acme screw\*. Rotary versions are available in three motor lengths. Interface connections are accomplished for standard MDrivePlus versions using 12.0" (30.5cm) flying leads, *and for expanded MDrivePlus<sup>2</sup> versions using pluggable locking wire crimp connectors.*

The MDrive34Plus is a compact, powerful and inexpensive solution that will reduce system cost, design and assembly time for a large range of brushless motor applications.

\*Consult Factory for Availability.

NOTE: Red italic text denotes new product enhancements.

# MDrive34Plus MOTION CONTROL

## STANDARD SPECIFICATIONS (Plus Versions)

<b>INPUT VOLTAGE (+V)</b>	Range	+12 to +75 VDC		
<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, 4-20 mA		
<b>GENERAL PURPOSE I/O</b>	Number/Type	4 Sinking Outputs/4 Sourcing or Sinking Inputs		
	Logic Range	Inputs and Outputs Tolerant to +24VDC, 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), 2.0B Active		
	ID	11 and/or 29 Bit		
	Isolation	Galvanic		
	Features	Node Guarding, Heartbeat, SDOs, PDOs (Variable Mapping)		
<b>MOTION</b>	Open 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)	
	Closed Loop Configuration (Optional)	Internal Encoder	Type	Internal, Magnetic
			Steps Per Revolution	51200
			Resolution	512 Lines/2048 Edges Per Rev
	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>		
<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		

## EXPANDED SPECIFICATIONS (Plus<sup>2</sup> Versions)

<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/Source Current	Up to 600 mA per Channel			
<b>MOTION</b>	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		
Closed Loop Configuration (Optional)	Remote Encoder	Type	User-Supplied Differential Encoder		
		Steps Per Revolution	See "Standard Specs Open Loop Steps/Rev" Above		
		Resolution	User-Defined Note: μstep/rev 2X the encoder count/rev minimum		

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

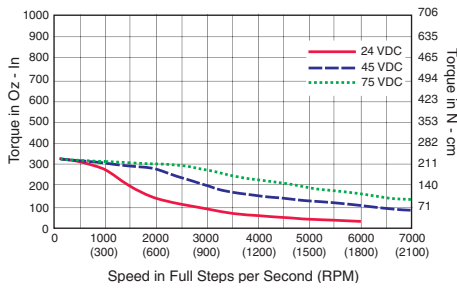
## MOTOR SPECIFICATIONS

	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
<b>SINGLE LENGTH</b>	381 oz-in / 269 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec <sup>2</sup> / 1.0 kg-cm <sup>2</sup>	4.1 lb / 1.9 kg
<b>DOUBLE LENGTH</b>	575 oz-in / 406 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec <sup>2</sup> / 1.6 kg-cm <sup>2</sup>	5.5 lb / 2.5 kg
<b>TRIPLE LENGTH</b>	1061 oz-in / 749 N-cm	19.83 oz-in / 14.0 N-cm	0.04815 oz-in-sec <sup>2</sup> / 3.4 kg-cm <sup>2</sup>	8.8 lb / 4.0 kg
	Maximum Thrust	Backlash	Maximum Screw Deflection	Weight (without screw)
<b>LINEAR ACTUATOR</b>	500 lbs / 2224 N	0.005 in / 0.127 mm	± 1°	5.5 lb / 2.5 kg

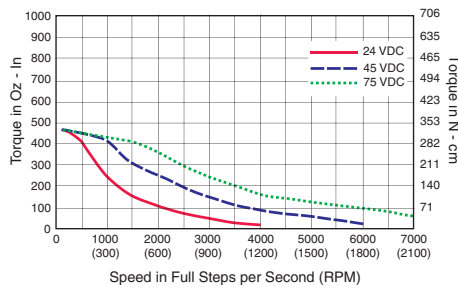
# MOTOR PERFORMANCE

## Speed-Torque

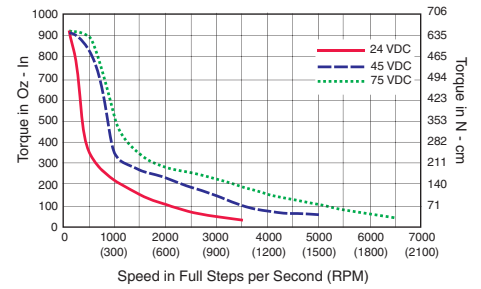
### Single Length Rotary Motor



### Double Length Rotary Motor

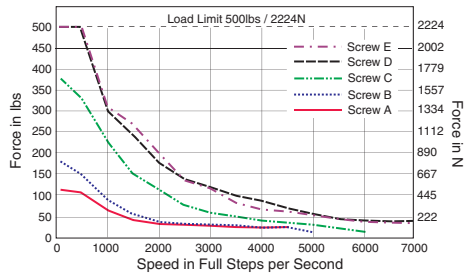


### Triple Length Rotary Motor

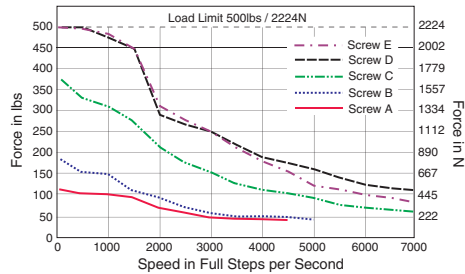


## Speed-Force

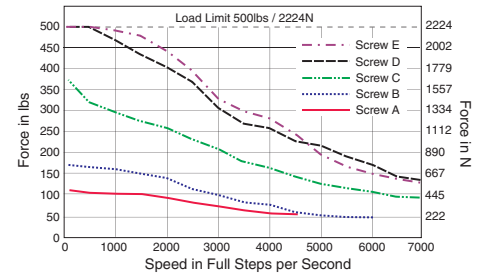
### Linear Actuator – 24 VDC



### Linear Actuator – 45 VDC



### Linear Actuator – 75 VDC



## PIN/WIRE ASSIGNMENTS – MDrive34Plus Motion Control

### Plus

P1: I/O & POWER CONNECTOR	
Flying Leads Wire Colors	Function
White/Yellow	I/O 1
White/Orange	I/O 2
White/Violet	I/O 3
White/Blue	I/O 4
Green	Analog Input
Black	Power/Aux-Ground
Red	+V (+12 to +75 VDC)

P2: COMM CONNECTOR	
RS-422/485	
10-Pin IDC	Function
Pin 1	TX +
Pin 2	TX -
Pin 3	RX +
Pin 4	RX -
Pin 5	Aux-Logic (+12 to +24 VDC)
Pin 6	RX +
Pin 7	RX -
Pin 8	TX -
Pin 9	TX +
Pin 10	Comm Ground

### Plus2

P1: I/O CONNECTOR		
Wire Crimp	Function	
	Expanded I/O	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 -	

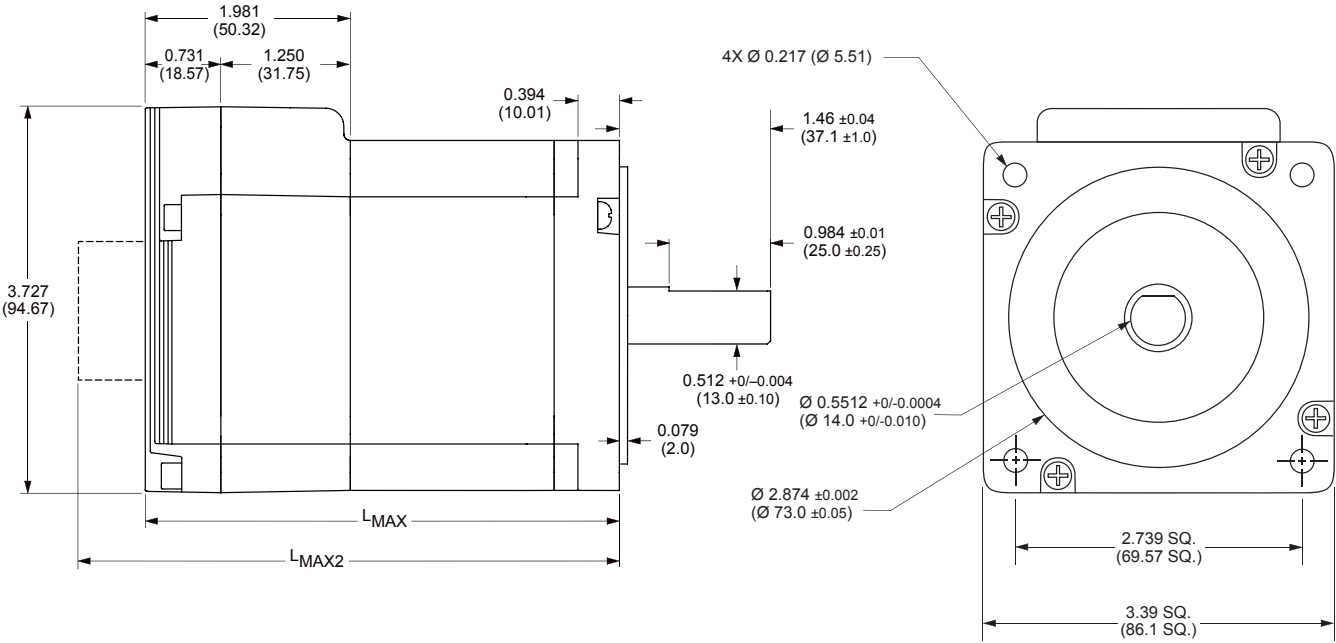
P2: COMM CONNECTOR	
RS-422/485	
Wire Crimp	Function
Pin 1	TX +
Pin 2	Comm Ground
Pin 3	RX -
Pin 4	TX -
Pin 5	Aux-Logic (+12 to +24 VDC)
Pin 6	RX +
Pin 7	RX +
Pin 8	RX -
Pin 9	TX +
Pin 10	TX -

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

# MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

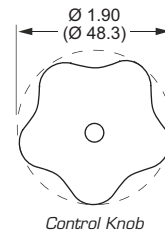
## MDrive34Plus Motion Control



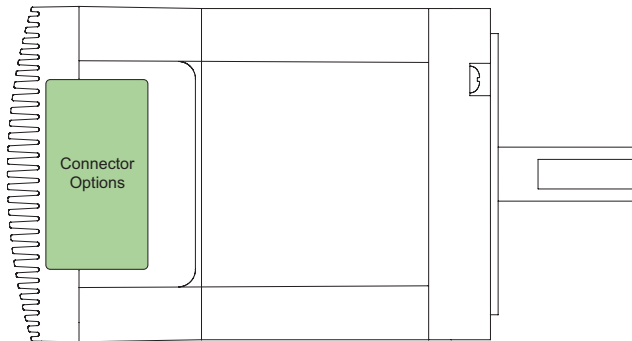
### MDrive Lengths Inches (mm)

Motor Length	L <sub>MAX</sub>	L <sub>MAX2</sub>
	SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	CONTROL KNOB VERSION
Single	3.71 (94.23)	4.42 (112.27)
Double	4.50 (114.30)	5.21 (132.33)
Triple	6.07 (154.18)	6.78 (172.21)

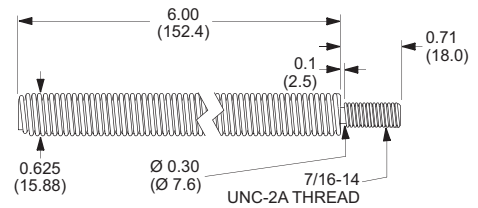
### L<sub>MAX2</sub> Option



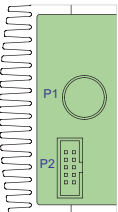
### Connector Options



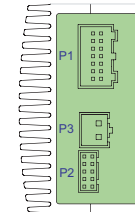
### Linear Actuator



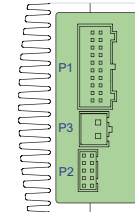
Standard Screw



Flying Leads



Pluggable Locking Wire Crimp



Pluggable Locking Wire Crimp with Remote Encoder

Connector mating information at: [www.imshome.com/mdriveplus\\_connectors.html](http://www.imshome.com/mdriveplus_connectors.html)

## OPTIONS

### Linear Actuator\*

The MDrive34Plus with non-captive style linear actuator is available with the following long life Acme screws:

- Screw A ..... 0.005" (0.127mm)/full step
- Screw B ..... 0.0025" (0.0635mm)/full step
- Screw C ..... 0.00125" (0.03175mm)/full step
- Screw D ..... 0.000625" (0.015875mm)/full step
- Screw E..... 0.0005" (0.0127mm)/full step

Standard screw length is 6.0" (152.4mm) plus the mounting end thread. Custom lengths up to 24.0" (609.6mm) are available without mounting end thread. Contact the factory regarding captive shaft or external style linear actuators.

*NOTE: May not be combined with other options.*

### Internal Encoder

All MDrive34Plus Motion Control versions are available with an optional internal 512-line (2048 count) optical encoder with index mark.

### Remote Encoder (Plus<sup>2</sup> versions only)

*MDrive34Plus<sup>2</sup> Motion Control versions are available with differential encoder inputs for use with a remote encoder (not supplied).*

### Control Knob

The MDrive34Plus 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 MDrive34Plus. Refer to details and part numbers on the back cover.

## ACCESSORIES

### Communications Converter Cables

These convenient accessory cables connect a PC's USB Port to the MDrive's P2 Connector. Total cable length is 12.0' (3.6m). An in-line RS-422 converter enables parameter setting to a single MDrive Motion Control. Purchase recommended with first orders.

*USB to 10-Pin IDC ..... MD-CC400-000  
Wire Crimp Adapter; Plus<sup>2</sup> Units... MD-ADP-H*

### Prototype Development Cables

*For testing and development of MDrives with pluggable locking wire crimp connectors, the following 10.0' (3m) interface cables are recommended with first orders:*

*I/O: 14-Pin Wire Crimp Cable.... PD14-2334-FL3  
I/O: 20-Pin Wire Crimp Cable.... PD20-3400-FL3  
Power: 2-Pin Wire Crimp Cable.. PDD2-3400-FL3  
Comm: 10-pin Wire Crimp Cable .. PD10-1434-FL3*

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

\* Consult Factory for Availability.

*NOTE: Red italic text denotes new product enhancements.*

## ORDER INFORMATION – MDrive34Plus Motion Control

**Plus**

**MDI1FRD34**  7 – **OPTION**

P1: I/O & Power  
12" Flying Leads

P2: Communications  
10-Pin IDC Connector

**Motor Lengths**  
A = Single Length & Linear Actuator\*  
B = Double Length  
C = Triple Length

**Example #1:** Part Number **MDI1FRD34A7** is an MDrive34Plus Motion Control with 12" flying leads I/O & power interface, RS-422/485 communications with 10-pin IDC connector, and NEMA 34 single length motor.

**Plus<sup>2</sup>**

**MDI3CRL34**  7 – **OPTION**

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

P3: Power  
2-Pin Locking Wire Crimp

P2: Communications  
10-Pin Friction Lock Wire Crimp

**Motor Lengths**  
A = Single Length & Linear Actuator\*  
B = Double Length  
C = Triple Length

**Example #2:** Part Number **MDI3CRL34A7** is an MDrive34Plus<sup>2</sup> Motion Control with 14-pin I/O interface, 2-pin power interface, RS-422/485 communications with 10-pin friction lock wire crimp connector, and NEMA 34 single length motor.

<sup>1</sup>Linear Actuator available ONLY with single length motor.

\*Consult Factory for Availability.

### OPTIONS

**Linear Actuator\*** **-L**

Acme Screw Type (Travel/Full Step)  
A = 0.005"  
B = 0.0025"  
C = 0.00125"  
D = 0.000625"  
E = 0.0005"

Custom Screw Lengths  
Range up to 24.0"  
Example: 095 for 9.5" Screw  
(6.0" Screw Length Standard)

Example: **MDI1FRD34A7-LA** adds standard 6" long, 0.005" screw.  
**NOTE: MAY NOT be combined with any other option.**  
Available ONLY with single length motor.

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**Internal Encoder** **-EQ**

Example: **MDI1FRD34A7-EQ** adds a 512-line internal optical encoder with index mark to example #1.

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**Remote Encoder** **-EE**

Example: **MDI3CRL34A7-EE** adds differential encoder inputs for use with remote encoder (not supplied) to example #2, increasing the wire crimp connector from 14-pins to 20-pins. Available with Plus<sup>2</sup> versions only. May not be combined with internal encoder option.

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**Control Knob** **-N**

Example: **MDI3CRL34A7-N** adds a rear control knob for manual positioning to example #2.

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**Planetary Gearbox** **-G**    **-F**

Refer to gearbox page for complete table of ratios and part numbers.  
Example: **MDI3CRL34A7-G1A2** adds a 1-stage planetary gearbox with 5.18:1 ratio to example #2. Add  F for optional NEMA flange.

## MDRIVE34PLUS WITH PLANETARY GEARBOX

The MDrive34Plus is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low

maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large number of reduction ratios in 1-, 2- and 3-stage configurations. An optional NEMA Output Flange allows

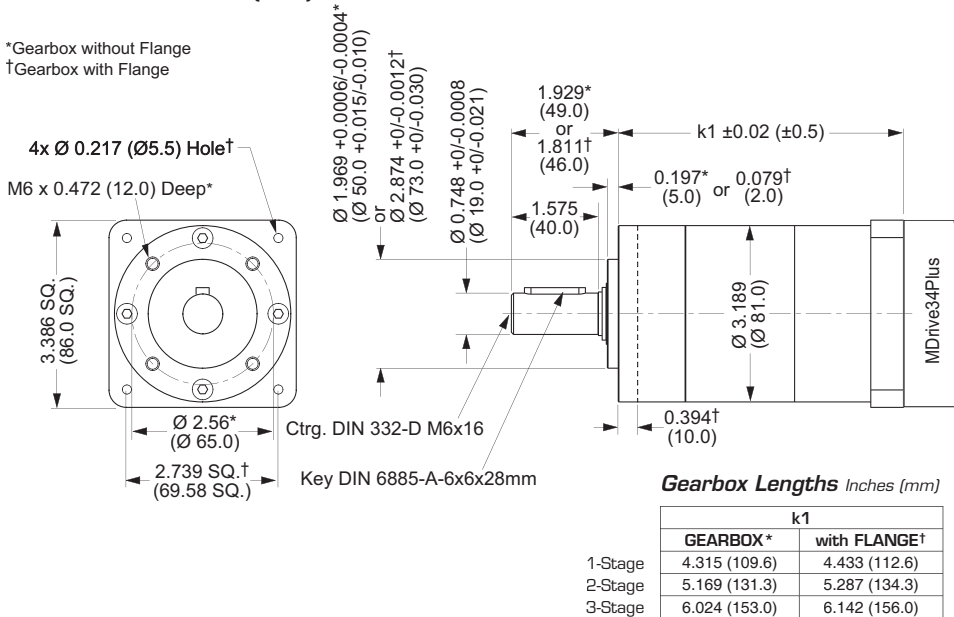
mounting the Planetary Gearbox to the load using a standard NEMA bolt circle. Planetary Gearbox may be combined with other MDrive34Plus options, however are unavailable with Linear Actuators.

### Planetary Gearbox Parameters

	Permitted Output Torque (oz-in/Nm)	Gearbox Efficiency	Maximum Backlash	Output Side with Ball Bearing			
				Maximum Load (lb-force/N)		Weight (oz/g)	
				Radial	Axial	Gearbox	with Flange
<b>1-STAGE</b>	2832/20.0	0.80	1.0°	90/400	18/80	64.4/1827	66.7/1890
<b>2-STAGE</b>	8496/60.0	0.75	1.5°	135/600	27/120	89.5/2538	92.6/2625
<b>3-STAGE</b>	16992/120.0	0.70	2.0°	225/1000	45/200	114.6/3248	118.5/3360

### Planetary Gearbox for MDrive34Plus

Dimensions in Inches (mm)



### Ratios and Part Numbers

Planetary Gearbox	Ratio (Rounded)	Part Number**
1-Stage	3.71:1	G1A1
1-Stage	5.18:1	G1A2
1-Stage	6.75:1	G1A3
2-Stage	13.73:1	G1A4
2-Stage	15.88:1	G1A5
2-Stage	18.37:1	G1A6
2-Stage	19.20:1	G1A7
2-Stage	22.21:1	G1A8
2-Stage	25.01:1	G1A9
2-Stage	26.85:1	G1B1
2-Stage	28.93:1	G1B2
2-Stage	34.98:1	G1B3
2-Stage	45.56:1	G1B4
3-Stage	50.89:1	G1B5
3-Stage	58.86:1	G1B6
3-Stage	68.07:1	G1B7
3-Stage	71.16:1	G1B8
3-Stage	78.72:1	G1B9
3-Stage	92.70:1	G1C1
3-Stage	95.18:1	G1C2
3-Stage	99.51:1	G1C3
3-Stage	107.21:1	G1C4
3-Stage	115.08:1	G1C5
3-Stage	123.98:1	G1C6
3-Stage	129.62:1	G1C7
3-Stage	139.14:1	G1C8
3-Stage	149.90:1	G1C9
3-Stage	168.85:1	G1D1
3-Stage	181.25:1	G1D2
3-Stage	195.27:1	G1D3
3-Stage	236.10:1	G1D4
3-Stage	307.55:1	G1D5

\*\*Include optional planetary gearbox by adding -G plus 3 characters to the end of an MDrive part number.



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