MDRIVE® 34 MOTOR+DRIVER Plus

SPEED CONTROL

FEATURES

- Highly Integrated Microstepping Driver, Intelligent Variable Speed Controller and NEMA 34 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +75 VDC
- Cost Effective
- Extremely Compact
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- 2 Selectable 10-bit Analog Speed Control Inputs Accept:
  - 0 to +5 VDC
  - 0 to +10 VDC
  - 4 to 20 mA
  - 0 to 20 mA
  - 15 to 25 kHz PWM
- Automatic Current Reduction
- Electronically Configurable:
  - Motor Run/Hold Current
  - Microstep Resolution
  - Acceleration/Deceleration
  - Initial and Max Velocity
  - Hold Current Delay Time/Motor Settling Delay Time
  - Programmable Filtering for the Start/Stop Input
- Available Options:
  - Long Life Linear Actuators**
  - Internal Optical Encoder
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
- 3 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Interface Options:
  - Pluggable Locking Wire Crimp
  - 12.0" (30.5cm) Flying Leads
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

** Consult Factory for Availability.

DESCRIPTION

The **MDrive®34Plus² Speed Control** offers system designers cost effective, programmable velocity control integrated with a NEMA 34 high torque 1.8° brushless step motor and a +12 to +75 volt microstepping driver.

The MDrive34Plus² Speed Control features a digital oscillator for accurate velocity control with an output frequency of up to 5 Megahertz. Output frequency will vary with the signal applied to the speed control input and can be limited by the amount specified by the Maximum Velocity parameter.

Speed can be adjusted using three modes of operation: voltage, current and PWM. The ranges are 0 to +5 volts and 0 to +10 volts in voltage mode, 0 to 20 mA and 4 to 20 mA in current mode, and 15 to 25 kHz in PWM mode. Voltage and current modes provide two configurable speed control inputs, Speed A1 & Speed A2, which may be preset and digitally selected.

There are two basic methods for controlling the velocity: bidirectional and unidirectional. By moving the center point, both speed and direction are controlled by a potentiometer or joystick. By setting the center point to zero or the lower end of the potentiometer, only velocity is controlled by the speed control input; direction is controlled by a separate digital input.

The MDrive34Plus² Speed Control has 21 setup parameters, which may be configured using the supplied IMS Analog Speed Control GUI, or a user-developed front-end communicating over SPI. The setup parameters enable the user to configure all MDrive operational parameters which are stored in nonvolatile memory.

The versatile, compact MDrive34Plus² Speed Control is available in multiple configurations to fit various system needs. Rotary motor versions come in three lengths and may include an optical encoder, control knob or planetary gearbox. Long life Acme screw linear actuators** are also available.

Connector style options give you choices for the best fit and features. Select from 12.0" (30.5cm) flying leads or locking wire crimp connectors.

MDrivePlus 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 5.*

The MDrive34Plus² is a compact, powerful and cost effective motion control solution that will reduce system cost, design and assembly time for a large range of brushless step motor applications.

CONFIGURING

The IMS Analog Speed Control is a software GUI for quick and easy parameter setup of the MDrivePlus Speed Control from a computer's USB port. GUI access is via the IMS SPI Motor Interface available at www.imshome.com. The IMS interface is also used to upgrade MDrivePlus Speed Control firmware.

IMS Analog Speed Control features:

- Easy installation.
- Automatic detection of MDrivePlus version and communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Simple screen interface.

MDrive34*Plus²* SPEED CONTROL

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range		+12 to +75 VDC *Power supply current requirements = 4A (maximum) per MDrive34Plus.* *Actual power supply current will depend on voltage and load.*		
SPEED CONTROL	Input	Speed A1	0 to +5 VDC*, 0 to +10 VDC*, 4 to 20 mA, 0 to 20 mA		
		Speed A2	0 to +5 VDC*, 0 to +10 VDC*, 4 to 20 mA, 0 to 20 mA		
	A/D Resolution		10 bit		
LOGIC INPUT	Optically Isolated Inputs		Speed A1/Speed A2 Select or PWM (15 to 25 kHz), Start/Stop, Direction		
	Voltage Range		Sourcing or Sinking		+5 to +24 VDC
LOGIC OUTPUTS	Step Clock/Direction		Open Drain	Drain Source (Max)	+100 VDC
				Continuous Drain Current	100 mA
			Output Pulse Width software configurable		100 nSec to 12.8 µSec
MOTION	Oscillator Frequency (Max)		5 MHz		
	Microstep Resolution		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)
THERMAL	Operating Temperature		Heat Sink		–40° to +75°C (non-condensing)
			Motor		–40° to +90°C (non-condensing)

**10 kΩ potentiometer resistance.*

SETUP PARAMETERS

	Function	Range	Units	Default
ACCL	Acceleration	91 to 1.5 X 10^9	steps/second^2	1,000,000
C**	Joystick Center	1 to 1022	counts	0
CLK OUT	Clock Out	None, Step/Dir, Quadrature, Up/Down	—	None
DB**	Analog Deadband	0 to 255	counts	1
DECL	Deceleration	91 to 1.5 X 10^9	steps/second^2	1,000,000
DIR	Motor Direction Override	Clockwise (CW) / Counterclockwise (CCW)	—	CW
FAULT	Fault/Checksum Error	Error Code	—	None
FS**	Analog Full Scale	1 to 1023	counts	1023
HCDT	Hold Current Delay Time	HCDT + MSDT <= 65535	milliseconds	500
IF**	Analog Input Filter	1 to 1000	counts	1
IMODE	Source	Speed A1/Speed A2 or PWM 15 to 25 kHz	—	A1&A2
	Analog Input (Speeds A1&A2)	0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA	volts or current	0 to +5 VDC
MHC	Motor Hold Current	0 to 100	percent	5
MRC	Motor Run Current	1 to 100	percent	25
MSDT	Motor Settling Delay Time	MSDT + HCDT <= 65535	milliseconds	0
MSEL	Microstep Resolution	1, 2, 4, 5, 8, 10, 16, 25, 32, 50, 64, 100, 108, 125, 127, 128, 180, 200, 250, 256	µsteps per full step	256
STEPW	Step Width	0 (Square Wave), 100 nSec to 12.8 µSec	nSec	550 nSec
SSD	Stop/Start Debounce	0 to 255	milliseconds	0
VI	Initial Velocity	0 to <VM	steps/second	1000
VM	Maximum Velocity	VI to 5,000,000	steps/second	768,000
TEMP	Warning Temperature	0 to 85°C	°C	80°C
USER ID	User ID	Customizable	1–3 characters	IMS

***Separate analog inputs for Speeds A1 & A2.*

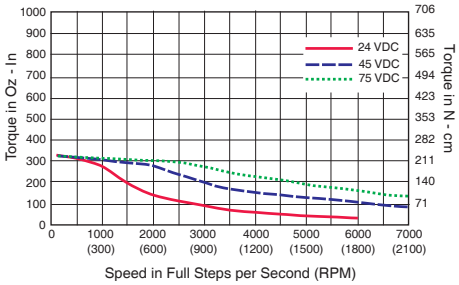
All parameters are set using the supplied IMS SPI Motor Interface GUI and may be changed on-the-fly.
An optional Communication Converter is recommended with first orders.

MOTOR SPECIFICATIONS

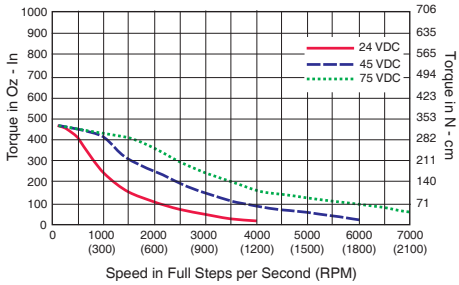
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	381 oz-in / 269 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec^2 / 1.0 kg-cm^2	4.1 lb / 1.9 kg
DOUBLE LENGTH	575 oz-in / 406 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec^2 / 1.6 kg-cm^2	5.5 lb / 2.5 kg
TRIPLE LENGTH	1061 oz-in / 749 N-cm	19.83 oz-in / 14.0 N-cm	0.04815 oz-in-sec^2 / 3.4 kg-cm^2	8.8 lb / 4.0 kg

MOTOR PERFORMANCE — Speed-Toruqe

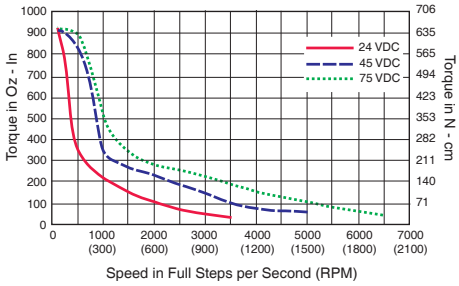
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



WIRE/PIN ASSIGNMENTS — MDrive34Plus² Speed Control

Flying Leads Interface

P1: I/O & POWER CONNECTOR		
Flying Leads Wire Colors	**Function**	
Violet	Stop/Start Input	
Blue	Direction Input	
White/Brown	Speeds A1/A2 Select or PWM Input	
White	Optocoupler Reference	
White/Orange	Step Clock Output	
White/Blue	Direction Output	
Yellow	Speeds A1/A2 +5 VDC Output (10K pot)	
Gray	Speeds A1/A2 Logic Ground (10K pot)	
Green	Speed A1 Control Input: 0-5V (10K pot)/0-10V (10K pot)/ 4-20mA/0-20mA	
White/Green	Speed A2 Control Input: 0-5V (10K pot) /0-10V (10K pot)/ 4-20mA/0-20mA	
Black	Power Ground	
Red	+V (+12 to +75 VDC)	
Encoder Option	Single-End Encoder	Differential Encoder
Yellow/Black	Ground	Ground
Yellow/Violet	Index	Index +
Yellow/Blue	Channel A	Channel A +
Yellow/Red	+5 VDC Input	+5 VDC Input
Yellow/Brown	Channel B	Channel B +
Yellow/Gray	—	Index –
Yellow/Green	—	Channel A –
Yellow/Orange	—	Channel B –

P2: COMM CONNECTOR (SPI)	
10-Pin IDC	**Function**
Pin 1	No Connect
Pin 2	No Connect
Pin 3	No Connect
Pin 4	SPI Chip Select
Pin 5	Communications Ground
Pin 6	+5 VDC Output
Pin 7	SPI Master Out – Slave In
Pin 8	SPI Clock
Pin 9	No Connect
Pin 10	SPI Master In – Slave Out

Pluggable Interface

P1: I/O CONNECTOR	
Wire Crimp	**Function**
Pin 1	Direction Output
Pin 2	Step Clock Output
Pin 3	Speeds A1/A2 Select or PWM Input
Pin 4	Stop/Start Input
Pin 5	Direction Input
Pin 6	Speed A1 Control Input: 0-5V (10K pot) /0-10V (10K pot)/ 4-20mA/0-20mA
Pin 7	Optocoupler Reference
Pin 8	Speed A2 Control Input: 0-5V (10K pot) /0-10V (10K pot)/ 4-20mA/0-20mA
Pin 9	Speed A1 Logic Ground (10K pot)
Pin 10	Speed A1 +5 VDC Output (10K pot)
Pin 11	Speed A2 +5 VDC Output (10k pot)
Pin 12	Speed A2 Logic Ground (10K pot)
Encoder Option	Differential Encoder
Pin 13	Ground
Pin 14	Channel A +
Pin 15	Channel A –
Pin 16	Channel B +
Pin 17	Channel B –
Pin 18	Index +
Pin 19	Index –
Pin 20	+5 VDC Input

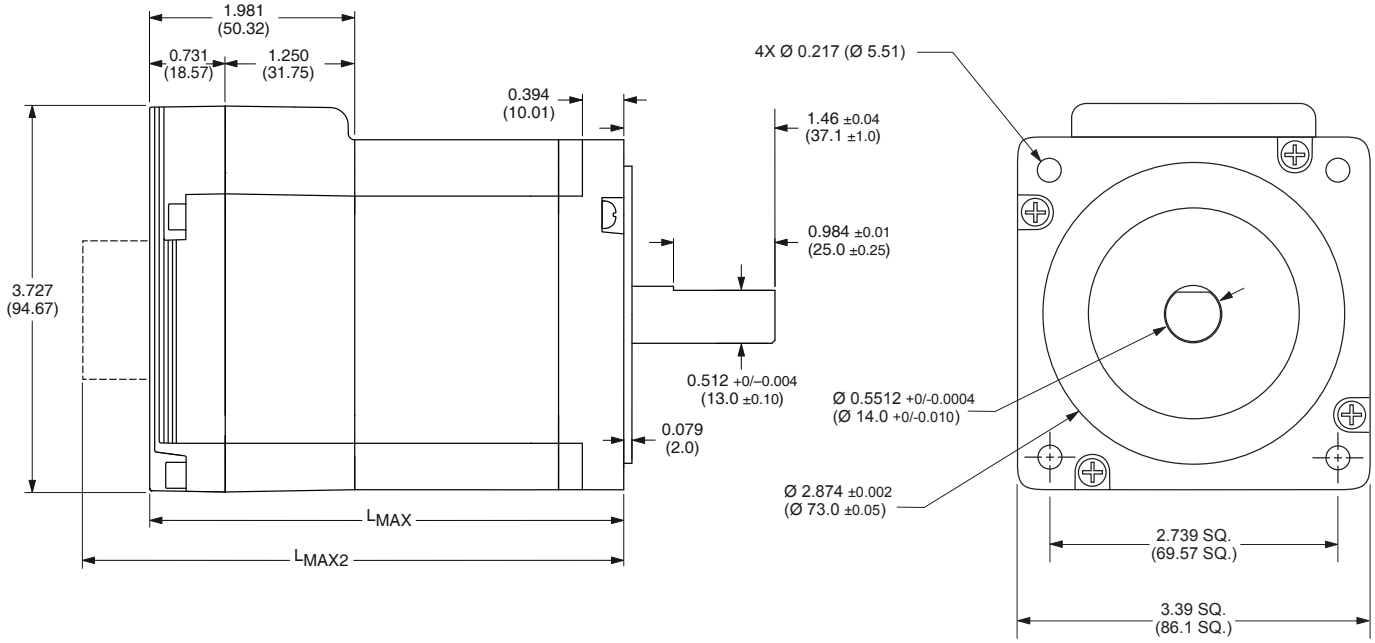
P2: COMM CONNECTOR (SPI)	
Wire Crimp	**Function**
Pin 1	No Connect
Pin 2	SPI Master In – Slave Out
Pin 3	SPI Master Out – Slave In
Pin 4	SPI Clock
Pin 5	Communications Ground
Pin 6	+5 VDC Output
Pin 7	No Connect
Pin 8	SPI Chip Select
Pin 9	No Connect
Pin 10	No Connect

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

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

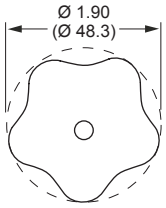
MDrive34Plus^2 Speed Control



MDrive Lengths *Inches (mm)*

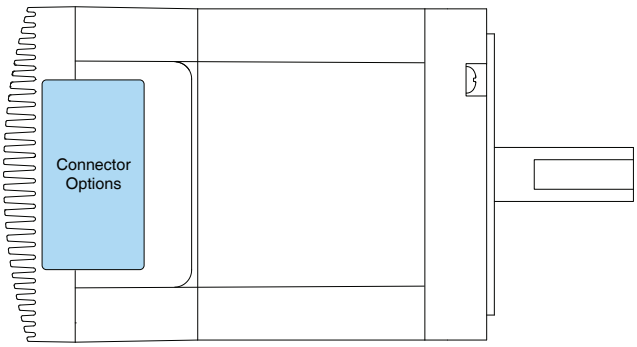
Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	LMAX2 CONTROL KNOB VERSION
Single	3.81 (96.77)	4.52 (114.81)
Double	4.60 (116.84)	5.31 (134.87)
Triple	6.17 (156.72)	6.88 (174.75)

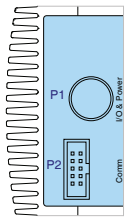
L_{MAX2} Option



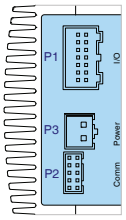
Control Knob

Connector Options

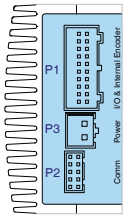




Flying Leads



Pluggable Locking Wire Crimp



Pluggable Locking Wire Crimp with Internal Encoder

Connectivity details:
www.imshome.com/cables_cordsets.html

CONNECTIVITY

QuickStart Kit
For rapid design verification, all-inclusive QuickStart Kits have communication converter, prototype development cable(s), instructions and CD for MDrivePlus initial functional setup and system testing.

Communication Converters
Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrivePlus via a PC's USB port. Length 12.0' (3.6m).
Mates to connector:
10-Pin IDC MD-CC300-001
10-Pin Wire Crimp MD-CC302-001

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:
12-Pin Wire Crimp PD12B-2334-FL3
20-Pin Wire Crimp PD20B-3400-FL3
2-Pin Wire Crimp PD02-3400-FL3

Mating Connector Kits
Use to build your own cables. Kits contain 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.
Mates to connector:
10-Pin Wire Crimp CK-02
12-Pin Wire Crimp CK-08
20-Pin Wire Crimp CK-11
2-Pin Wire Crimp CK-05
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDC CK-01

OPTIONS

Linear Actuator**
The MDrive34Plus² is offered with numerous linear actuator styles and options to satisfy a broad range of linear motion applications. Contact the factory for details or see: www.imshome.com/mdriveplus_linear_actuator.html

Internal Encoder
Internal optical encoders, single-end or differential† styles, are offered factory-mounted with MDrive34Plus² Speed Control products. Refer to the table below.

Line Count	100	200	250	256	400	500	512	1000	1024
Single-End part#	E1	E2	E3	EP	E4	E5	EQ	E6	ER
Differential part# †	EA	EB	EC	EW	ED	EH	EX	EJ	EY

†MDrives with pluggable interface available with Differential Encoder only.

Control Knob
The MDrive34Plus² Speed Control is available with a factory-mounted rear control knob for manual shaft positioning.

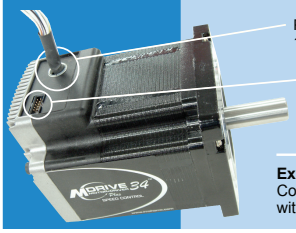
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive34Plus. Refer to details and part numbers on the back cover.

**Consult Factory for Availability.

Connectivity details: www.imshome.com/cables_cordsets.html

PART NUMBERING

Plus² flying leads interface



K **MDO3FSD34** ☐ **7 –** **OPTION**
QuickStart Kit details above
Motor
A = Single Length & Linear Actuator**
B = Double Length
C = Triple Length
P1: I/O & Power
12" Flying Leads
P2: Communications
10-Pin IDC Connector

Example #1: Part Number **MDM3FSD34A7** is an MDrive34Plus² Speed Control with 12" flying leads I/O & power interface, SPI communications with 10-pin IDC connector, and NEMA 34 single length motor.

Plus² pluggable interface

K **MDO3CSL34** ☐ **7 –** **OPTION**
QuickStart Kit details above
Motor
A = Single Length & Linear Actuator**
B = Double Length
C = Triple Length
P1: I/O
12-Pin Locking Wire Crimp
(20-Pin with Encoder Option)
P3: Power
2-Pin Locking Wire Crimp
P2: Communications
10-Pin Friction Lock Wire Crimp

Example #2: Part Number **MDO3CSL34A7** is an MDrive34Plus² Speed Control with 12-pin I/O interface, 2-pin power connector, 10-pin SPI communications connector, and NEMA 34 single length motor.

***Consult Factory for Availability.*

OPTIONS

Linear Actuator**
–L
For complete product specifications, see: www.imshomecom/mdriveplus_linear_actuator.html

Internal Encoder
–E ☐
Refer to encoder specifications table for line counts and part numbers.
Example: **MDO3CSL34A7–EH** adds an internal 500-line count differential optical encoder with index mark to example #2, which is interfaced via a 20-pin friction lock wire crimp connector at P1.

Control Knob
–N
Example: **MDO3CSL34A7–N** adds a rear control knob for manual positioning to example #2.

Planetary Gearbox
–G ☐☐☐ **–** **F**
Refer to gearbox page for complete table of ratios and part numbers.
Optional NEMA Flange
Example: **MDO3CSL34A7–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

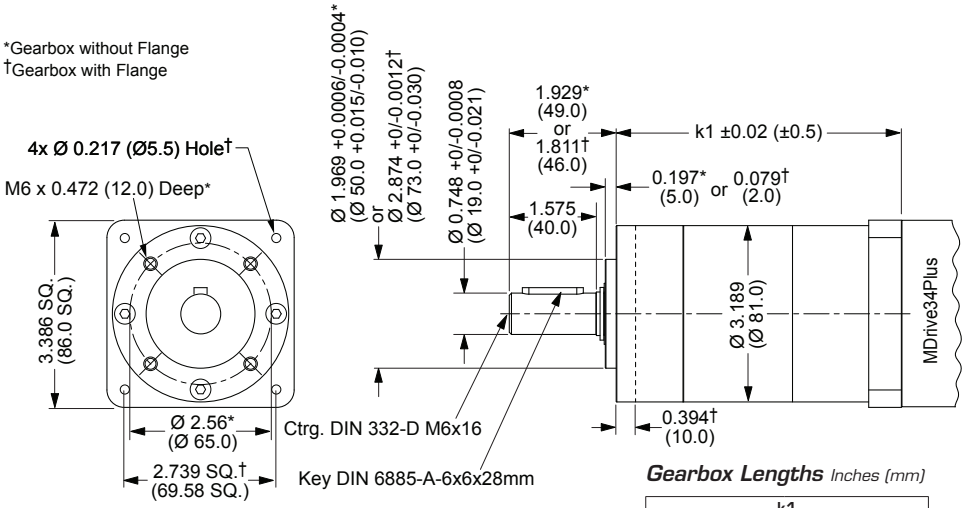
The MDrive34Plus is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large number 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
1-STAGE	2832/20.0	0.80	1.0°	90/400	18/80	64.4/1827	66.7/1890
2-STAGE	8496/60.0	0.75	1.5°	135/600	27/120	89.5/2538	92.6/2625
3-STAGE	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)



Gearbox Lengths *Inches (mm)*

	k1	
	GEARBOX*	with FLANGE†
1-Stage	4.315 (109.6)	4.433 (112.6)
2-Stage	5.169 (131.3)	5.287 (134.3)
3-Stage	6.024 (153.0)	6.142 (156.0)

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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