



MDRIVE 23™ MOTOR+DRIVER *Plus* MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver and NEMA 23 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
- Optically Isolated Input Options:
 - Universal +5 to +24 VDC Signals, Sourcing or Sinking
 - Differential +5 VDC Signals
- Automatic Current Reduction
- Configurable:
 - Motor Run/Hold Current
 - Motor Direction vs. Direction Input
 - Microstep Resolution
 - Clock Type: Step and Direction, Quadrature, Step Up and Step Down, Clockwise and Counterclockwise
 - Programmable Digital Filtering for Clock and Direction Inputs
- Available Options:
 - Long Life Linear Actuators**
 - Encoder: External Optical or Internal Magnetic
 - Integrated Planetary Gearbox
 - Control Knob for Manual Positioning
 - Linear Slide
 - IP65 Sealed Configuration with M23 Circular Connector¹
- 3 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Interface Options:
 - Pluggable Locking Wire Crimp
 - Pluggable Terminal Strip
 - 12.0" (30.5cm) Flying Leads
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

DESCRIPTION

The **MDrive23Plus Microstepping** high torque integrated motor and step and direction driver is ideal for designers who want the simplicity of a motor with on-board electronics. The integrated electronics of the MDrive23Plus eliminate the need to run motor cabling through the machine, reducing the potential for problems due to electrical noise.

The unsurpassed smoothness and performance delivered by the MDrive23-Plus Microstepping 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 MDrive23Plus 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.

The MDrive23Plus uses a NEMA 23 frame size high torque brushless step motor integrated with a microstepping driver, and accepts up to 20 resolution settings from full to 256 microsteps per full step, including: degrees, metric and arc minutes. These settings may be changed on-the-fly or downloaded and stored in nonvolatile memory with the use of a simple GUI which is provided. This eliminates the need for external switches or resistors. Parameters are changed via an SPI port.

For use in environments where exposure to chemical, dust and liquids may occur, a sealed MDrive23Plus-65 Microstepping

unit with 19-pin M23 circular connector meets IP65 specifications.¹

The versatile MDrive23Plus Microstepping is available in multiple configurations to fit various system needs. Rotary motor versions come in three lengths and may include an encoder, control knob, planetary gearbox or linear slide. Long life Acme screw linear actuators** are also available.

Numerous connector styles give you choices for the best fit and features. Select from 12.0" (30.5cm) flying leads, pluggable terminal strip, locking wire crimp connectors, and M23 circular connectors on IP65 sealed versions¹.

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 MDrive23Plus 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 Motor Interface software is an easy to install and use GUI for configuring the MDrive23Plus from a computer's USB port. GUI access is via the IMS SPI Motor Interface available at www.imshome.com.

The IMS SPI Motor Interface features:

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

**Consult Factory for Availability.

¹Not available with Differential Input option.

MDrive23Plus MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	+12 to +75 VDC Power supply current requirements = 2A (maximum) per MDrive23Plus. Refer to illustration. Actual power supply current will depend on voltage and load.	
ISOLATED INPUT	Universal	Voltage Range: +5 to +24 VDC Sourcing or Sinking	
	Differential	Voltage Range: +5 VDC	
MOTION	Digital Filter Range	50 nS to 12.9 μ S (10 MHz to 38.8 kHz)	
	Clock Types	Step/Direction, Quadrature, Step Up/Step Down, Clockwise/Counterclockwise	
	Step Frequency	2 MHz Default / 5 MHz Max	
	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/ μ step), 21600 (1 arc minute/ μ step), 25400 (0.001mm/ μ step)
THERMAL	Operating Temperature	Heat Sink	-40° to +85°C (non-condensing)
		Motor	-40° to +100°C (non-condensing)

SETUP PARAMETERS

	Function	Range	Units	Default
MHC	Motor Hold Current	0 to 100	percent	5
MRC	Motor Run Current	1 to 100	percent	25
MSEL	Microstep Resolution	1, 2, 4, 5, 8, 10, 16, 25, 32, 50, 64, 100, 108, 125, 127, 128, 180, 200, 250, 256	μ steps per full step	256
DIR	Motor Direction Override	0/1	—	CW
HCDT	Hold Current Delay Time	0 or 2-65535	mSec	500
CLK TYPE	Clock Type	Step/Dir, Quadrature, Up/Down, CW/CCW	—	Step/Dir
CLK IOF	Clock and Direction Filter	50 nS to 12.9 μ S (10 MHz to 38.8 kHz)	nS (MHz)	200 nS (2.5 MHz)
USER ID	User ID	Customizable	1-3 characters	IMS
EN ACT	Enable Active	High/Low	—	High

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	90 oz-in / 64 N-cm	3.9 oz-in / 2.7 N-cm	0.0025 oz-in-sec ² / 0.18 kg-cm ²	21.6 oz / 612.3 g
DOUBLE LENGTH	144 oz-in / 102 N-cm	5.6 oz-in / 3.92 N-cm	0.0037 oz-in-sec ² / 0.26 kg-cm ²	26.4 oz / 748.4 g
TRIPLE LENGTH	239 oz-in / 169 N-cm	9.7 oz-in / 6.86 N-cm	0.0065 oz-in-sec ² / 0.46 kg-cm ²	39.2 oz / 1111.3 g

ENCODER PIN ASSIGNMENTS

External Encoder

Pluggable Interface	DIFFERENTIAL ENCODER <i>with locking connector feature</i>	SINGLE-END ENCODER
	Function	Function
Pin 1	No Connect	Ground
Pin 2	+5 VDC Input	Index
Pin 3	Ground	Channel A
Pin 4	No Connect	+5 VDC Input
Pin 5	Channel A -	Channel B
Pin 6	Channel A +	
Pin 7	Channel B -	
Pin 8	Channel B +	
Pin 9	Index -	
Pin 10	Index +	

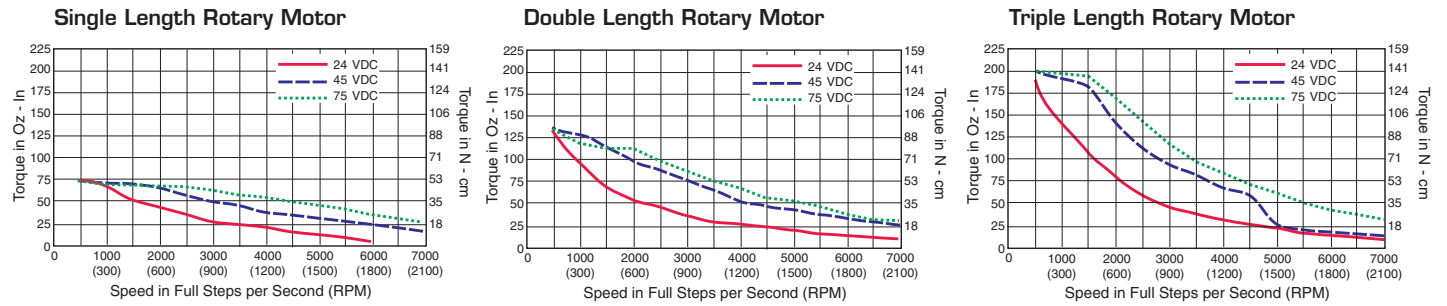
Optional encoder cables are available.

Internal Encoder

An internal differential encoder option is available on MDrive23Plus Microstepping regular and IP65 sealed versions.

See Wire/Pin Assignments on the following page for connection details.

MOTOR PERFORMANCE — Speed-Torque



WIRE/PIN ASSIGNMENTS — MDrive23Plus Microstepping

Plus

P1: I/O & POWER CONNECTOR				
Pluggable Terminal Strip	Flying Leads Wire Colors	Pluggable Locking Wire Crimp**	Function	
			Universal Input	Differential Input <i>Clockwise/Counterclockwise</i>
Pin 1	White	Pin 3	Optocoupler Reference	CW +
Pin 2	—	—	No Connect	No Connect
Pin 3	Orange	Pin 4	Step Clock Input	CW –
Pin 4	Blue	Pin 6	CW/CCW Direction Input	CCW –
Pin 5	Brown	Pin 5	Enable Input	CCW +
Pin 6	Black	Pin 1	Power Ground	Power Ground
Pin 7	Red	Pin 2	+V (+12 to +75 VDC)	+V (+12 to +75 VDC)
		Pin 7	+5 VDC Output	+5 VDC Output
		Pin 8	SPI Clock	SPI Clock
		Pin 9	Communications Ground	Communications Ground
		Pin 10	SPI Master Out – Slave In	SPI Master Out – Slave In
		Pin 11	SPI Chip Select	SPI Chip Select
		Pin 12	SPI Master In – Slave Out	SPI Master In – Slave Out

Plus-65 (sealed)

P1: I/O, POWER & COMM CONNECTOR	
M23 Circular (Male)	Function
Pin 1	Optocoupler Reference
Pin 2	Enable Input
Pin 6	+V (+12 to +75 VDC)
Pin 8	SPI Master Out – Slave In
Pin 9	SPI Chip Select
Pin 10	+5 VDC Output
Pin 11	Communications Ground
Pin 12	Shell Connect
Pin 13	CW/CCW Direction Input
Pin 16	SPI Clock
Pin 17	SPI Master In – Slave Out
Pin 18	Step Clock Input
Pin 19	Power Ground

Pins below are No Connect unless populated for encoder option.

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

***The 12-Pin Pluggable Locking Wire Crimp connector at P1 eliminates the P2 connector.*

Optional Internal Differential Encoder	
Pin 3	Index +
Pin 4	Channel B +
Pin 5	Channel B –
Pin 7	Channel A +
Pin 14	Index –
Pin 15	Channel A –

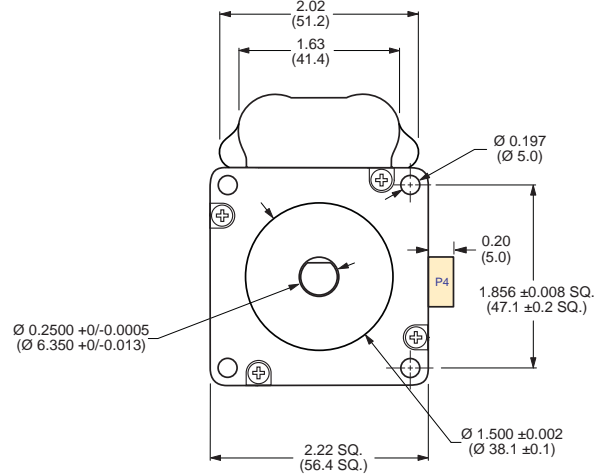
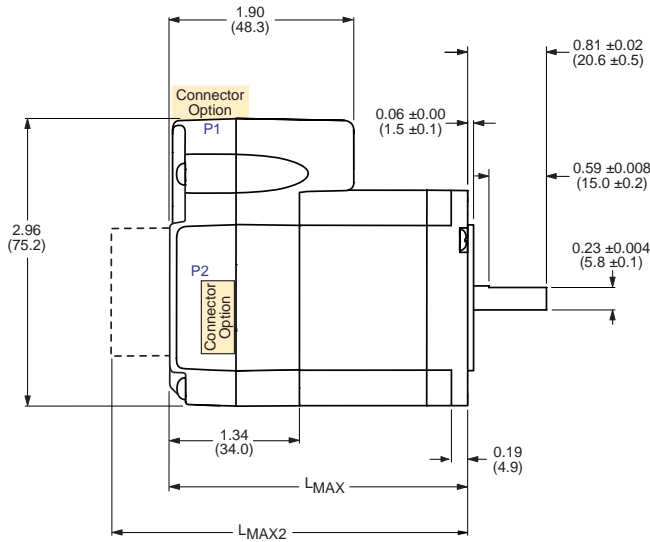
P4: OPTIONAL INTERNAL DIFFERENTIAL ENCODER	
10-Pin Wire Crimp	Function
Pin 1	Ground
Pin 2	Channel A +
Pin 3	Channel A –
Pin 4	Channel B +
Pin 5	Channel B –
Pin 6	Index +
Pin 7	Index –
Pin 8	No Connect
Pin 9	No Connect
Pin 10	No Connect

An optional encoder cable is available.

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

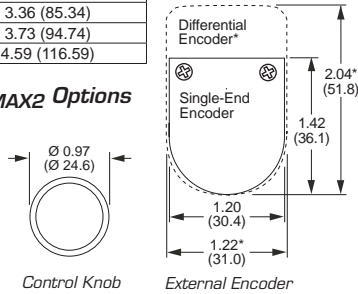
MDrive23Plus Microstepping



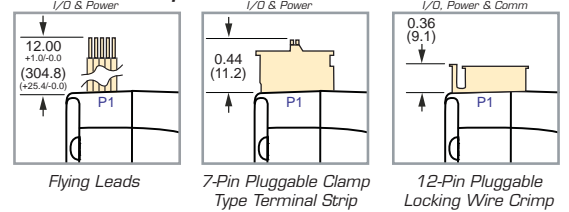
MDrive Lengths Inches (mm)

Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER, or LINEAR ACTUATOR	LMAX2 CONTROL KNOB or EXTERNAL ENCODER
Single	2.65 (67.31)	3.36 (85.34)
Double	3.02 (76.71)	3.73 (94.74)
Triple	3.88 (98.55)	4.59 (116.59)

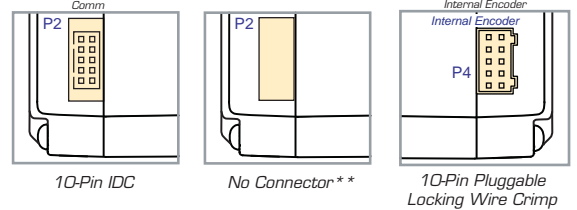
LMAX2 Options



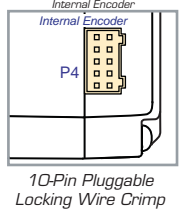
P1 Connector Options



P2 Connector Options

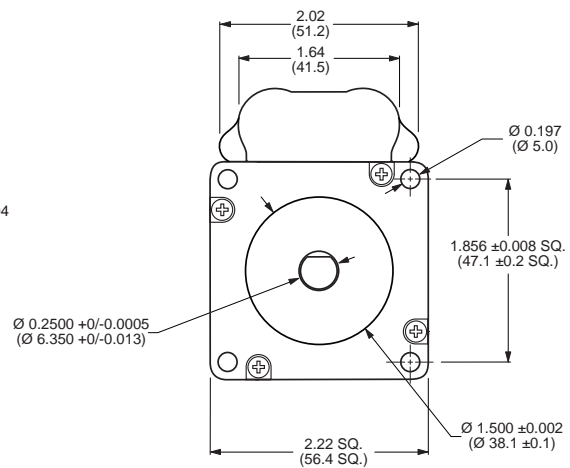
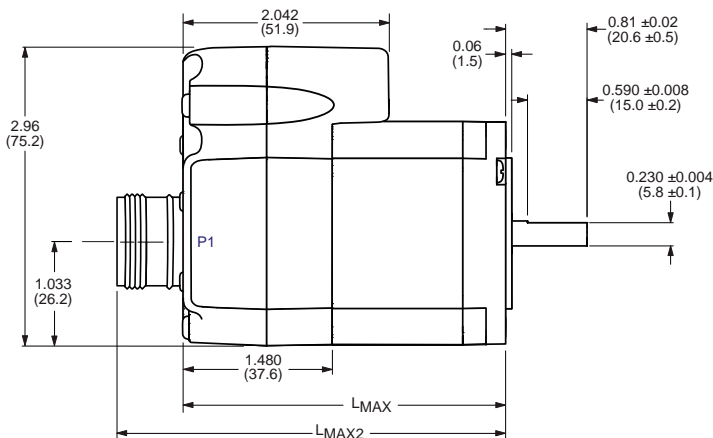


P4 Option



**12-Pin Pluggable Locking Wire Crimp connector at P1 eliminates the P2 connector.

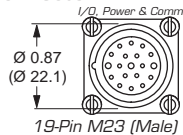
MDrive23Plus-65 Microstepping (sealed)



Sealed MDrive Lengths Inches (mm)

Motor Length	LMAX	LMAX2
Single	2.82 (71.63)	3.48 (88.39)
Double	3.16 (80.26)	3.82 (97.03)
Triple	4.02 (102.11)	4.67 (118.62)

Connector



ORDER INFORMATION — MDrive23Plus Microstepping

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 IDCMD-CC300-001
12-Pin Wire CrimpMD-CC303-001
19-Pin M23 (sealed version)MD-CC301-001

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 CrimpPD12-1434-FL3
For IP65 sealed versions, single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0" (4.0m).
19-Pin M23
Straight TerminationMD-CS100-000
Right Angle TerminationMD-CS101-000

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:

12-Pin Wire CrimpCK-03
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDCCK-01

** Consult Factory for Availability.

‡ Not Available with Sealed -65 Versions.

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

OPTIONS

Linear Actuator**

The MDrive23Plus 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

External Encoder‡

External optical encoders, single-end or differential, are offered factory-mounted with the MDrive23Plus. All encoders come with an index mark. 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#	EAL	EBL	ECL	EWL	EDL	EHL	EXL	EJL	EYL

Optional encoder cables are available. Order separately.

Single-end Cable (12.0"/30.5cm) ES-CABLE-2

Differential Locking Cable (6.0"/1.8m) ED-CABLE-6

Internal Encoder

Internal differential magnetic encoders with index mark are options with regular and IP65 sealed versions.

Line Count	100	200	250	256	400	500	512	800	1000
Differential part#	EAM	EBM	ECM	EWL	EDM	EHL	EXM	EFM	EJM

An optional encoder cable, mating to the regular version's 10-pin wire crimp connector, is available. Order separately.

Internal Encoder Cable (6.0"/1.8m) ED-CABLE-JST10

Control Knob‡

The MDrive23Plus 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 MDrive23Plus. Refer to details and part numbers on the back cover.

Linear Slide

Integrated linear slides are available factory installed for precision linear movement. Screw leads are 0.1", 0.2", 0.5" or 1.0" of travel per rev. Slides are 12.0" (30.5cm) to 36.0" (91.44cm) long. Contact factory for custom lengths. Refer to separate datasheet or web site for complete details.

PART NUMBERING

Plus
base version

K **MDM** **S** **23** **7** - **OPTION**

QuickStart Kit
details above

Input Version
1 = Universal
5 = Differential

P1: I/O & Power
F = 12" Flying Leads
P = Pluggable Clamp Type Terminal Strip
C = 12-Pin Locking Wire Crimp (Includes I/O, Power & Comm)

P2: Communications
D = SPI with 10-Pin IDC Connector
Z = None. Used with 12-Pin Locking Wire Crimp in Position P1, which includes Communications.

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

Example #1: Part Number **MDM1PSD23A7** is an MDrive23Plus Microstepping with pluggable I/O & power interface, SPI communications with 10-pin IDC connector, and NEMA 23 single length motor.

Plus - 65
IP65 sealed

K **MDM2MSZ23** **7** - **OPTION**

QuickStart Kit
details above

P1: I/O, Power & Communications
19-Pin M23 Circular Connector

Motor
A = Single Length
B = Double Length
C = Triple Length

Example #2: Part Number **MDM2MSZ23B7** is an MDrive23Plus-65 Microstepping sealed with IP65 rating, 19-pin M23 I/O, power and communications circular connector, and NEMA 23 double length motor.

**Consult Factory for Availability.

OPTIONS

Linear Actuator** -L
For complete product specifications, see: www.imshome.com/mdriveplus_linear_actuator.html

External Encoder -E
Refer to external encoder table for line counts and part numbers.
Example: **MDM1PSD23A7-EHL** adds an external 500-line count differential optical encoder with index mark to example #1.
Not available with sealed -65 versions.

Internal Encoder -E
Refer to internal encoder table for line counts and part numbers.
Example: **MDM1PSD23A7-ECM** adds an internal 250-line count differential magnetic encoder with index mark to example #1.

Control Knob -N
Example: **MDM1PSD23A7-N** adds a rear control knob for manual positioning to example #1. Not available with sealed -65 versions.

Planetary Gearbox -G -F
Refer to gearbox page for complete table of ratios and part numbers.
Example: **MDM1PSD23A7-G1A2** adds a 1-stage planetary gearbox with 5.18:1 ratio to example #1. Add -F for optional NEMA flange.

Linear Slide -R
Screw Lead (inches/rev)
A = 0.10" (2.54mm)
B = 0.20" (5.08mm)
C = 0.50" (12.7mm)
D = 1.00" (25.4mm)
Standard Screw Lengths
12", 18", 24" or 36"
For Custom Lengths, Consult Factory
Example: **MDM1PSD23A7-RA12** adds a Linear Slide with 0.10" screw lead, 12" long to example #1.

MDrive23PLUS WITH PLANETARY GEARBOX

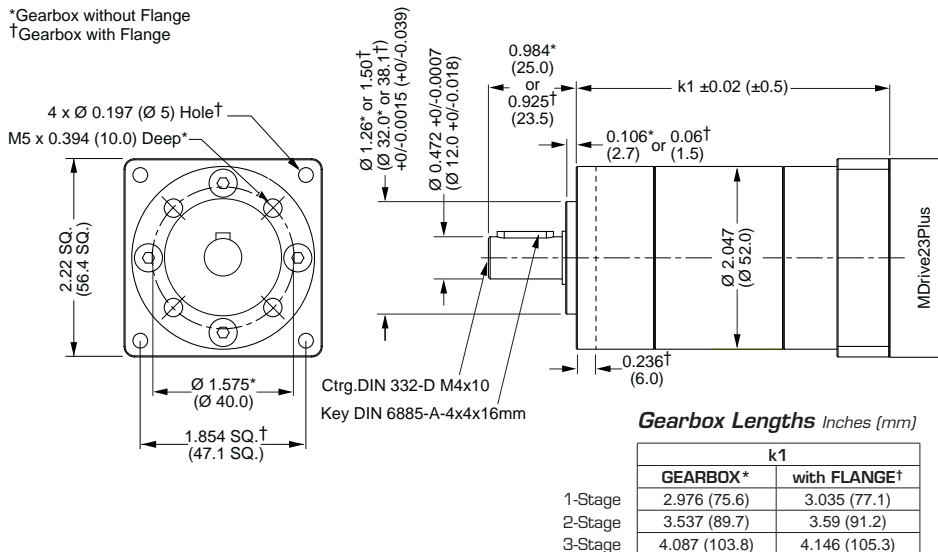
The MDrive23Plus is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large number 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 MDrive23Plus 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	566/4.0	0.80	0.70°	45/200	13/60	25.0/711	25.9/735
2-STAGE	1699/12.0	0.75	0.75°	72/320	22/100	32.2/914	33.3/945
3-STAGE	3540/25.0	0.70	0.80°	101/450	34/150	39.4/1117	40.7/1155

Planetary Gearbox for MDrive23Plus

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.

U.S.A. SALES OFFICES

Eastern Region

Tel. 862 208-9742 - Fax 973 661-1275
e-mail: jroake@imshome.com

Central Region

Tel. 260 402-6016 - Fax 419 858-0375
e-mail: dwaksman@imshome.com

Western Region

Tel. 602 578-7201
e-mail: dweisenberger@imshome.com

IMS ASIA PACIFIC OFFICE

30 Raffles Pl., 23-00 Caltex House, Singapore 048622
Tel. +65/6233/6846 - Fax +65/6233/5044
e-mail: wlee@imshome.com

IMS EUROPEAN SALES MANAGEMENT

4 Quai Des Etoits
69005 Lyon, France
Tel. +33/4 7256 5113 - Fax +33/4 7838 1537
e-mail: bmartinez@imshome.com

IMS UK Ltd.

Sanderson Centre, 15 Lees Lane
Gosport, Hampshire PO12 3UL
Tel. +44/0 2392-520775 - Fax +44/0 2392-502559
e-mail: mcheckley@imshome.com

TECHNICAL SUPPORT

Tel. +00 (1) 860 295-6102 - Fax +00 (1) 860 295-6107
e-mail: etech@imshome.com

Intelligent Motion Systems, Inc.

370 North Main Street, P.O. Box 457
Marlborough, CT 06447 - U.S.A.
Tel. +00 (1) 860 295-6102 - Fax +00 (1) 860 295-6107
e-mail: info@imshome.com
http: //www.imshome.com