

MDRIVE® AccuStep 23

STEP • TORQUE • SPEED

MDrive® AccuStep™ motion systems, technology leading all-in-one brushless step motors with integrated electronics, feature revolutionary new control technology that prevents loss of synchronization due to transient or continued overload, extreme acceleration or deceleration, or excessive slew speed.

MDrive AccuStep motion systems react quickly to large changes in loads without loss of synchronization, delivering the performance of brush, brushless and servo motors in a lower cost solution. Additional benefits include:

- No tuning;
- Higher inertia mismatch allowed;
- High starting torque;
- Smooth motion, even at extremely slow speeds.

The product's enhanced performance is accomplished using a cost effective step motor, while eliminating associated disadvantages. AccuStep control technology benefits include:

- Eliminating loss of synchronization;
- Allowing full use of motor's torque;
- Allowing maximum acceleration, deceleration and move times;
- Maintaining constant motor torque *with torque mode*;
- Access to internal encoder signals;
- Reduced motor heating *with variable current control*;
- Eliminates impact of system resonance.

MDrive AccuStep motion systems also allow the motor to handle large fluctuations in loads even at high rates of change.

The MDrive AccuStep Step•Torque•Speed version offers three (3) operating modes:

- **Step:** microstepping step and direction including clockwise/counterclockwise and quadrature inputs;
- **Torque:** maintains constant motor torque set either in software or the analog input;
- **Speed:** delivers accurate velocity control with a choice of three input voltage ranges.

The MDrive AccuStep 23 features a NEMA 23 1.8° brushless step motor with highly integrated microstepping driver, eliminating the need to run motor cabling through the machine and thereby reducing the potential for problems due to electrical noise. A rugged, internal magnetic encoder comes standard with index mark and signals made available for external use and a choice of line counts.

The MDrive AccuStep 23 accepts a broad input voltage range from +12 to +60 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.

MDrive AccuStep motion systems communicate over RS-422/485. An AccuStep GUI is provided for ease of installing and configuring this product's three (3) operating modes.

The MDrive AccuStep 23 is available in 4 rotary motor lengths. Options may include a control knob, planetary gearbox, linear actuator* or IP-65 rating*. Connectivity options range from all-inclusive Quick-Start Kits to individual interfacing cables and mating connector kits to build your own cables. *See pg 5.*

With AccuStep control technology, there is now a low cost alternative where brushless technology is required. When you combine its flexible operating environment and long list of features, the integrated motor technology of MDrive AccuStep offers clear advantages in a very cost effective package for a large range of motion control applications.

AccuStep™

AccuStep is a revolutionary control technology that, when applied to step motors, prevents the loss of synchronization due to transient or continued overload, extreme acceleration or deceleration, or excessive slew speed.

AccuStep control technology continually monitors the relationship between the rotor and stator at sub-microsecond intervals, and will not allow that relationship to exceed the point where synchronization is lost.

Variable current control can be enabled to allow only the required current necessary to perform the task, further enhancing performance and efficiency.

*Consult factory for availability.

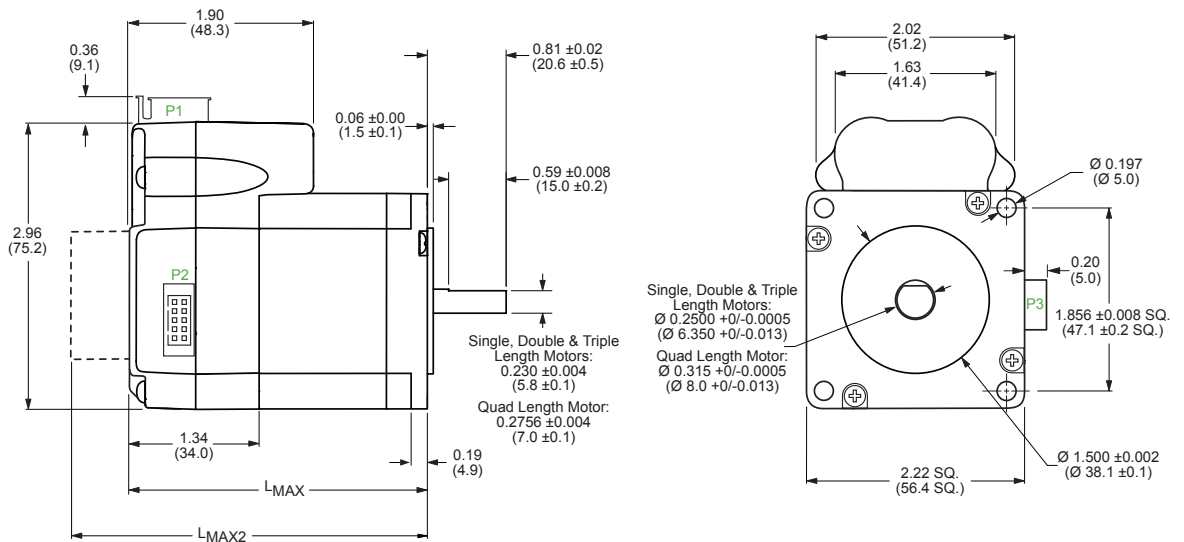
MDrive AccuStep 23 Step•Torque•Speed

MDrive AccuStep motion systems offer clear advantages in a very cost effective package for a wide range of motion control applications such as:

- Point-to-point positioning
 - Reduce motor frame size requirement
- Conveyor control
 - No loss of synchronization
 - Adapts to sudden load changes
- Drilling
 - Variable torque
- Web handling
 - Tension control
- Hydraulic and pneumatics replacement
 - Low cost
 - Accurate and variable positioning
- Rotary and linear positioning to torque specification
 - Container capping
 - Clamping / holding
 - Screw tightening
- On-the-fly product marking (labeling)
 - High acceleration and deceleration rates

Mechanical specifications

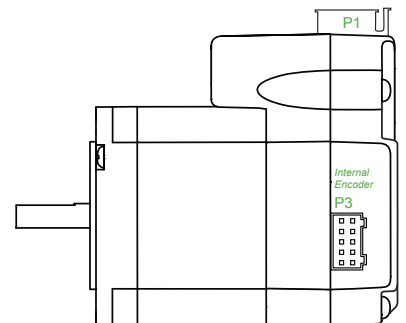
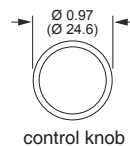
Dimensions in Inches (mm)



MDrive AccuStep lengths Inches (mm)

Motor length	LMAX	LMAX2
	with single shaft or internal encoder	with control knob
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)
Quad	5.28 (134.15)	5.99 (152.19)

LMAX2 option

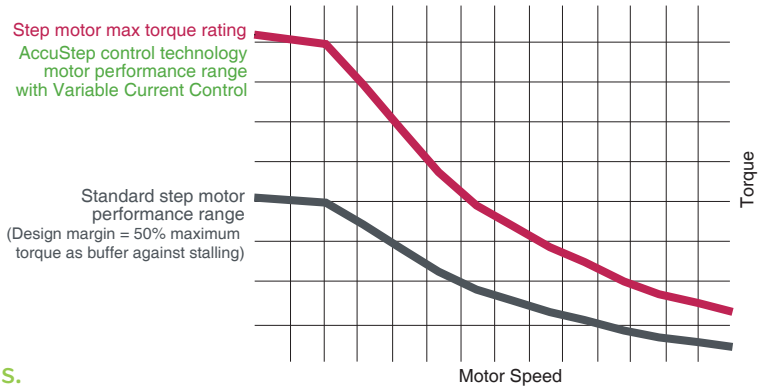


Speed-torque performance

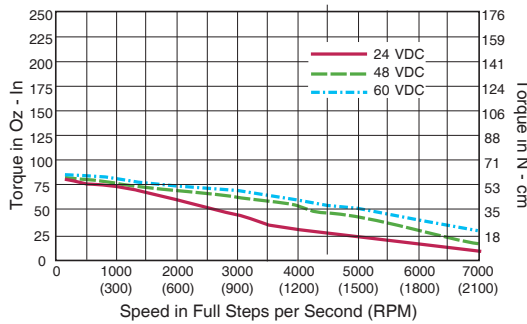
AccuStep revolutionary control technology allows full use of a step motor's maximum torque rating;

eliminates derating of up to 50%

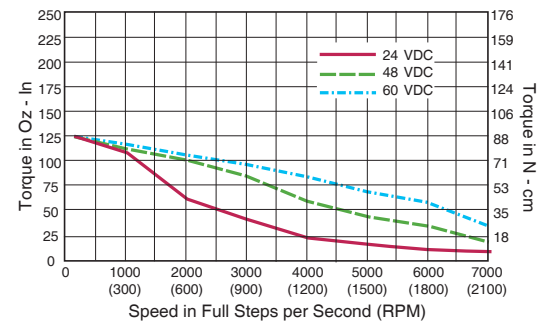
as buffer against stalling of standard step motor systems.



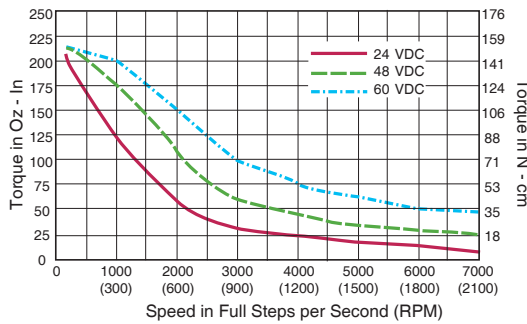
Single length motor speed-torque curves



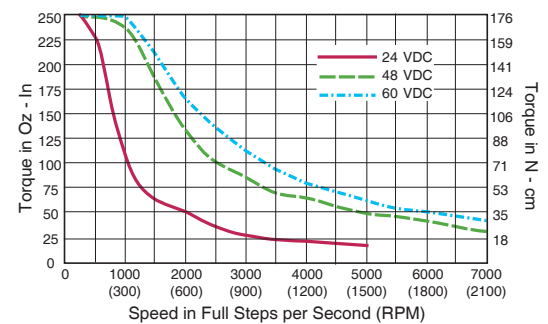
Double length motor speed-torque curves



Triple length motor speed-torque curves



Quad length motor speed-torque curves



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
Quad length	283 oz-in / 200 N-cm	14.2 oz-in / 10.0 N-cm	0.0108 oz-in-sec ² / 0.76 kg-cm ²	61.6 oz / 1746.3 g

MDrive AccuStep 23 Step•Torque•Speed

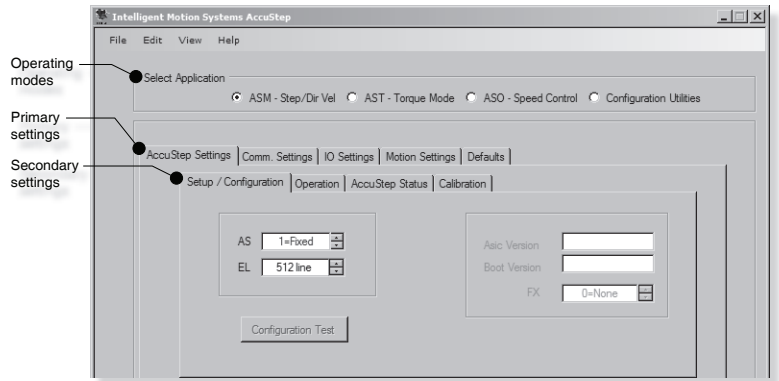
Standard specifications

Input voltage (+V)	Range	+12 to +60 VDC	Power supply current requirements = 3.5A (max)		
Isolated input	Voltage range	+5 to +24 VDC sourcing or sinking			
Communication	Type	RS-422/485			
	Baud rate	4.8 to 115.2kbps			
Motion	Digital filter range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)			
	Clock types (Step mode)	Step/Direction, Quadrature, Step Up/Step Down			
	Step frequency	5 MHz maximum			
		100 ns minimum pulse width			
	Closed loop configuration	Internal magnetic encoder	Resolutions 100, 200, 250, 256, 400, 500, 512, 1000		
Microstep resolution	Number of settings	20			
		Steps per revolution	Binary	200, 400, 800, 1600, 3200, 6400, 12800, 25600, 51200, 36000 (0.01 deg/μstep), 21600 (1 arc minute/μstep), 25400 (0.001mm/μstep)	
			Decimal	1000, 2000, 5000, 10000, 20000, 25000, 40000, 50000	
Thermal	Operating temperature	Heat sink	-40° to +85°C (non-condensing)		
		Motor	-40° to +100°C (non-condensing)		

Setup parameters

An AccuStep configuration GUI is provided for ease of setup and configuring your device. The image (right) depicts the GUI's main screen with choice of operating mode, primary and secondary parameter settings.

Note that available settings vary with each one of the three operating modes. Shown below is an overview of all settings with general descriptions. More detailed information is covered in the product manual.



Operating Mode (Select Application)	Select: Step & Direction (ASM), Torque Control (AST) or Speed Control (ASO)	
AccuStep Settings	Setup/Configuration	Turn AccuStep off or on in fixed or variable mode; set and confirm encoder line count
	Operation	Set control bounds for motor torque and speed, lead, lag, and make-up of lost steps
	AccuStep Status	Display status alerts of 8 pre-programmed fields, read-only
	Calibration	To maintain synchronization, select options for motor's rotor-to-stator physical position
Analog Settings	Set analog ranges, select input mode: 0-5V, 0-10V, -10 to +10V (not applicable for Step mode)	
Communication Settings	Set baud rate; enable/disable parity mode and features; Check Sum integrity quality assurance	
I/O Settings	Clock and filter settings; Attention Output with 11 pre-programmed fields to select among	
Motion Settings	All operating modes	Set various motion settings, which vary with the operating mode selected ex. Current, MSEL
	Speed control mode	Additional settings: for setting acceleration, deceleration, velocity and flags
Defaults	Restore system defaults or previously stored settings; view current communication settings	

Interface pin assignments

P1 I/O and power connector	
12-pin locking wire crimp	Function
Pin 1	Power ground
Pin 2	+V (+12 to +60 VDC)
Pin 3	Optocoupler reference
Pin 4	Motion
Pin 5	Enable input
Pin 6	CW/CCW direction input
Pin 7	Aux-Power
Pin 8	Attention output emitter
Pin 9	Attention output collector
Pin 10	Analog
Pin 11	Ground
Pin 12	+5 VDC output

P2 Communication connector	
10-pin friction lock wire crimp	Function
Pin 1	TX +
Pin 2	Communication ground
Pin 3	RX -
Pin 4	TX -
Pin 5	Communication ground
Pin 6	RX +
Pin 7	RX +
Pin 8	RX -
Pin 9	TX +
Pin 10	TX -

P3 Internal encoder	
10-pin locking 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

Order information

Connectivity

QuickStart Kit

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

Communication Converters

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

Mates to:

P2 connectorMD-CC402-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads opposite end. P1 & P2 cable lengths 10.0' (3.0m), P3 cable length 6.0' (1.8m).

Mates to:

P1 connectorPD12-1434-FL3
 P2 connectorPD10-1434-FL3
 P3 connectorED-CABLE-JST10

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:

P1 connectorCK-03
 P2 connectorCK-02
 P3 connectorCK-13

Options

Linear Actuator

Integrated MDrive non-captive shaft and external shaft linear actuators are available with AccuStep control technology. Contact the factory for product specifications.

Control Knob

MDrive AccuStep 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 MDrive AccuStep. Refer to details and part numbers on the back cover.


Encoder

Internal Magnetic Encoder

MDrive AccuStep products include an internal differential magnetic encoder with index mark and signals made available for external use. A choice of resolutions, from 100 to 1000 lines, are available.

NOTE: AccuStep control performance is optimized at the higher resolution selections.

Part numbering



K **MAM3CRL23** **6** - **E** **M** - **OPTION**

QuickStart Kit details above

Motor length
 A = single
 B = double
 C = triple
 D = quad

Internal differential magnetic encoder line count
 A = 100
 B = 200
 C = 250
 W = 256
 D = 400
 H = 500
 X = 512
 J = 1000

P1: I/O and power
 12-pin locking wire crimp connector

P2: RS-422/485 communication
 10-pin friction lock wire crimp connector

P3: Internal encoder (not shown)
 10-pin locking wire crimp connector

Example #1: **MAM3CRL23A6-EAM** is an MDrive AccuStep 23 Step • Torque • Speed with locking wire crimp I/O and power interface, RS-422/485 communication via a friction lock crimp connector, NEMA 23 single length motor, 100 line count internal differential magnetic encoder.

Options

Linear Actuator **-L**
 Contact factory for availability.

Control Knob **-N**
 Ex: **MAM3CRL23A6-EAM-N** adds a rear control knob for manual positioning to example #1.

Planetary Gearbox **-G** **-F**
 Refer to gearbox page for complete table of ratios and part numbers. **Optional NEMA Flange**
 Ex: **MAM3CRL23A6-EAM-G1A2** adds 1-stage planetary gearbox with 5.18:1 ratio to example #1. Add -F for optional NEMA flange.

Planetary gearbox

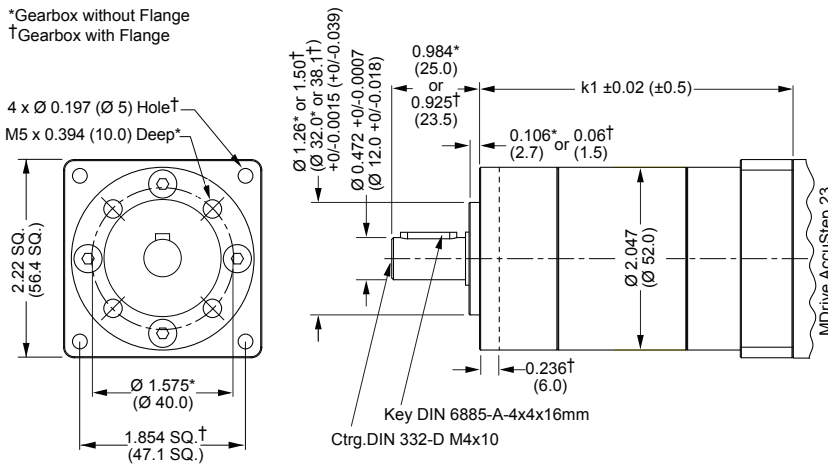
The MDrive AccuStep 23 is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large 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.

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

Dimensions in inches (mm)

*Gearbox without Flange
†Gearbox with Flange



Gearbox lengths in inches (mm)

	k1	
	Gearbox*	with Flange†
1-Stage	2.976 (75.6)	3.035 (77.1)
2-Stage	3.537 (89.7)	3.59 (91.2)
3-Stage	4.087 (103.8)	4.146 (105.3)

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 AccuStep 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 Chevron House, Singapore 048622
Tel. +65/6233/6846 - Fax +65/6233/5044
e-mail: wlee@imshome.com

IMS EUROPEAN SALES MANAGEMENT

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

IMS UK Sales

Machine Technology Centre, Blackhill Drive
Wolverton, Milton Keynes MK12 5TS
Tel. +44/0 1908 628000 - Fax +44/0 1908 628001
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