

MDrive® Linear Actuator

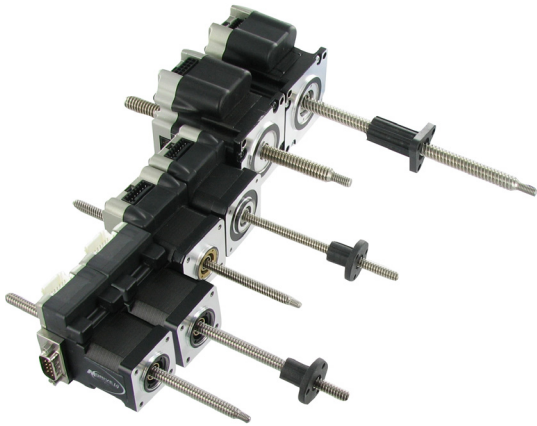
Compact, integrated all-in-one linear motion systems



MDrive 23 Plus Linear Actuator
CANopen

IMS
INTELLIGENT MOTION
SYSTEMS, INC.

Schneider
Electric



MDrive® Plus Linear Actuator with CANopen
non-captive and external shaft styles

Presentation

The MDrive® Plus Linear Actuator with CANopen interface is an integrated product that combines a stepper motor linear actuator with mechanicals and electronics to form a single, compact system. It features a 1.8° 2-phase stepper motor linear actuator with on-board controller, drive electronics and optional encoder. Signals are converted directly from rotary to linear motion, eliminating the need for belts and pulleys, rack and pinion, hydraulics, pneumatics or other mechanical system.

IMS CANopen firmware is provided for MDrive Plus Linear Actuator CANopen products, in addition to CANopen Tester GUI software for interface with the MD-CC500-000 CANopen dongle.

MDrive Plus Linear Actuator CANopen products support CiA DS301 and DSP402 Device Profile for Drives and Motion Control.

Application areas

The MDrive Plus Linear Actuator with CANopen interface is ideal for machine builders who want an optimized stepper motor linear actuator with on-board electronics. The integrated electronics of the MDrive product reduces the potential for problems due to electrical noise by eliminating the cable between motor and drive.

These compact, powerful and cost effective linear motion control solutions deliver unsurpassed smoothness and performance that will reduce system cost, design and assembly time for a large range of applications.

Features

Standard Plus

- Highly integrated microstepping drive, controller, and high torque 1.8° 2-phase stepper motor linear actuator
 - Non-captive or external shaft style
 - Load limit up to 200 lbs
 - Precision rolled lead screws
- Advanced current control for exceptional performance and smoothness
- Single supply: from +12 up to +75 VDC
- Cost effective
- Extremely compact
- 20 microstep resolutions to 51,200 steps/rev including: Degrees, Metric, Arc Minutes
- Auxiliary logic power supply input
- Open or optional closed loop control
- Programmable motor run and hold currents
- Four +5 to +24 VDC I/O lines accept sinking outputs, or sourcing or sinking inputs
- One 10 bit analog input selectable: 0 to +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 0 to 5 MHz step clock rate selectable in 0.59 Hz increments
- CANopen communication
- Available options:
 - Encoder
 - Drive Protection Module
- Graphical user interface (GUI) provided for quick and easy configuration and programming via optional MD-CC500-000 communication converter

Expanded Plus²

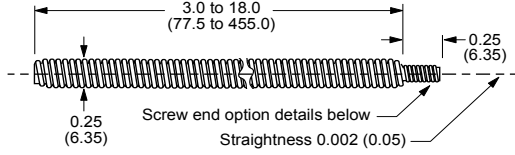
- +24 VDC tolerant I/O sourcing or sinking, inputs and outputs with up to 8 I/O lines and electronic gearing
- Closed loop control available with remote encoder option
- High speed position capture input or trip output

General specifications			MDrive 14	MDrive 17	MDrive 23
Input power	Voltage	VDC	12 to 48	12 to 48	12 to 75
	Current maximum (1)	amp	1	2	2
Maximum thrust (2)	Non-captive shaft	lbs	50	50	200
		kg	22	22	91
	External shaft with general purpose nut	lbs	25	25	60
		kg	11	11	27
External shaft with anti-backlash nut	lbs	5	5	25	
	kg	2	2	11	
Maximum repeatability	General purpose	inch	0.005		
		mm	0.127		
	Anti-backlash (3)	inch	0.0005		
		mm	0.0127		
Thermal	Operating temp non-condensing	Heat sink	-40° to +85°C		
		Motor	-40° to +100°C		
Auxiliary logic input	Voltage range (4)		+12 to +24 VDC		
Analog input	Resolution		10 bit		
	Voltage range		0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA		
Communication	Type		CANopen CiA DS301 (V3.0), DSP402 (V2.0), 2.0B active		
	Baud rate		Configurable 5 KB to 1 Mb		
	ID		11 and/or 29 bit		
	Isolation		Galvanic		
Software	Features		Node guarding, heartbeat, SDOs, PDOs (variable mapping)		
	Setup parameters		Storable to nonvolatile memory		
	Transmit PDOs		3 dynamically mappable		
	Receive PDOs		3 dynamically mappable		
	Manufacturer specific objects		I/O configuration, run/hold current		
	Modes of operation		Profile position, homing mode, profile velocity		
	Input functions		General purpose, homing mode profiles		
General purpose I/O	Output functions		General purpose		
	Number		Standard Plus products		Expanded Plus² products (5)
		Type	4	8 (4 with remote encoder option selected)	
	Logic range		Sourcing or sinking inputs, or sinking outputs		Sourcing or sinking outputs/inputs
			Inputs and outputs tolerant to +24 VDC, inputs TTL level compatible		Sourcing outputs +12 to +24 VDC, inputs and sinking outputs tolerant to +24 VDC, inputs TTL level compatible
Output sink current		Up to 600 mA		Up to 600 mA	
Protection		Over temp, short circuit, transient, over voltage, inductive clamp			
Motion	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)		
	Counters	Type	position, encoder/32 bit		
		Edge rate maximum	5 MHz		
	Velocity	Range	+/- 5,000,000 steps per second		
		Resolution	0.5961 steps per second		
	Accel/Decel	Range	1.5 x 10 ⁹ steps per second ²		
		Resolution	90.9 steps per second ²		
	Electronic gearing	External clock in range (6)	—		0.001 to 2.000
		Resolution/threshold	—		32 bit resolution/TTL threshold
		Input filter range	—		50 nS to 12.9 μS (10 MHz to 38.8 kHz)
		Secondary clock out range (6)	—		1 to 1
	High speed I/O	Position capture	Input filter range	—	
		Resolution		50 nS to 12.9 μS (10 MHz to 38.8 kHz)	
Trip output – speed/resolution/threshold			32 bit		
			150 nS/32 bit/TTL		

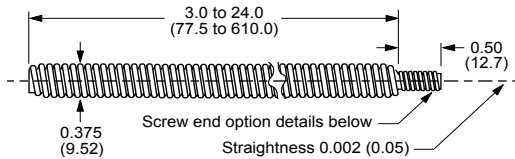
(1) Actual power supply current will depend on voltage and load.
 (2) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.
 (3) Only applicable for External shaft linear actuator with anti-backlash nut.
 (4) When input voltage is removed, maintains power only to control and feedback circuits.
 (5) MDrive14 products available only as Plus² versions.
 (6) Adjusting the microstep resolution can increase the range.

 See User Manual for complete details: www.imshome.com/manuals.html

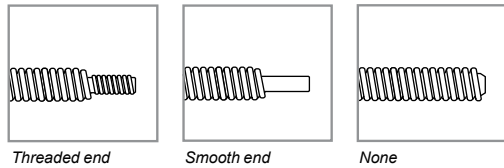
Dimensions in inches (mm)



MDrive 14 and MDrive 17 screw dimensions



MDrive 23 screw dimensions



Screw specifications

Material

MDrive Linear Actuator precision rolled lead screws are designed specifically for motion control applications to deliver maximum life and quiet operation. Corrosion resistant and non-magnetic, screws are manufactured from premium grade stainless steel.

Coating

An optional Teflon® screw coating is available for smooth operation and extended life.

Length

Length (1)	MDrive 14 and MDrive 17		MDrive 23	
	minimum	maximum	minimum	maximum
inches	3.0	18.0	3.0	24.0
mm	77.5	455.0	77.5	610.0

(1) Screw lengths are available in 0.1" (2.5mm) increments.

Lead/pitch options

Screw	travel	MDrive 14 and MDrive 17		MDrive 23	
		per revolution	per full step	per revolution	per full step
Screw G	inches	—	—	0.3750	0.001875
	mm	—	—	9.525	0.0476
Screw A	inches	0.250	0.00125	0.200	0.001
	mm	6.350	0.0317	5.08	0.0254
Screw B	inches	0.125	0.00063	0.1670	0.000835
	mm	3.175	0.0158	4.233	0.0212
Screw C	inches	0.063	0.00031	—	—
	mm	1.588	0.0079	—	—
Screw D	inches	0.031	0.00016	0.0833	0.0004165
	mm	0.794	0.0040	2.116	0.0106

End options

Threaded	metric end	MDrive 14 and MDrive 17	MDrive 23
		M4 x 0.7 mm thread to within 0.03"/0.76 mm of shoulder	M6 x 1.0 mm thread to within 0.03"/0.76 mm of shoulder
Smooth	inches	Ø 0.1967 ±0.001	Ø 0.2362 ±0.001
	mm	Ø 5 ±0.003	Ø 6 ±0.003
None		—	—

Load limit

Non-captive shaft (2)	lbs	MDrive 14 and MDrive 17	MDrive 23
		50 (3)	200
External shaft	kg	22 (3)	91
	General purpose nut	lbs	60
	kg	11	27
	Anti-backlash nut	lbs	25
	kg	2	11

(2) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

(3) Screw D has a load limit of 10 lbs/4.5 kg. Heavier loads will degrade screw life. Consult factory for alternative.

Calculating length

■ Non-captive shaft products

Screw length = [mounting surface plate thickness] + [desired stroke length] + [•]

● MDrive 14 = 1.4" / 35.6 mm

● MDrive 17 = 1.4" / 35.6 mm

● MDrive 23 = 1.8" / 45.7 mm

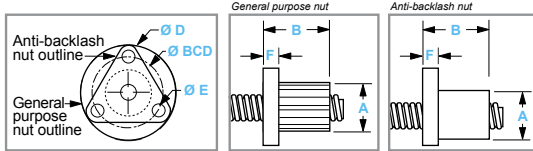
■ External shaft products

Available stroke length = [screw length] – [nut length] – [mounting surface plate thickness]

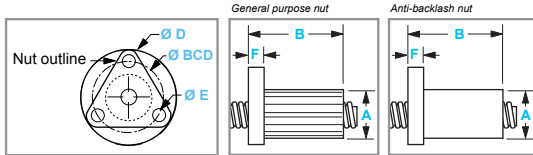
Nut specifications

MDrive Linear Actuators with external shaft employ a nut which moves axially along the threaded shaft as the screw rotates. Two nut styles are available: general purpose and anti-backlash. While anti-backlash nuts provide higher accuracy and low drag torque, general purpose nuts are rated for higher load limits but lack wear compensation.

MDrive 14 and MDrive 17 nuts



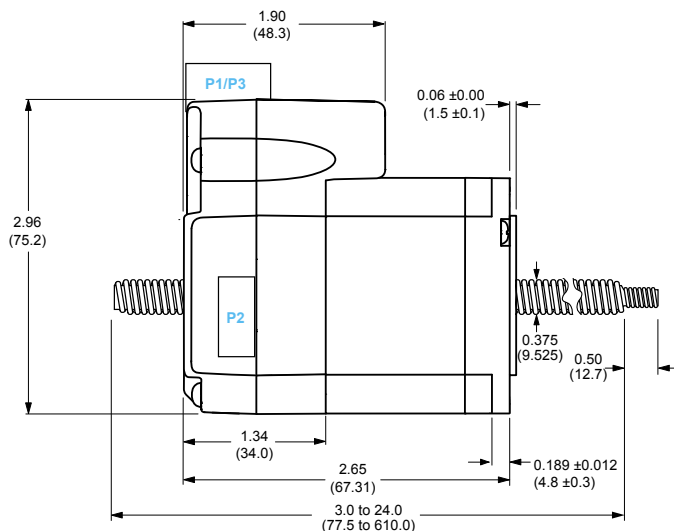
MDrive 23 nuts



Dimensions and performance

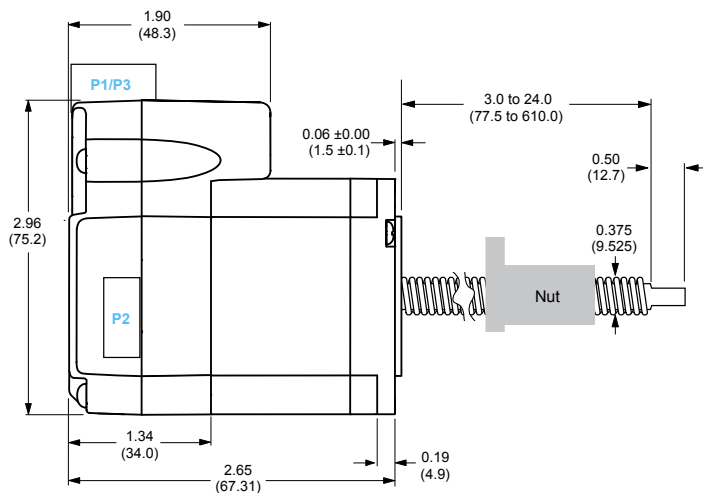
		MDrive 14 and MDrive 17		MDrive 23	
	nut type	general purpose	anti-backlash	general purpose	anti-backlash
A	inches	0.50	0.50	0.71	0.82
	mm	12.7	12.7	18.0	20.8
B	inches	0.75	0.9 max	1.50	1.875 max
	mm	19.1	22.86 max	38.1	47.63 max
D	inches	1.0	1.0	1.5	1.5
	mm	25.4	25.4	38.1	38.1
E	inches	0.14	0.143	0.20	0.20
	mm	3.6	3.63	5.08	5.08
F	inches	0.15	0.18	0.20	0.20
	mm	3.81	4.57	5.08	5.08
BCD	inches	0.75	0.75	1.125	1.125
	mm	19.1	19.1	28.6	28.6
Load limit	lbs	25	5	60	25
	kg	11	2	27	11
Drag torque		free wheeling	< 1.0 oz-in	free wheeling	1 to 3
			< 0.7 N-cm		

– Non-captive shaft – mechanical specifications, dimensions in inches (mm)



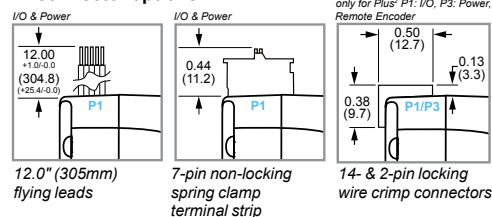
Unsupported loads and side loading are not recommended for non-captive shaft MDrive® linear actuator products.

– External shaft – mechanical specifications, dimensions in inches (mm)

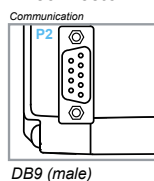


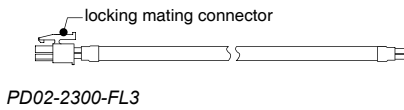
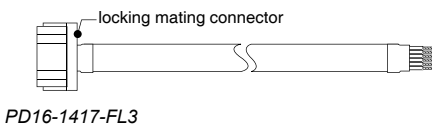
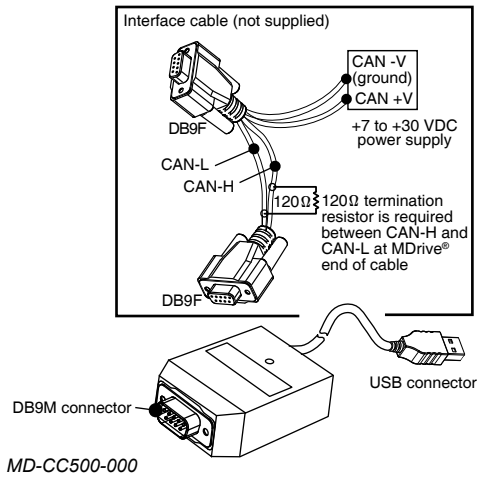
Loads for external shaft MDrive® linear actuator products **MUST BE** supported. Side loading is not recommended.

P1 connector options



P2 connector





Installation accessories

Description	Length feet (m)	Part number
-------------	-----------------	-------------

Communication converter

Electrically isolated, in-line converter pre-wired with mating connector to conveniently set/program communication parameters for a single MDrive Plus Linear Actuator via a PC's USB port.

- Mates to DB9 connector (1) 12.0 (3.6) **MD-CC500-000**

Prototype development cable

Speed test/development with pre-wired mating connector with other cable end open.

- Mates to 14-pin locking wire crimp connector for I/O and remote encoder option 10.0 (3.0) **PD14-2334-FL3**
- Mates to 2-pin locking wire crimp connector for power 10.0 (3.0) **PD02-2300-FL3**

Mating connector kit

Connectors for assembly of cables, cable material not supplied. Sold in lots of 5. Manufacturer's crimp tool recommended for crimp connectors.

- 14-pin locking wire crimp connector for I/O and remote encoder option — **CK-09**
- 2-pin locking wire crimp connector for power — **CK-04**

Drive protection module

Limits surge current and voltage to a safe level when DC input power is switched on-and-off to an MDrive.

- For all MDrive Linear Actuator products — **DPM75**

(1) Requires mating connector adapter and power supply, not supplied.

MDrive® 23 Plus Linear Actuator CANopen

MDrive® 23 Plus



- P1: I/O & Power**
F = 12" flying leads
P = non-locking spring clamp terminal strip
- P2: Communication**
B = CANopen with DB9 male connector

MDrive® 23 Plus²



- P1: I/O, and optional remote encoder**
C = 14-pin locking wire crimp connector
- P2: Communication**
B = CANopen with DB9 male connector
- P3: Power**
2-pin locking wire crimp connector



Non-captive shaft style



External shaft style

Part numbers

Example:	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
MDrive Plus Linear Actuator version	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
MLI = CANopen													
Type	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
1 = Plus, standard features													
3 = Plus², expanded features													
P1 connector	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
F = flying leads (1)													
P = pluggable (1)													
C = wire crimp (2)													
Communication	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
C = CANopen													
P2 connector	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
B = DB9													
Motor size	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
23 = NEMA 23 (2.3" / 57 mm)													
Motor length	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
A = single stack													
Drive voltage	M	L	I	1	F	C	B	2	3	A	7	-EQ	-●
7 = +12 to +75 VDC													
Encoder												-EQ	-●
Leave blank if not wanted													
-EQ = internal encoder, 512-line internal magnetic encoder with index mark													
-EE = remote encoder interface, differential encoder to be provided by user (2)													
Linear actuator specifications													-●
Complete the part number from the table below													

Continued – Part numbers

Example - linear actuator specifications:	-L	G	1	M	0	6	0	Z	T
Linear actuator	-L	G	1	M	0	6	0	Z	T
-L									
Screw lead/pitch	-L	G	1	M	0	6	0	Z	T
G = 0.375" / 9.525 mm travel per rev									
A = 0.200" / 5.08 mm travel per rev									
B = 0.167" / 4.233 mm travel per rev									
D = 0.083" / 2.116 mm travel per rev									
Shaft style	-L	G	1	M	0	6	0	Z	T
1 = Non-captive									
3 = External									
Screw end finish	-L	G	1	M	0	6	0	Z	T
M = metric threaded									
U = UNC threaded									
S = smooth									
Z = none									
Screw length	-L	G	1	M	0	6	0	Z	T
030 = 3.0" (77.5 mm) minimum up to									
240 = 24.0" (610.0 mm) maximum, in 0.1" (2.5 mm) increments									
Nut	-L	G	1	M	0	6	0	Z	T
Z = none, only with Non-captive shaft products									
G = general purpose, only with External shaft products (3)									
A = anti-backlash, only with External shaft products (4)									
Coating	-L	G	1	M	0	6	0	Z	T
T = Teflon									
Z = None									

(1) Only available with Plus products.
 (2) Only available with Plus² products.
 (3) Dynamic load limit to 60 lbs / 22 kg.
 (4) Dynamic load limit to 25 lbs / 11 kg.

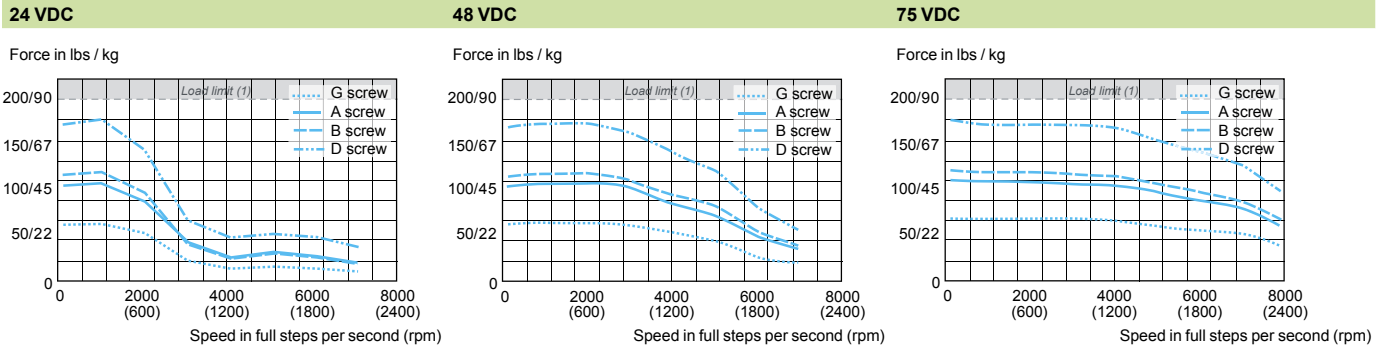


Easy MDrive part numbers via an interactive tool at:
www.imschneider.com/MDriveLinear.html

Motor specifications			
Stack length			Single
Holding torque		oz-in	90.0
		N-cm	64.0
Rotor inertia		oz-in-sec ²	0.0025
		kg-cm ²	0.18
Maximum screw misalignment		°	± 1
Weight without screw		oz	22.0
		g	625.0
Maximum thrust (1)	Non-captive shaft	lbs	200
		kg	91
	External shaft with general purpose nut	lbs	60
		kg	27
	External shaft with anti-backlash nut	lbs	25
		kg	11
Maximum repeatability	General purpose	inch	0.005
		mm	0.127
	Anti-backlash (2)	inch	0.0005
		mm	0.0127

(1) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.
 (2) Only applicable for External shaft linear actuator with anti-backlash nut.

Speed force characteristics



(1) Load limits are for non-captive shaft linear actuators: 200lbs/91kg.
 Load limits for external shaft linear actuators are determined by the nut selected.
 Note: Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

USA SALES OFFICES

Eastern Region

Tel. 862 208-9742 - Fax 973 661-1275

e-mail: e.region@imshome.com

Northeast Region

Tel. 860 368-9703

e-mail: n.region@imshome.com

Central Region

Tel. 860 295-6102

e-mail: c.region@imshome.com

Western Region

Tel. 602 578-7201

e-mail: w.region@imshome.com

State of California

Tel. 310 717-7969

e-mail: california@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: europa.sales@imshome.com

TECHNICAL SUPPORT

Tel. +00 (1) 860 295-6102 - Fax +00 (1) 860 295-6107

e-mail: etech@imshome.com

Schneider Electric Motion USA

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

www.schneider-electric-motion.us

© Schneider Electric Motion USA All Rights Reserved.

REV042011

Product Disclaimer and most recent product information online.

IMS
INTELLIGENT MOTION
SYSTEMS, INC.

Schneider
Electric