MDrivePlus

Brushless step motor technology
with integrated controls

IMS™ INTELLIGENT MOTION SYSTEMS, INC.

by Schneider Electric

Brushless step motor technology with integrated controls — make your best move

Over 156,000 integrated motion control solutions available with the leading technology of MDrivePlus™

MDrivePlus Versions

Microstepping
Motor + Driver with Step & Direction Input

- Brushless step motors NEMA sizes 14, 17, 23, 34, 34AC, 42AC
- 20 resolutions up to 51,200
- Optically isolated step/direction inputs
- Options: encoder, control knob, gearbox, linear slide, linear actuator, IP65 rating

Motion Control
Motor + Driver + Programmable Controller

- Single supply from +12 up to +75 VDC or 120/240 VAC (see AC version below)
- Up to 8 I/O lines
- 10-bit analog input, configurable
- RS-422/485 with CANopen option

Speed Control
Motor + Driver + Variable Speed Controller

- Programmable velocity control
- 10-bit analog speed control input
- Resolutions switchable on-the-fly
- Electronically configurable

AC Power
Motor + Driver + Controller + Power Supply*

- Brushless step motor NEMA size 34 or 42
- Single supply: 120 or 240 VAC
- Holding torque to 2294 oz-in
- High positioning accuracy
- No tuning required
- High starting torque

*Motion Control Version

Ordering

IMS has a worldwide network of authorized Stocking Distributors. When opening an account, they typically offer local stock, lower shipping costs, local applications support and lower order minimums than the factory. Order through your local IMS-authorized Stocking Distributor. For the name of an authorized Distributor near you, call IMS Customer Service at +00 (1) 860 295-6102 or contact an IMS Representative listed at www.imshome.com.

Customer Service

The IMS Customer Service Department is open from 8:30 A.M. to 5:00 P.M., Monday through Friday, Eastern Time (U.S.A.).

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Web Site .....www.imshome.com

Technical Support

We pride ourselves on our ability to provide first-rate technical support. Our friendly and helpful technical staff have both the knowledge and desire to answer all your technical inquiries.

Tel.....+00 (1) 860 295-6102
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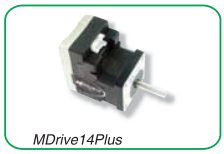
Try MDrivePartsBuilder, an online interactive tool to configure your MDrivePlus at: www.imshome.com/MDrivePartsBuilder/MDrivePartSelect.HTM

MDRIVE™ MOTOR+DRIVER Plus

All-in-one integrated motion control.
Compact. Powerful. Affordable.

Pictured: MDrive23Plus
Motion Control IP65 Sealed


MDrive14Plus

MDrive17Plus

MDrive23Plus

MDrive34Plus

MDrive34AC Plus

MDrive42AC Plus

Table of contents

MDrive Size	Version [abbreviation]	Input Voltage	Communication	Pg
NEMA 14	Microstepping [MDM14]	+12 to +48 VDC	SPI	2
	Motion Control [MDI14]	+12 to +48 VDC	RS-422/485	6
	Motion Control [MDI14]	+12 to +48 VDC	CANopen	6
NEMA 17	Microstepping [MDM17]	+12 to +48 VDC	SPI	10
	Motion Control [MDI17]	+12 to +48 VDC	RS-422/485	15
	Motion Control [MDI17]	+12 to +48 VDC	CANopen	15
	Speed Control [MDO17]	+12 to +48 VDC	SPI	20
NEMA 23	Microstepping [MDM23]	+12 to +75 VDC	SPI	24
	Motion Control [MDI23]	+12 to +75 VDC	RS-422/485	29
	Motion Control [MDI23]	+12 to +75 VDC	CANopen	29
	Speed Control [MDO23]	+12 to +75 VDC	SPI	34
NEMA 34	Microstepping [MDM34]	+12 to +75 VDC	SPI	38
	Motion Control [MDI34]	+12 to +75 VDC	RS-422/485	43
	Motion Control [MDI34]	+12 to +75 VDC	CANopen	43
	Speed Control [MDO34]	+12 to +75 VDC	SPI	48
NEMA 34 AC	Microstepping [MDM34AC]	120 or 240 VAC	SPI	53
	Motion Control [MDI34AC]	120 or 240 VAC	RS-422/485	57
	Motion Control [MDI34AC]	120 or 240 VAC	CANopen	57
NEMA 42 AC	Microstepping [MDM42AC]	120 or 240 VAC	SPI	61
	Motion Control [MDI42AC]	120 or 240 VAC	RS-422/485	65
	Motion Control [MDI42AC]	120 or 240 VAC	CANopen	65

Accessories

Planetary Gearboxes 69
Linear Slides 72
Connectivity Overview 78

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IMS™ INTELLIGENT MOTION SYSTEMS, INC.
by Schneider Electric

MDRIVE 14 MOTOR+DRIVER Plus MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver and NEMA 14 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 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
- Single Motor Length Available
- Setup Parameters May Be Switched On-The-Fly
- Pluggable Locking Wire Crimp Interface
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

**Consult Factory for Availability.

DESCRIPTION

The **MDrive14Plus 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 MDrive14Plus 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 MDrive14-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 MDrive14Plus accepts a broad input voltage range from +12 to +48 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 MDrive14Plus uses a NEMA 14 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.

Motor configurations include a single length rotary and a linear actuator with long life Acme screw**. Rotary motors may include an encoder, control knob or planetary gearbox. Interface connections are accomplished using 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 MDrive14Plus 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 MDrive14Plus 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.

MDrive14*Plus* MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	+12 to +48 VDC *Power supply current requirements = 1A (maximum) per MDrive14Plus.* *Actual power supply current will depend on voltage and load.*	
ISOLATED INPUT	Universal	Voltage Range: +5 to +24 VDC Sourcing or Sinking Step Clock, Direction and Enable	
	Differential	Voltage Range: +5 VDC Clockwise and Counterclockwise	
MOTION	Digital Filter Range	50 nS to 12.9 µS (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/µstep), 21600 (1 arc minute/µstep), 25400 (0.001mm/µstep)
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	µsteps 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 µS (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	18.0 oz-in / 12.71 N-cm	2.0 oz-in / 1.4 N-cm	0.000241 oz-in-sec^2 / 0.0170 kg-cm^2	5.29 oz / 150.0 g

ENCODER PIN ASSIGNMENTS

External Encoder

	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
Pluggable Interface	**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 +	

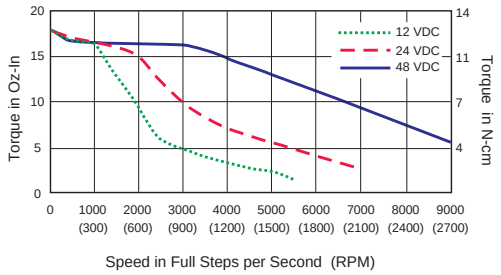
Optional encoder cables are available.

Internal Encoder

An internal differential encoder option is available. See Wire/Pin Assignments on the following page for connection details.

MOTOR PERFORMANCE — Speed-Torque

Single Length Rotary Motor



PIN ASSIGNMENTS — MDrive14Plus Microstepping

P1: I/O, POWER & COMM CONNECTOR		
Wire Crimp	Function	
	Universal Input	Differential Input *Clockwise/Counterclockwise*
Pin 1	Power Ground	Power Ground
Pin 2	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)
Pin 3	Optocoupler Reference	CW +
Pin 4	Step Clock Input	CW –
Pin 5	Enable Input	CCW +
Pin 6	CW/CCW Direction Input	CCW –
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

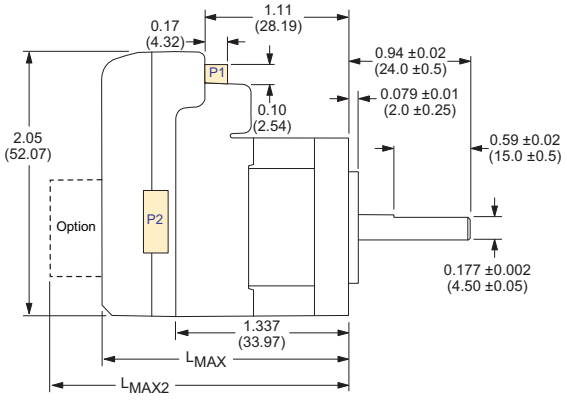
P2: OPTIONAL INTERNAL DIFFERENTIAL ENCODER	
Wire Crimp	Function
Pin 1	Ground
Pin 2	Channel A +
Pin 3	Channel A –
Pin 4	Channel B +
Pin 5	Channel B –
Pin 6	Index +
Pin 7	Index –
Pin 8	+5 VDC Input
Pin 9	No Connect
Pin 10	No Connect

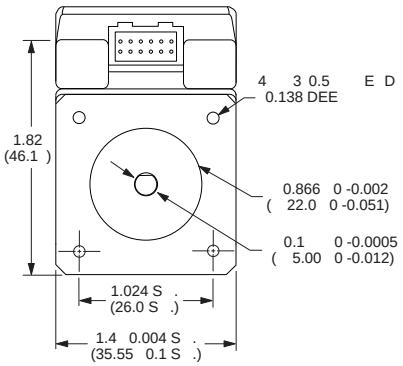
P2 present only with internal encoder option.

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

MDrive14Plus Microstepping

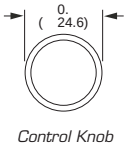




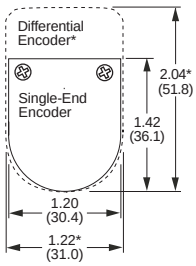
MDrive Lengths *Inches (mm)*

LMAX	LMAX2
SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	CONTROL KNOB or EXTERNAL ENCODER VERSION
1.91 (48.51)	2.61 (66.29)

LMAX2 Options

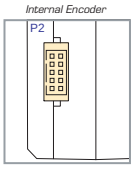


Control Knob



External Encoder

P2 Connector



10-Pin Locking Wire Crimp for Internal Encoder Option Only

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

ORDER INFORMATION — MDrive14Plus Microstepping

CONNECTIVITY

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

Communication Converter
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:
12-Pin Wire Crimp MD-CC305-001

Prototype Development Cable
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12B-1434-FL3

Mating Connector Kit
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 Crimp CK-08

** Consult Factory for Availability.

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

OPTIONS

Linear Actuator**
The MDrive14Plus 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 MDrive14Plus. 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 available.

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

An optional encoder cable is available. Order separately.
Internal Encoder Cable (10.0'/3.0m) PD10-3400-FL3

Control Knob
The MDrive14Plus 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 MDrive14Plus. Refer to details and part numbers on the back cover.

PART NUMBERING

Plus

K MDM ☐ CSZ14A4 – OPTION

P P
2 P

Example #1: P MDM1CSZ14A4 P
2

OPTIONS

Linear Actuator –L

External Encoder –E ☐
MDM1CSZ14A4–EHL

Internal Encoder –E ☐
MDM1CSZ14A4–ECM 2

Control Knob –N
MDM1CSZ14A4–N a

Planetary Gearbox –G ☐☐☐ – F
MDM1CSZ14A4–G1A2

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MDRIVE 14 MOTOR+DRIVER Plus™

MOTION CONTROL
(with optional CANopen)

STANDARD FEATURES

- Highly Integrated Microstepping Driver, Intelligent Motion Controller and NEMA 14 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 VDC
- Cost Effective
- Extremely Compact
- Available Options:
  - Long Life Linear Actuators**
  - Internal Magnetic Encoder for Closed Loop Control
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
- 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 +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 0 to 5MHz Step Clock Rate Selectable in 0.59Hz Increments
- RS-422/485 Communications
- 62 Software Addresses for Multi-Drop Communications
- Simple 1 to 2 Character Instructions
- Pluggable Locking Wire Crimp Interface

EXPANDED PLUS^2 FEATURES

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

**Consult Factory for Availability.

DESCRIPTION

The **MDrive14Plus Motion Control** offers system designers a cost effective, full featured programmable motion controller integrated with a NEMA 14 high torque 1.8° brushless step motor and a +12 to +48 volt microstepping driver.

The unsurpassed smoothness and performance delivered by the MDrive14Plus 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 MDrive14Plus accepts a broad input voltage range from +12 to +48 VDC, delivering enhanced performance and speed. Oversized input capacitors are used to minimize power line surges, reducing problems that can occur with long cable 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 of all MDrive14Plus 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 of MDrive14Plus^2 versions include up to 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 MDrive14Plus 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) magnetic 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 MDrive14Plus^2 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 producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.

Motor configurations include a single length rotary and a linear actuator with long life Acme screw**. Interface connections are accomplished using locking wire crimp connectors.

new

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 9.*

The MDrive14Plus 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.

MDrive14*Plus* MOTION CONTROL

STANDARD SPECIFICATIONS (Plus Versions)

INPUT VOLTAGE (+V)	Range		+12 to +48 VDC *Power supply current requirements = 1A (maximum) per MDrive14Plus.* *Actual power supply current will depend on voltage and load.*	
AUX. LOGIC INPUT VOLTAGE	Range		+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.	
ANALOG INPUT	Resolution		10 Bit	
	Voltage Range		0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA	
GENERAL PURPOSE I/O	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	
COMMUNICATION	Type (Standard)		RS-422/485	
	Baud Rate		4.8 to 115.2kbps	
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)
	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 10^9 Steps Per Second^2
			Resolution	90.9 Steps Per Second^2
SOFTWARE	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, General Purpose
			Outputs	Moving, Fault, Stall, Velocity Change, General Purpose
	Trip Functions		Trip on Input, Trip on Position, Trip on Time, Trip Capture, Trip on Relative Position	
	Party Mode Addresses		62	
	Encoder Functions		Stall Detection, Position Maintenance, Find Index	
THERMAL	Operating Temperature		Heat Sink	–40° to +85°C (non-condensing)
			Motor	–40° to +100°C (non-condensing)

EXPANDED SPECIFICATIONS (Plus^2 Versions)

GENERAL PURPOSE I/O	Number/Type		8 Sourcing or Sinking Outputs/Inputs (or 4 when Remote Encoder Option is Selected)		
	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		
COMMUNICATION	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)		
MOTION	Electronic Gearing		Range‡/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‡ (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

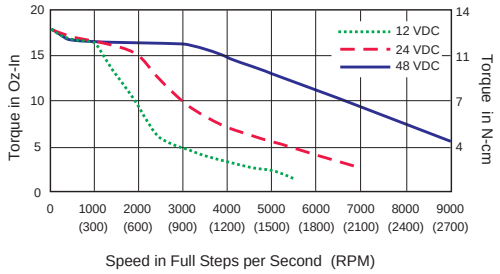
‡ Adjusting the microstep resolution can increase the range.

MOTOR SPECIFICATIONS

	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	18.0 oz-in / 12.71 N-cm	2.0 oz-in / 1.4 N-cm	0.000241 oz-in-sec^2 / 0.0170 kg-cm^2	5.29 oz / 150.0 g

MOTOR PERFORMANCE — Speed-Torque

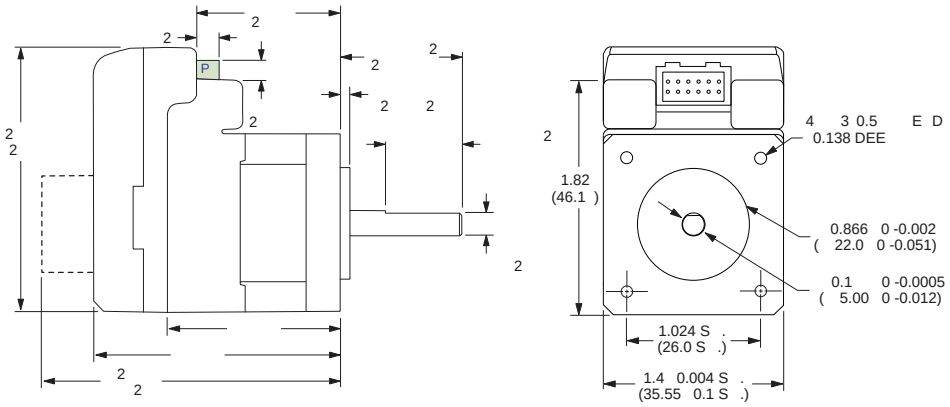
Single Length Rotary Motor



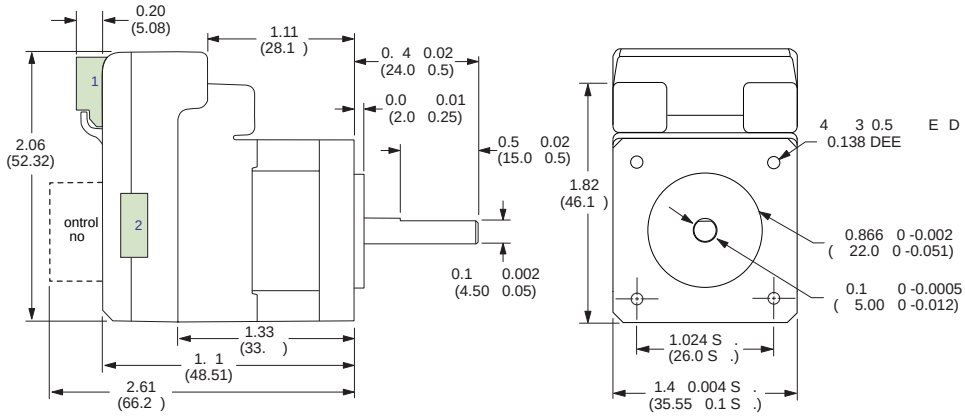
MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

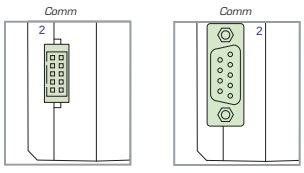
MDrive14Plus Motion Control



MDrive14Plus² Motion Control



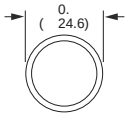
P2 Connector Options



10-Pin Friction Lock Wire Crimp

DB9 (Male) CANopen Only

Option



Control Knob

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

PIN ASSIGNMENTS — MDrive14Plus Motion Control

Plus

P1: I/O, POWER & COMM CONNECTOR	
Wire Crimp	**Function**
Pin 1	Power/Aux/Comm Ground
Pin 2	+V (+12 to +48 VDC)
Pin 3	I/O 2
Pin 4	I/O 3
Pin 5	I/O 4
Pin 6	Analog Input
Pin 7	I/O 1
Pin 8	Aux-Logic (+12 to +24 VDC)
Pin 9	TX +
Pin 10	TX –
Pin 11	RX –
Pin 12	RX +

Plus²

P1: I/O & POWER 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	Channel A +
Pin 8	I/O 10	Channel A –
Pin 9	I/O 11	Channel B +
Pin 10	I/O 12	Channel B –
Pin 11	Capture/Trip I/O	Capture/Trip I/O
Pin 12	Analog In	Analog In
Pin 13	Step/Clock I/O	Index +
Pin 14	Direction/Clock I/O	Index –
Pin 15	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)
Pin 16	Power/Aux Ground	Power/Aux Ground

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 –
CANopen	
DB9 (Male)	**Function**
Pin 1	No Connect
Pin 2	CAN Low
Pin 3	CAN –V
Pin 4	Aux Power
Pin 5	Shield
Pin 6	CAN –V
Pin 7	CAN High
Pin 8	No Connect
Pin 9	CAN +V

ORDER INFORMATION — MDrive14Plus Motion Control

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:
12-Pin Wire Crimp MD-CC403-001
10-Pin Wire Crimp MD-CC402-001
DB9 CANopen MD-CC500-000*
*Requires mating connector adapter and power supply, not supplied.

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12B-1434-FL3
10-Pin Wire Crimp PD10-1434-FL3
16-Pin Wire Crimp PD16-1417-FL3

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 Crimp CK-08
10-Pin Wire Crimp CK-02
16-Pin Wire Crimp CK-10

OPTIONS

Linear Actuator
The MDrive14Plus 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
All MDrive14Plus Motion Control versions are available with an optional internal 512-line (2048 count) magnetic encoder with index mark.

Remote Encoder (Plus² versions only)
MDrive14Plus² Motion Control versions are available with differential encoder inputs for use with a remote encoder (not supplied).

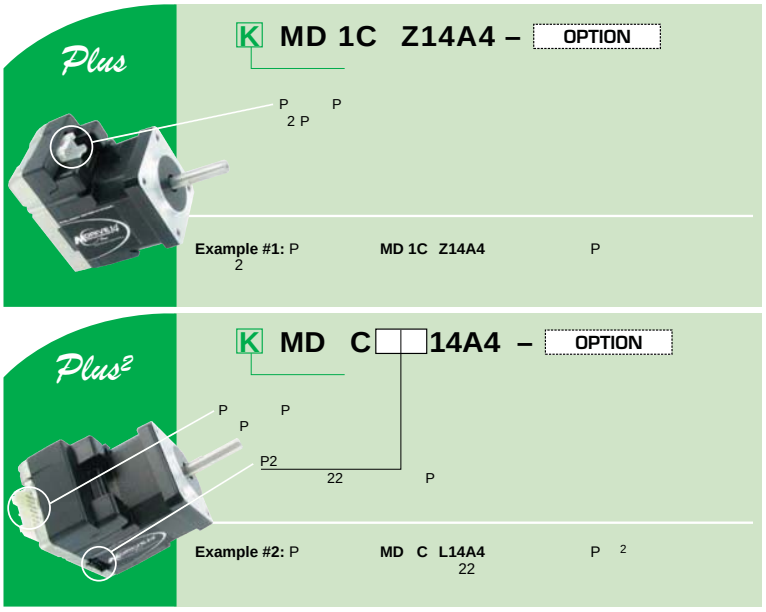
Control Knob
The MDrive14Plus is available with a factory-mounted rear control knob for manual shaft positioning.

Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive14Plus. Refer to details and part numbers on the back cover.

**Consult Factory for Availability.

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

PART NUMBERING



**Consult actor or Availabilit

OPTIONS		
Linear Actuator**	–L	
Internal Encoder	–E	MD 1C Z14A4–E 2
Remote Encoder	–EE	MD C L14A4–EE Available ith Plus versions onl a not be combined ith internal encoder option
Control Knob	–N	MD C L14A4–N a 2
Planetary Gearbox	–G □□□ – F	MD C L14A4–G1A2 2

MDRIVE 17™ MOTOR+DRIVER Plus

MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver and NEMA 17 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 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 Connector[1]
- 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

**Consult Factory for Availability.
[1]Not available with Differential Input option.

DESCRIPTION

The **MDrive17Plus 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 MDrive17Plus 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 MDrive17Plus 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 MDrive17Plus accepts a broad input voltage range from +12 to +48 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 MDrive17Plus uses a NEMA 17 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 MDrive17Plus-65 Microstepping unit with 19-pin M23 circular connector meets IP65 specifications.[1]

The versatile MDrive17Plus 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 versions[1].

new

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 14.*

The MDrive17Plus is a compact, powerful and cost effective motion control solution that will reduce system cost, design and assembly time for a large range of brushlessstep motor applications.

CONFIGURING

The IMS Motor Interface software is an easy to install and use GUI for configuring the MDrive17Plus 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.

MDrive17*Plus* MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	+12 to +48 VDC *Power supply current requirements = 2A (maximum) per MDrive17Plus.* *Actual power supply current will depend on voltage and load.*	
ISOLATED INPUT	Universal	Voltage Range: +5 to +24 VDC Sourcing or Sinking Step Clock, Direction and Enable	
	Differential	Voltage Range: +5 VDC Clockwise and Counterclockwise	
MOTION	Digital Filter Range	50 nS to 12.9 µS (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/µstep), 21600 (1 arc minute/µstep), 25400 (0.001mm/µstep)
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	µsteps 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 µS (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	32 oz-in / 22.6 N-cm	1.66 oz-in / 1.17 N-cm	0.00053 oz-in-sec^2 / 0.038 kg-cm^2	10.4 oz / 294.8 g
DOUBLE LENGTH	60 oz-in / 42.4 N-cm	2.08 oz-in / 1.47 N-cm	0.00080 oz-in-sec^2 / 0.057 kg-cm^2	12.0 oz / 340.2 g
TRIPLE LENGTH	74.9 oz-in / 52.9 N-cm	3.47 oz-in / 2.45 N-cm	0.00116 oz-in-sec^2 / 0.082 kg-cm^2	15.2 oz / 430.9 g

ENCODER PIN ASSIGNMENTS

External Encoder

	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
Pluggable Interface	**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.

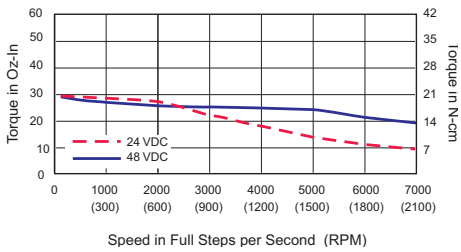
Internal Encoder

An internal differential encoder option is available on MDrive17Plus Microstepping regular and IP65 sealed versions.

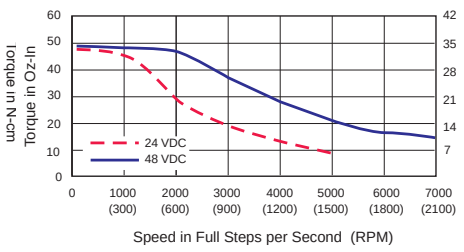
See Wire/Pin Assignments on the following page for connection details.

MOTOR PERFORMANCE — Speed-Torque

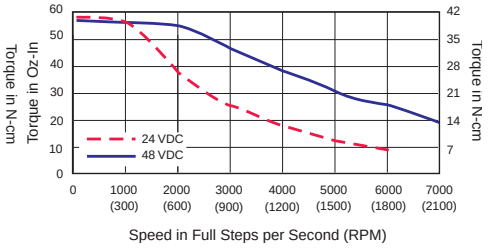
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



WIRE/PIN ASSIGNMENTS — MDrive17Plus Microstepping

Plus

P1: I/O & POWER CONNECTOR				
Pluggable Terminal Strip	Flying Leads Wire Colors	Pluggable Locking Wire Crimp**	Function	
			Universal Input	Differential Input *Clockwise/Counterclockwise*
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 +48 VDC)	+V (+12 to +48 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

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.*

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.

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 +48 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

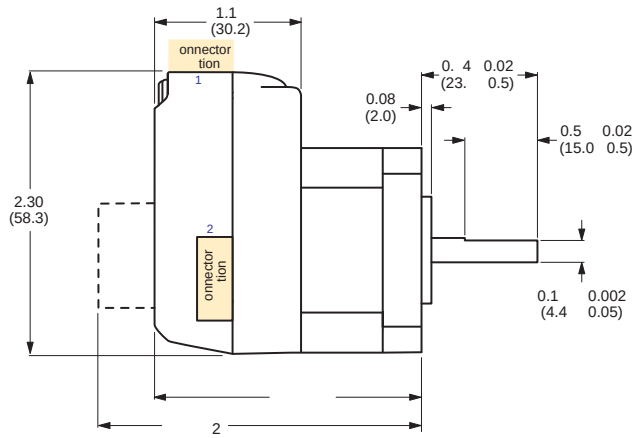
Pins below are No Connect unless populated for encoder option.

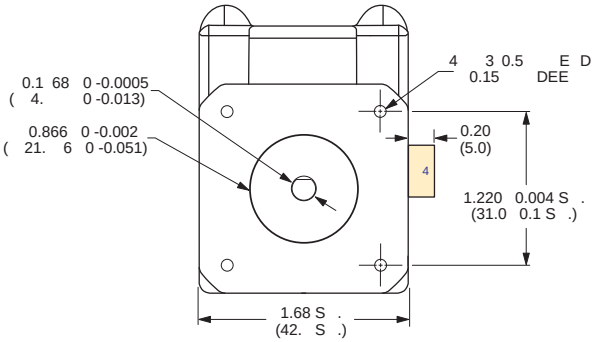
	Optional Internal Differential Encoder
Pin 3	Index +
Pin 4	Channel B +
Pin 5	Channel B –
Pin 7	Channel A +
Pin 14	Index –
Pin 15	Channel A –

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

MDrive17Plus Microstepping

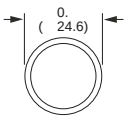




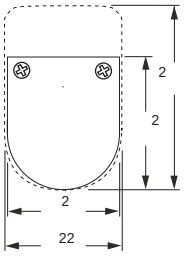
MDrive Lengths Inches (mm)

Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER, or LINEAR ACTUATOR	LMAX2 CONTROL KNOB or EXTERNAL ENCODER
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

LMAX2 Options

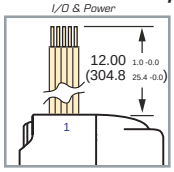


Control Knob

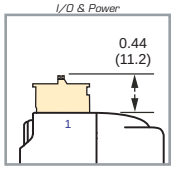


External Encoder

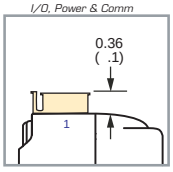
P1 Connector Options



Flying Leads

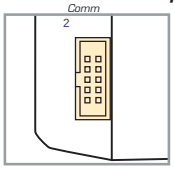


7-Pin Pluggable Clamp Type Terminal Strip

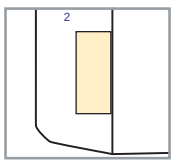


*12-Pin Pluggable Locking Wire Crimp***

P2 Connector Options

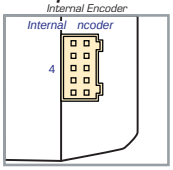


10-Pin IDC



*No Connector***

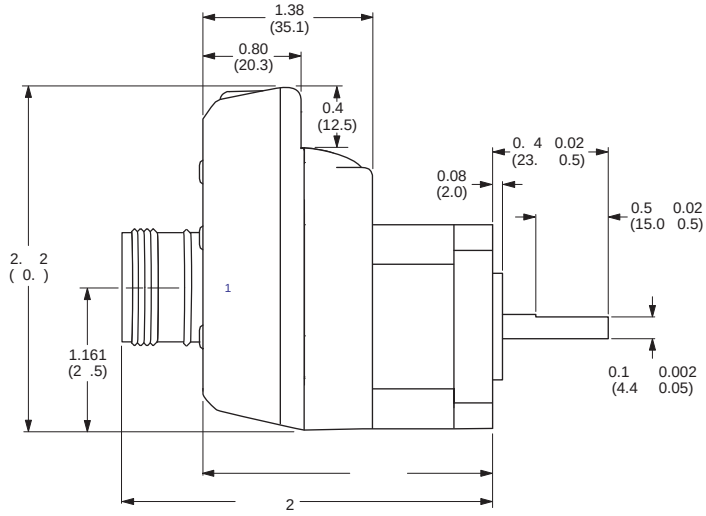
P4 Option

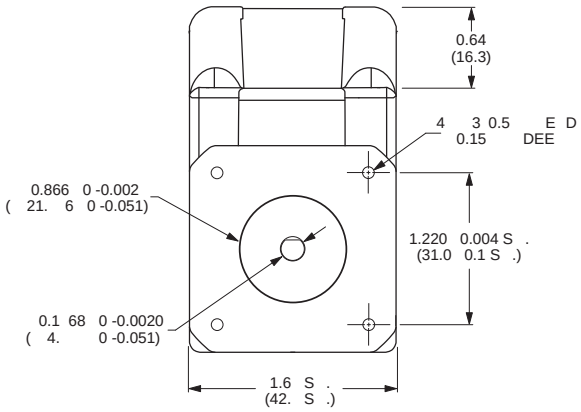


10-Pin Pluggable Locking Wire Crimp

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

MDrive17Plus-65 Microstepping (sealed)

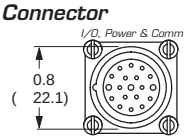




Sealed MDrive Lengths Inches (mm)

Motor Length	LMAX	LMAX2
Single	2.39 (60.71)	3.06 (77.72)
Double	2.62 (66.55)	3.29 (83.57)
Triple	2.96 (75.18)	3.63 (92.20)

Connector



19-Pin M23 (Male)

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

ORDER INFORMATION — MDrive17Plus Microstepping

CONNECTIVITY

new **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.

new **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
12-Pin Wire Crimp MD-CC303-001
5-Pin M12 (sealed version) MD-CC301-001

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12-1434-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 Termination MD-CS100-000
Right Angle Termination.....MD-CS101-000

new **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 Crimp CK-03
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDC CK-01

** Consult Factory for Availability.
‡ Not Available with Sealed –65 Versions.

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

OPTIONS

Linear Actuator**
The MDrive17Plus 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 MDrive17Plus. 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 available with regular and IP65 sealed versions.

Line Count	100	200	250	256	400	500	512	800	1000
Differential part#	EAM	EBM	ECM	EWM	EDM	EHM	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 MDrive17Plus is available with a factory-mounted rear control knob for manual shaft positioning.

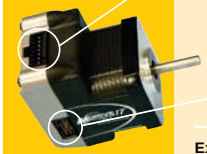
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive17Plus. Refer to details and part numbers on page 69.

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, or contact the factory for custom lengths. For more details, go to page 72.

PART NUMBERING

Plus

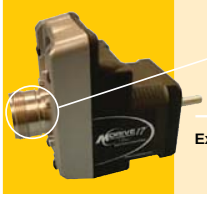
K MDM □ □ S □ 1 □ 4 – OPTION



Example #1: P MDM1 SD1 A4 P
P

Plus-65
P

K MDM2MSZ1 □ 4 – OPTION



Example #2: P MDM2MSZ1 4 P
P 2

Consult actor or Availabilit

OPTIONS

Linear Actuator **–L**

External Encoder **–E** □

MDM1 SD1 A4–EHL

Not available ith sealed 65 versions

Internal Encoder **–E** □

MDM1 SD1 A4–ECM 2

Control Knob **–N**

MDM1 SD1 A4–N a
Not available ith sealed 65 versions

Planetary Gearbox **–G** □□□ **–F**

MDM1 SD1 A4–G1A2

Linear Slide **–** □□

2 2
or Custom engths Consult actor
2 NO lengths onl ith A or leads
2 5 lengths onl ith A or C leads
2 6 lengths onl ith leads

MDM1 SD1 A4– A1

MDRIVE 17 MOTOR+DRIVER Plus™

MOTION CONTROL
(with optional CANopen)

STANDARD FEATURES

- Highly Integrated Microstepping Driver, Intelligent Motion Controller and NEMA 17 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 VDC
- Cost Effective
- Extremely Compact
- Available Options:
  - Long Life Linear Actuators**
  - Internal Magnetic Encoder for Closed Loop Control
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 3 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 +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 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:
  - Pluggable Terminal Strip
  - 12.0” (30.5cm) Flying Leads

EXPANDED PLUS^2 FEATURES

- +24 VDC Tolerant I/O Lines Sourcing or Sinking, Inputs and Outputs:
  - 8 I/O Lines with Electronic Gearing (or)
  - 4 I/O Lines with External/Remote Encoder for Closed Loop Control
- High Speed Position Capture Input or Trip Output
- Pluggable Locking Wire Crimp Interface
- IP65 Sealed Configuration with M12/M23 Circular Connectors

**Consult Factory for Availability.

DESCRIPTION

The **MDrive17Plus Motion Control** offers system designers a cost effective, full featured programmable motion controller integrated with a NEMA 17 high torque 1.8° brushless step motor and a +12 to +48 volt microstepping driver.

The unsurpassed smoothness and performance delivered by the MDrive17Plus 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 MDrive17Plus accepts a broad input voltage range from +12 to +48 VDC, delivering enhanced performance and speed. Oversized input capacitors are used to minimize power line surges, reducing problems that can occur with long cable 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 of all MDrive17Plus 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 of MDrive17Plus^2 versions include up to 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.

For use in environments where exposure to chemical, dust and liquids may occur, MDrive17Plus^2-65 sealed assembly versions are designed to meet IP65 specifications.

All MDrive17Plus 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) magnetic 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 MDrive17Plus^2 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 producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.

Motor configurations include a single shaft rotary in three lengths, and linear actuators with long life Acme screw**.

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 M12/M23 circular connectors on IP65 sealed versions.

new

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 19.*

The MDrive17Plus 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.

MDrive17*Plus* MOTION CONTROL

STANDARD SPECIFICATIONS (Plus Versions)

INPUT VOLTAGE (+V)	Range	+12 to +48 VDC *Power supply current requirements = 2A (maximum) per MDrive17Plus.* *Actual power supply current will depend on voltage and load.*	
AUX. LOGIC INPUT VOLTAGE	Range	+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.	
ANALOG INPUT	Resolution	10 Bit	
	Voltage Range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA	
GENERAL PURPOSE I/O	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	
COMMUNICATION	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)	
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)
	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 10^9 Steps Per Second^2
		Resolution	90.9 Steps Per Second^2
SOFTWARE	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, General Purpose
		Outputs	Moving, Fault, Stall, Velocity Change, General Purpose
	Trip Functions	Trip on Input, Trip on Position, Trip on Time, Trip Capture, Trip on Relative Position	
	Party Mode Addresses	62	
	Encoder Functions	Stall Detection, Position Maintenance, Find Index	
THERMAL	Operating Temperature	Heat Sink	–40° to +85°C (non-condensing)
		Motor	–40° to +100°C (non-condensing)

EXPANDED SPECIFICATIONS (Plus^2 & Plus^2-65 Versions)

GENERAL PURPOSE I/O	Number/Type	8 Sourcing or Sinking Outputs/Inputs (or 4 when Remote Encoder Option is Selected)		
	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		
MOTION	Electronic Gearing	Range‡/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‡ (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

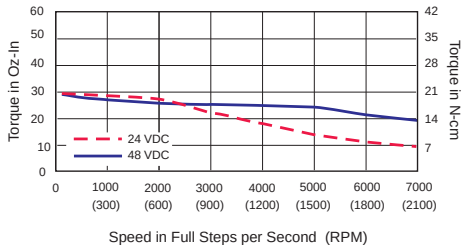
‡ Adjusting the microstep resolution can increase the range.

MOTOR SPECIFICATIONS

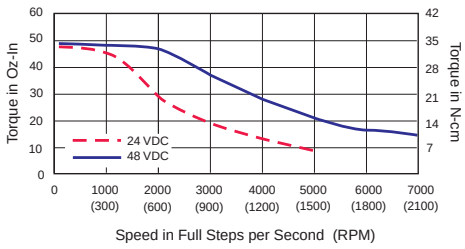
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	32 oz-in / 22.6 N-cm	1.66 oz-in / 1.17 N-cm	0.00053 oz-in-sec^2 / 0.038 kg-cm^2	10.4 oz / 294.8 g
DOUBLE LENGTH	60.0 oz-in / 42.4 N-cm	2.08 oz-in / 1.47 N-cm	0.00080 oz-in-sec^2 / 0.057 kg-cm^2	12.0 oz / 340.2 g
TRIPLE LENGTH	74.9 oz-in / 52.9 N-cm	3.47 oz-in / 2.45 N-cm	0.00116 oz-in-sec^2 / 0.082 kg-cm^2	15.2 oz / 430.9 g

MOTOR PERFORMANCE — Speed-Torque

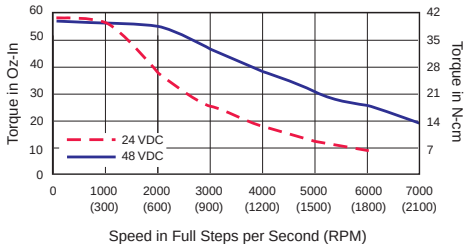
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



PIN/WIRE ASSIGNMENTS — MDrive17Plus Motion Control

Plus

P1: I/O & POWER CONNECTOR		
Pluggable Terminal Strip	Flying Leads Wire Colors	Function
Pin 1	White/Yellow	I/O 1
Pin 2	White/Orange	I/O 2
Pin 3	White/Violet	I/O 3
Pin 4	White/Blue	I/O 4
Pin 5	Green	Analog Input
Pin 6	Black	Power/Aux Ground
Pin 7	Red	+V (+12 to +48 VDC)

P2: COMM CONNECTOR				
RS-422/485			CANopen	
10-Pin IDC	Wire Crimp	Function	DB9 (male)	Function
Pin 1	Pin 9	TX +	Pin 1	No Connect
Pin 2	Pin 10	TX –	Pin 2	CAN Low
Pin 3	Pin 7	RX +	Pin 3	CAN –V
Pin 4	Pin 8	RX –	Pin 4	Aux Power
Pin 5	Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	Pin 6	RX +	Pin 6	CAN –V
Pin 7	Pin 3	RX –	Pin 7	CAN High
Pin 8	Pin 4	TX –	Pin 8	No Connect
Pin 9	Pin 1	TX +	Pin 9	CAN +V
Pin 10	Pin 2	Comm Ground		

Plus^2

P1: I/O & POWER 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	Channel A +
Pin 8	I/O 10	Channel A –
Pin 9	I/O 11	Channel B +
Pin 10	I/O 12	Channel B –
Pin 11	Capture/Trip I/O	Capture/Trip I/O
Pin 12	Analog In	Analog In
Pin 13	Step/Clock I/O	Index +
Pin 14	Direction/Clock I/O	Index –
Pin 15	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)
Pin 16	Power/Aux Ground	Power/Aux Ground

P2: COMM CONNECTOR				
RS-422/485			CANopen	
10-Pin IDC	Wire Crimp	Function	DB9 (male)	Function
Pin 1	Pin 9	TX +	Pin 1	No Connect
Pin 2	Pin 10	TX –	Pin 2	CAN Low
Pin 3	Pin 7	RX +	Pin 3	CAN –V
Pin 4	Pin 8	RX –	Pin 4	Aux Power
Pin 5	Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	Pin 6	RX +	Pin 6	CAN –V
Pin 7	Pin 3	RX –	Pin 7	CAN High
Pin 8	Pin 4	TX –	Pin 8	No Connect
Pin 9	Pin 1	TX +	Pin 9	CAN +V
Pin 10	Pin 2	Comm Ground		

Plus^2-65 (sealed)

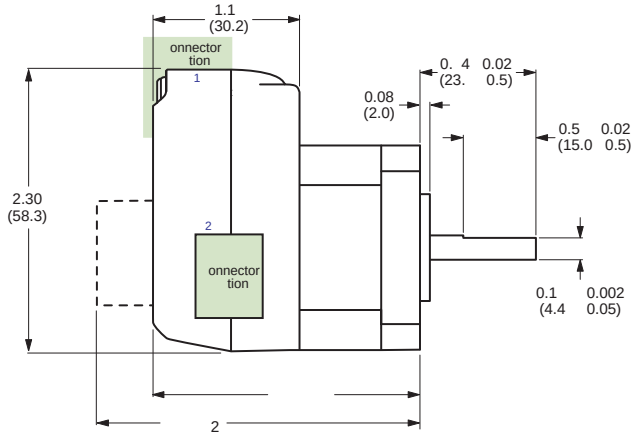
P1: I/O & POWER CONNECTOR		
M23 Circular (Male)	Function	
	Expanded I/O	Remote Encoder Closed Loop Control
Pin 1	I/O 9	Channel A +
Pin 2	I/O 11	Channel B +
Pin 3	Step/Clock I/O	Index +
Pin 4	I/O 1	I/O 1
Pin 5	Direction/Clock I/O	Index –
Pin 6	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)
Pin 7	Aux-Logic (+12 to +24 VDC)	Aux-Logic (+12 to +24 VDC)
Pin 8	Comm Ground	Comm Ground
Pin 9	I/O 3	I/O 3
Pin 10	I/O Ground	I/O Ground
Pin 11	I/O Power	I/O Power
Pin 12	Shell Connect	Shell Connect
Pin 13	I/O 12	Channel B –
Pin 14	Capture/Trip I/O	Capture/Trip I/O
Pin 15	Analog In	Analog In
Pin 16	I/O 2	I/O 2
Pin 17	I/O 4	I/O 4
Pin 18	I/O 10	Channel A –
Pin 19	Power/Aux Ground	Power/Aux Ground

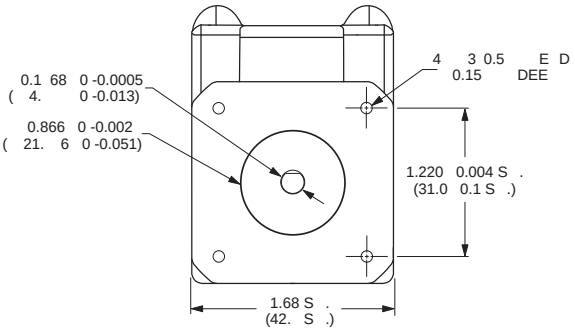
P2: COMM CONNECTOR			
RS-422/485		CANopen	
M12 Circular (Female)	Function	M12 Circular (Male)	Function
Pin 1	TX –	Pin 1	Shield
Pin 2	TX +	Pin 2	CAN +V
Pin 3	RX +	Pin 3	CAN –V
Pin 4	RX –	Pin 4	CAN High
Pin 5	Comm Ground	Pin 5	CAN Low

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

MDrive17Plus & Plus^2 Motion Control

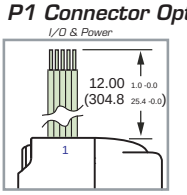




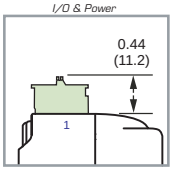
MDrivePlus Lengths Inches (mm)

Motor Length	L_{MAX} SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR	L_{MAX2} CONTROL KNOB
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

P1 Connector Options MDrivePlus

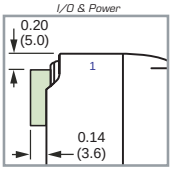


Flying Leads



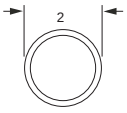
7-Pin Pluggable Clamp Type Terminal Strip

MDrivePlus^2 (Only)



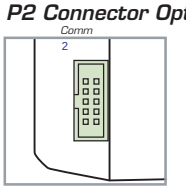
16-Pin Pluggable Locking Wire Crimp

L_{MAX2} Options

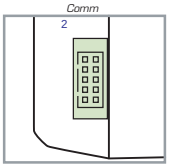


Control Knob

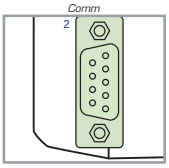
P2 Connector Options MDrivePlus & Plus^2



10-Pin IDC

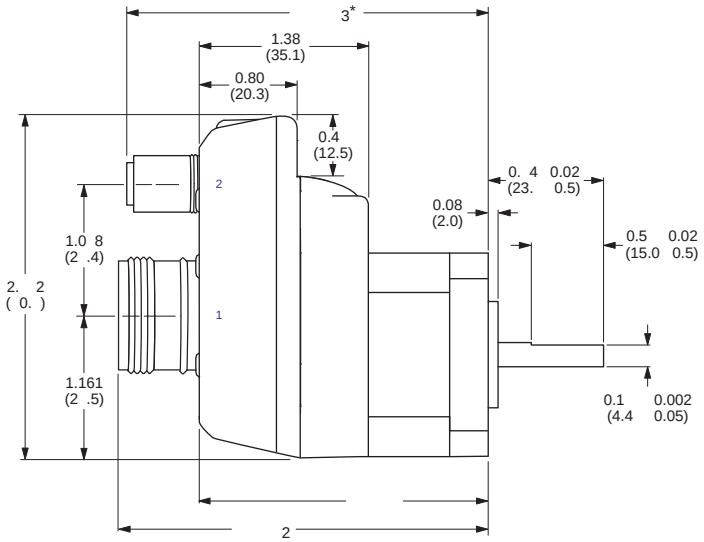


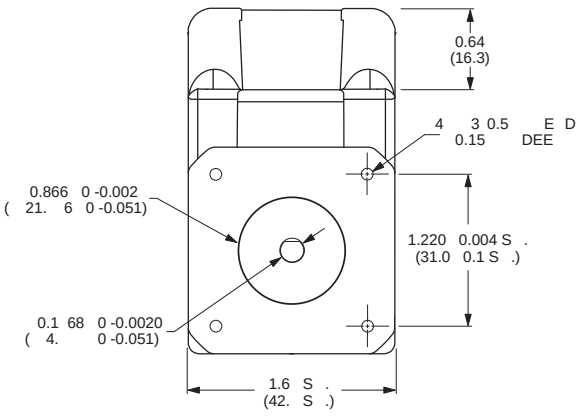
10-Pin Friction Lock Wire Crimp



DB9 (Male) for CANopen Only

MDrive17Plus^2-65 Motion Control (sealed)



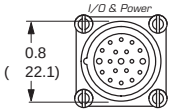


Sealed MDrivePlus Lengths Inches (mm)

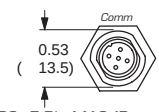
Motor Length	L_{MAX}	L_{MAX2}	L_{MAX3}*
Single	2.39 (60.71)	3.06 (77.72)	2.99 (75.95)
Double	2.62 (66.55)	3.29 (83.57)	3.22 (81.79)
Triple	2.96 (75.18)	3.63 (92.20)	3.56 (90.42)

*CANopen increases measurement by 0.09"/2.0mm

Connectors



P1: 19-Pin M23 (Male)



P2: 5-Pin M12 (Female) (or CANopen – Male)

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

ORDER INFORMATION — MDrive17Plus Motion Control

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-CC400-001
10-Pin Wire Crimp MD-CC402-001
DB9 CANopen MD-CC500-000*
5-Pin M12 CANopen (sealed version) MD-CC500-000*
5-Pin M12 RS-422/485 (sealed version) MD-CC401-001

*Requires mating connector adapter and power supply, not supplied.

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).

Mates to connector:

10-Pin Wire Crimp PD10-1434-FL3
16-Pin Wire Crimp PD16-1417-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 Termination MD-CS100-000
Right Angle Termination.....MD-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:

10-Pin Wire Crimp CK-02
16-Pin Wire Crimp CK-10

Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.

10-Pin IDC CK-01

OPTIONS

Linear Actuator
The MDrive17Plus 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
All MDrive17Plus Motion Control versions are available with an optional internal 512-line (2048 count) magnetic encoder with index mark.

Remote Encoder (Plus² versions only)
MDrive17Plus² Motion Control versions are available with differential encoder inputs for use with a remote encoder (not supplied).

Control Knob‡
The MDrive17Plus is available with a factory-mounted rear control knob for manual shaft positioning.

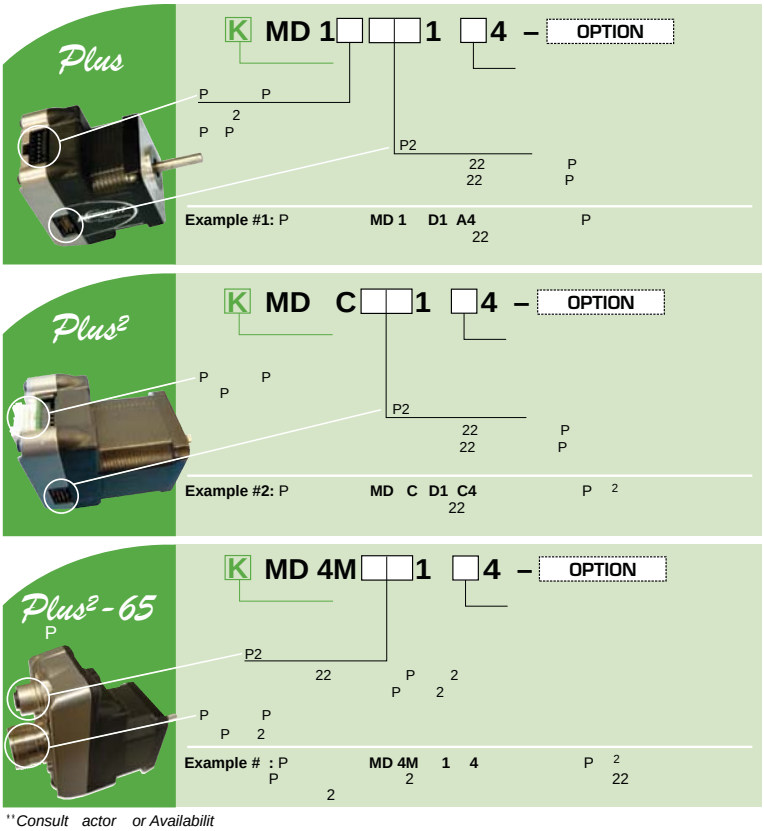
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive17Plus. Refer to details and part numbers on page 69.

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, or contact the factory for custom lengths. For more details, go to page 72.

** Consult Factory for Availability.
‡ Not Available with Sealed –65 Versions.

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

PART NUMBERING



**Consult actor or Availabilit

OPTIONS

Linear Actuator** **–L**

Internal Encoder **–E**
MD 4M 1 4–E 2

Remote Encoder **–EE**
MD 4M 1 4–EE
Available ith Plus versions onl
a not be combined ith internal encoder option

Control Knob **–N**
MD C D1 C4–N a
2 Not available ith sealed 65 versions

Planetary Gearbox **–G – F**
MD C D1 C4–G1A2
2

Linear Slide **–**
2 2
2 or Custom engths Consult actor
NO lengths onl ith A or leads
2 5 lengths onl ith A or C leads
2 6 lengths onl ith leads
MD 1 D1 A4– A1

MDRIVE 17™ MOTOR+DRIVER Plus
SPEED CONTROL

FEATURES

- Highly Integrated Microstepping Driver, Intelligent Variable Speed Controller and NEMA 17 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 VDC
- Cost Effective
- Extremely Compact
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- 10-bit Analog Speed Control Input Accepts:
  - 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**
  - External Optical Encoder
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 3 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Interface Options:
  - Pluggable Terminal Strip
  - 12.0” (30.5cm) Flying Leads
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

** Consult Factory for Availability.

DESCRIPTION

The **MDrive17Plus Speed Control** offers system designers cost effective, programmable velocity control integrated with a NEMA 17 high torque 1.8° brushless step motor and a +12 to +48 volt microstepping driver.

The MDrive17Plus 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. This allows the MDrive17Plus Speed Control to be driven by a wide variety of sensors and control devices.

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 MDrive17Plus Speed Control has 18 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 MDrive17Plus 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, planetary gearbox or linear slide. 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 pluggable terminal strip.

new

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 23.*

The MDrive17Plus is a compact, powerful and cost effective motion control solution that will reduce system cost, design and assembly time for a large range of brushlessstep 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.

MDrive17*Plus* SPEED CONTROL

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	+12 to +48 VDC *Power supply current requirements = 2A (maximum) per MDrive17Plus.* *Actual power supply current will depend on voltage and load.*	
SPEED CONTROL	Input	0 to +5 VDC*, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA or 15 to 25 kHz PWM	
	A/D Resolution	10 bit	
LOGIC INPUT	Start/Stop and Direction	Low Level	0 to +0.8 VDC
		High Level	+2.0 to +5.0 VDC
		Internal Pull-up Resistance (to +3.3 VDC)	20 kΩ
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 +85°C (non-condensing)
		Motor	–40° to +100°C (non-condensing)

**10 kΩ potentiometer resistance.*

SETUP PARAMETERS

	Function	Range	Units	Default
A1	Analog Input Mode	0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA, 15 to 25 kHz PWM	—	0 to +5 VDC
ACCL	Acceleration	91 to 1.5 X 10^9	steps/second^2	1,000,000
C	Joystick Center	1 to 1022	counts	0
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
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
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
USER ID	User ID	Customizable	1–3 characters	IMS

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	32 oz-in / 22.6 N-cm	1.66 oz-in / 1.17 N-cm	0.00053 oz-in-sec^2 / 0.038 kg-cm^2	10.4 oz / 294.8 g
DOUBLE LENGTH	60 oz-in / 42.4 N-cm	2.08 oz-in / 1.47 N-cm	0.00080 oz-in-sec^2 / 0.057 kg-cm^2	12.0 oz / 340.2 g
TRIPLE LENGTH	74.9 oz-in / 52.9 N-cm	3.47 oz-in / 2.45 N-cm	0.00116 oz-in-sec^2 / 0.082 kg-cm^2	15.2 oz / 430.9 g

ENCODER SPECIFICATIONS

Pin Assignments

	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
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 +	

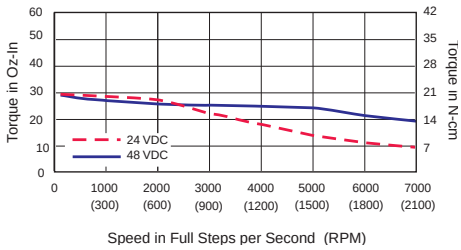
Optional encoder cables are available.

Line Counts and Part Numbers

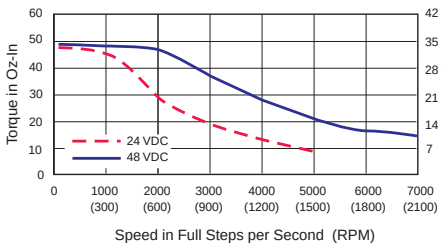
	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
Line Count	**Part Number**	**Part Number**
100	EAL	E1
200	EBL	E2
250	ECL	E3
256	EWL	EP
400	EDL	E4
500	EHL	E5
512	EXL	EQ
1000	EJL	E6
1024	EYL	ER

MOTOR PERFORMANCE — Speed-Torque

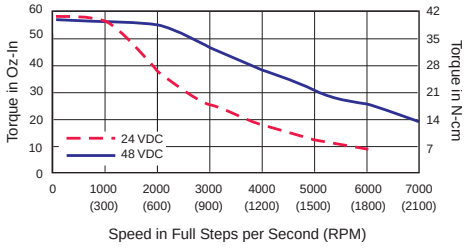
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



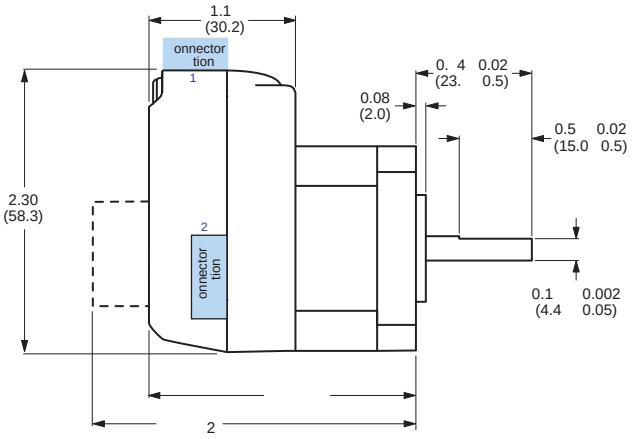
WIRE/PIN ASSIGNMENTS — MDrive17Plus Speed Control

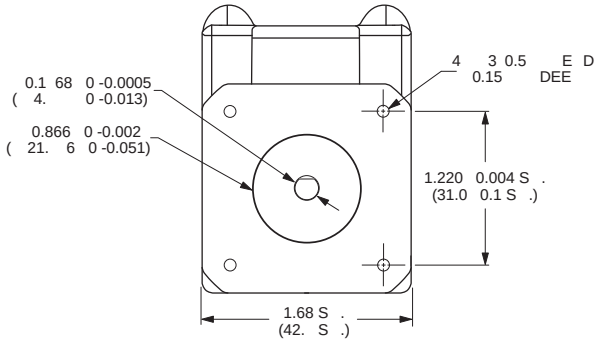
P1: I/O & POWER CONNECTOR		
Pluggable Terminal Strip	**Flying Leads** Wire Colors	**Function**
Pin 1	Violet	Start/ Stop Input
Pin 2	Blue	CW/CCW Direction Input
Pin 3	Green	Speed Control Input
Pin 4	Yellow	+5 VDC Output
Pin 5	Gray	Logic Ground
Pin 6	Black	Power Ground
Pin 7	Red	+V (+12 to +48 VDC)

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

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

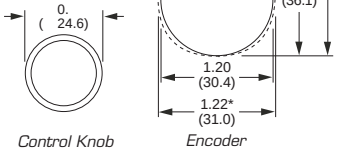




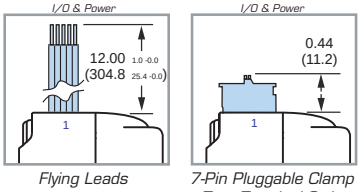
MDrive Lengths Inches (mm)

Motor Length	L_{MAX} SINGLE SHAFT or LINEAR ACTUATOR VERSION	L_{MAX2} CONTROL KNOB or ENCODER VERSION
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

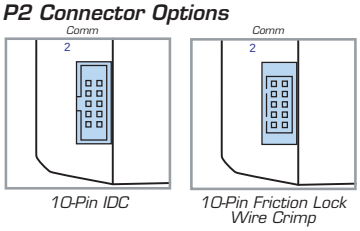
L_{MAX2} Options



P1 Connector Options



P2 Connector Options



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

ORDER INFORMATION — MDrive17Plus Speed Control

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

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:
10-Pin Wire Crimp CK-02
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDC CK-01

**Consult Factory for Availability.

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

OPTIONS

Linear Actuator**
The MDrive17Plus 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

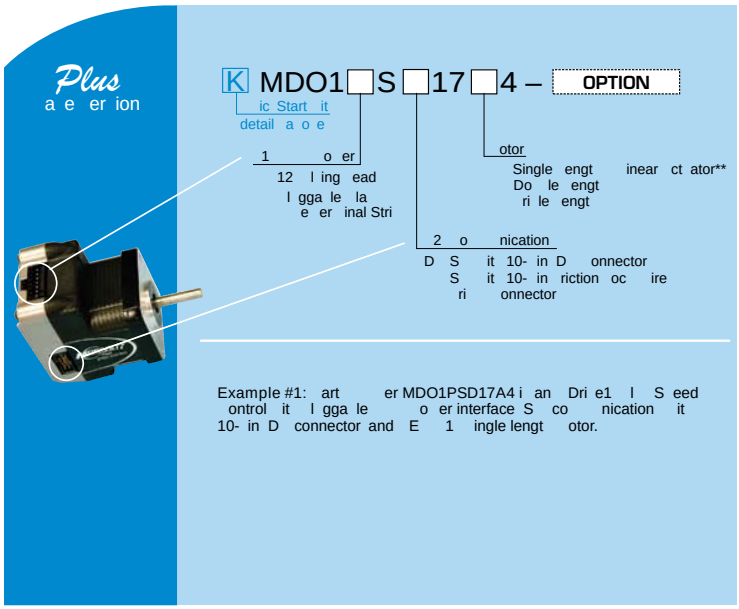
External Encoder
External optical encoders, single-end or differential, are offered factory-mounted with the MDrive17Plus. Refer to the Encoder Specifications section for available line counts. All encoders come with an index mark.
Optional encoder cables are available. Order separately.
Single-end Cable (12.0"/30.5cm).....ES-CABLE-2
Differential Locking Cable (6.0'/1.8mm).....ED-CABLE-6

Control Knob
The MDrive17Plus 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 MDrive17Plus. Refer to details and part numbers on page 69.

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, or contact the factory for custom lengths. For more details, go to page 72.

PART NUMBERING



**Consult actor or Availabilit

OPTIONS

Linear Actuator** –L
or co lete rod ct ecification ee
.i o e.co dri e l linear act ator. t l

External Encoder –E
efer to encoder ecification ection for line co nt and art n er .
E a le MDO1PSD17A4–EHL add an e ternal 500-line co nt differential o tical encoder it inde ar to e a le 1.

Control Knob –N
E a le MDO1PSD17A4–N add a rear control no for an al o itioning to e a le 1.

Planetary Gearbox – G – F
tional E lange
efer to gear o age for co lete ta le of ratio and art n er .
E a le MDO1PSD17A4–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 1. dd for o tional E flange.

Linear Slide –R
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
NO
Standard Scre engt
10 12 15 18 24 or 36
or Custom engths Consult actor
lengths onl ith A or leads
5 lengths onl ith A or C leads
6 lengths onl ith leads
E a le MDO1PSD17A4–RA10 add a inear Slide it 0.10 cre lead 10 long to e a le 1.

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 up 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 Connector[1]
- 4 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

* 12–75 VDC single, double & triple length motors; 12–60 VDC quad length motor.

**Consult Factory for Availability.

[1]Not available with Differential Input option.

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 up 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 four 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 versions[1].

new

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 28.*

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

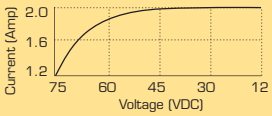
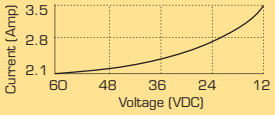
The IMS Motor Interface software is an easy to install and use GUI for configuring the MDrive23Plus from a computer's USB port. GUI access is via the IMS SPI Motor Interface available at www.imshome.com.

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.

MDrive23*Plus* MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	**+12 to +75 VDC** ***applicable for motors:*** ***- Single length*** ***- Double length*** ***- Triple length***  *Power supply current requirements = 2A (maximum)*	**+12 to +60 VDC** ***applicable for motor:*** ***- Quad length***  *Power supply current requirements = 3.5A (maximum)*
		Actual power supply current will depend on voltage and load.	
ISOLATED INPUT	Universal	Voltage Range: +5 to +24 VDC Sourcing or Sinking Step Clock, Direction and Enable	
	Differential	Voltage Range: +5 VDC Clockwise and Counterclockwise	
MOTION	Digital Filter Range	50 nS to 12.9 µS (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/µstep), 21600 (1 arc minute/µstep), 25400 (0.001mm/µstep)
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	µsteps 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 µS (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
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

ENCODER PIN ASSIGNMENTS

External Encoder

	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
Pluggable Interface	**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.

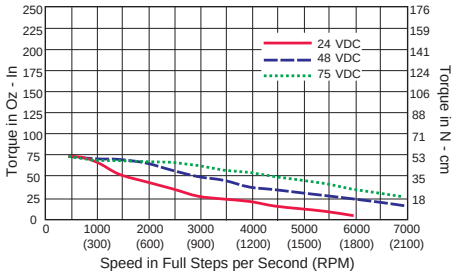
Internal Encoder

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

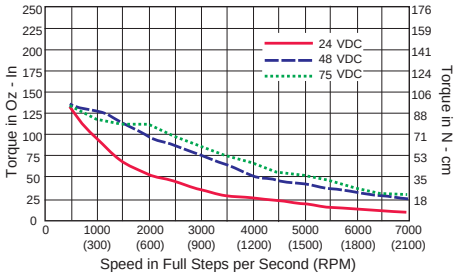
See Wire/Pin Assignments on the following page for connection details.

MOTOR PERFORMANCE — Speed-Torque

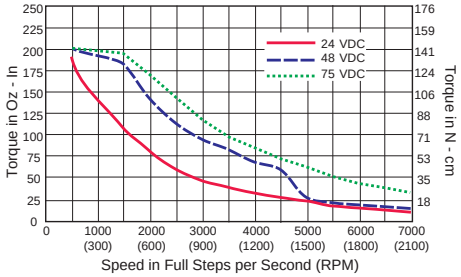
Single Length Rotary Motor



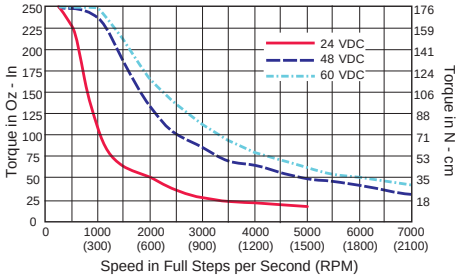
Double Length Rotary Motor



Triple Length Rotary Motor



Quad Length Rotary Motor



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 *Clockwise/Counterclockwise*
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	Input Voltage*	Input Voltage*
		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

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.*

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.

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.

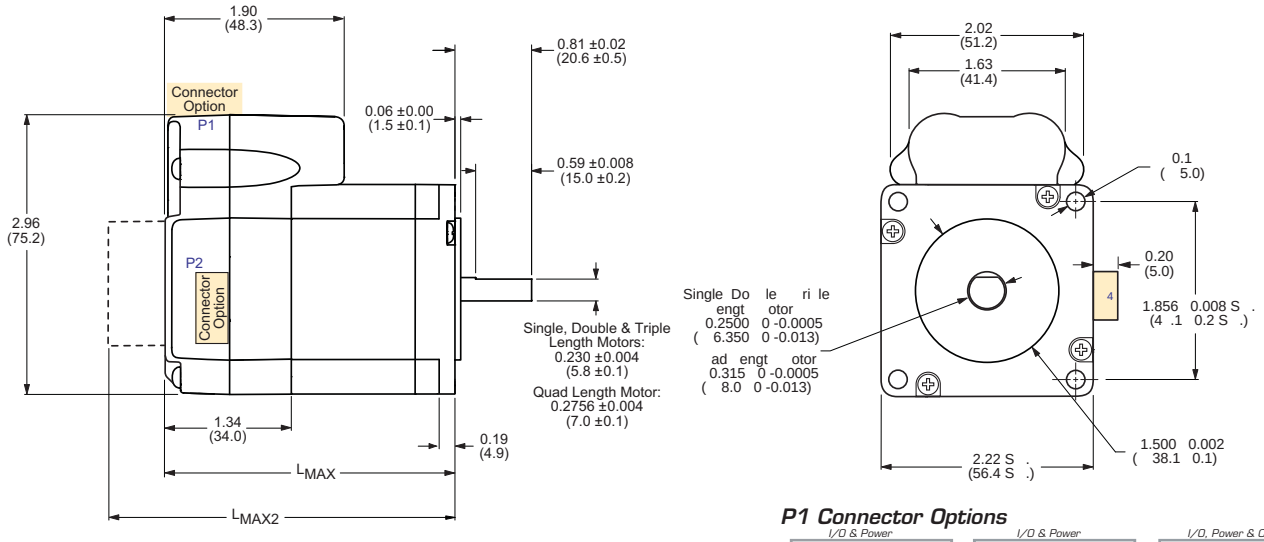
	Optional Internal Differential Encoder
Pin 3	Index +
Pin 4	Channel B +
Pin 5	Channel B –
Pin 7	Channel A +
Pin 14	Index –
Pin 15	Channel A –

*Input Voltage
+12 to +75 VDC – Single, Double & Triple Length Motors
+12 to +60 VDC – Quad Length Motor

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

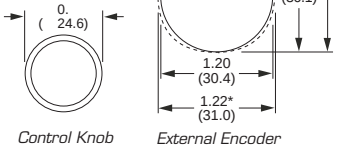
MDrive23Plus Microstepping



MDrive Lengths Inches (mm)

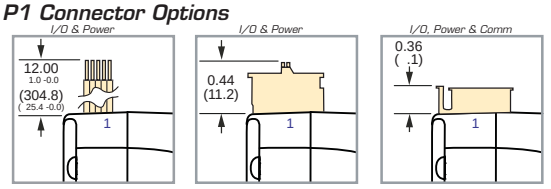
Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR	LMAX2 CONTROL KNOB or EXTERNAL ENCODER
Single	2.65 (67.31)	3.36 (85.34)
Double	3.02 (76.71)	3.73 (94.74)
Triple	3.88 (98.55)	4.59 (116.59)
Quad	5.28 (134.15)	5.99 (152.19)

LMAX2 Options



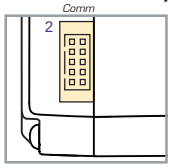
Control Knob *External Encoder*

P1 Connector Options



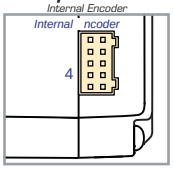
Flying Leads *7-Pin Pluggable Clamp Type Terminal Strip* *12-Pin Pluggable Locking Wire Crimp***

P2 Connector Options



10-Pin IDC *No Connector***

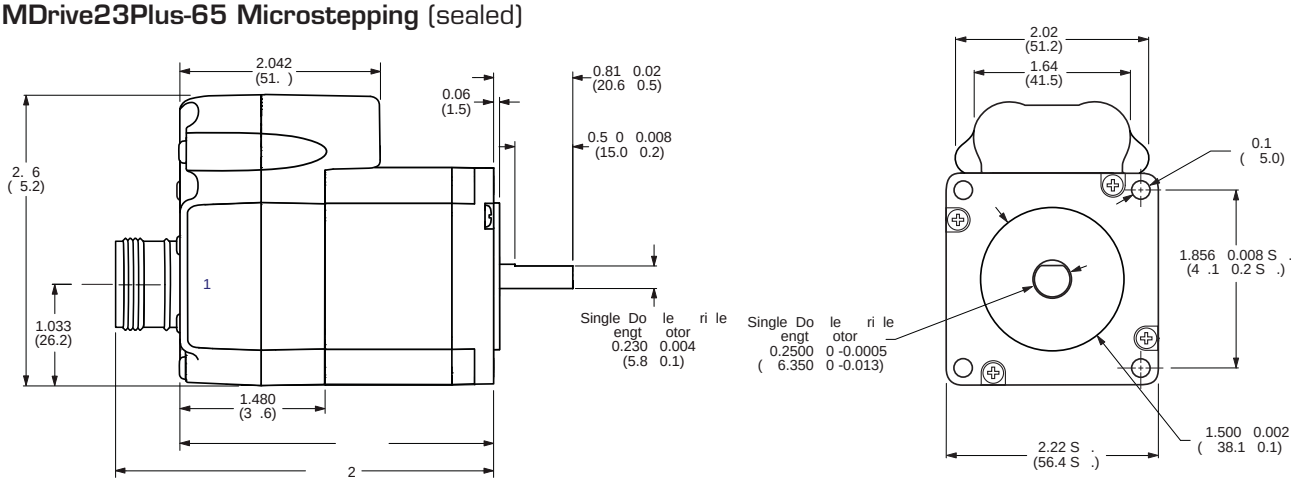
P4 Option



10-Pin Pluggable Locking Wire Crimp

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

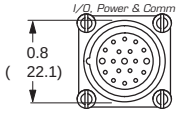
MDrive23Plus-65 Microstepping (sealed)



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



19-Pin M23 (Male)

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

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 IDC MD-CC300-001
12-Pin Wire Crimp MD-CC303-001
19-Pin M23 (sealed version).....MD-CC301-001

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12-1434-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 Termination MD-CS100-000
Right Angle Termination.....MD-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 Crimp CK-03
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDC CK-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	EWM	EDM	EHM	EXM	EFM	EJM

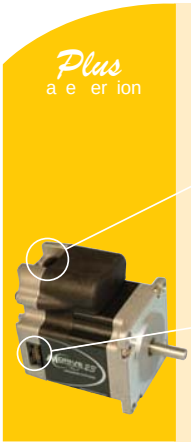
An optional encoder cable, mating to the regular version's 10-pin wire crimp connector, is available. Order separately.
Internal Encoder Cable (6.0'/1.8m).....ED-CABLE-JST10

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 beginning on page 69.

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, or contact the factory for custom lengths. For more details, go to page 74.

PART NUMBERING



K MDM ☐☐S☐2 ☐☐ – OPTION
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Example #1: art er MDM1PSD2 A7 i an Dri e23 l
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K MDM2MS 2 ☐☐ – OPTION
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Example #2: art er MDM2MS 2 7 i an Dri e23 l -65
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Consult actor or Availabilit

OPTIONS

Linear Actuator –L
or co lete rod ct ecification ee
.i o e.co dri e l linear act ator. t l

External Encoder –E☐
efer to e ternal encoder ta le for line co nt and art n er .
E a le MDM1PSD2 A7–EHL add an e ternal 500-line co nt differential o tical encoder it inde ar to e a le 1.
Not available ith sealed 65 versions

Internal Encoder –E☐
efer to internal encoder ta le for line co nt and art n er .
E a le MDM1PSD2 A7–E M add an internal 250-line co nt differential agnetic encoder it inde ar to e a le 1.

Control Knob –N
E a le MDM1PSD2 A7–N add a rear control no for an al o itioning to e a le 1. *Not available ith sealed 65 versions*

Planetary Gearbox –G☐☐☐–F
efer to gear o age for co lete tional E lange ta le of ratio and art n er .
E a le MDM1PSD2 A7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 1. dd for o tional E flange.

Linear Slide –R☐☐☐
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 or 36
or Custom engths Consult actor
E a le MDM1PSD2 A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 1.

MDRIVE 23 PLUS™
MOTOR+DRIVER
MOTION CONTROL
(with optional CANopen)

STANDARD FEATURES

- Highly Integrated Microstepping Driver, Intelligent Motion Controller and NEMA 23 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 up to +75 VDC*
- Cost Effective
- Extremely Compact
- Available Options:
  - Long Life Linear Actuators**
  - Internal Magnetic Encoder for Closed Loop Control
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 4 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 +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 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:
  - Pluggable Terminal Strip
  - 12.0” (30.5cm) Flying Leads

EXPANDED PLUS^2 FEATURES

- +24 VDC Tolerant I/O Lines Sourcing or Sinking, Inputs and Outputs:
  - 8 I/O Lines with Electronic Gearing (or)
  - 4 I/O Lines with External/Remote Encoder for Closed Loop Control
- High Spd Position Capture Input or Trip Output
- Pluggable Locking Wire Crimp Interface
- IP65 Sealed Configuration with M12/M23 Circular Connectors

* 12–75 VDC single, double & triple length motors; 12–60 VDC quad length motor.

**Consult Factory for Availability.

DESCRIPTION

The **MDrive23Plus Motion Control** offers system designers a cost effective, full featured programmable motion controller integrated with a NEMA 23 high torque 1.8° brushless step motor and a +12 up to +75 VDC* microstepping driver.

The unsurpassed smoothness and performance delivered by the MDrive23Plus 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 MDrive23Plus accepts a broad input voltage range from +12 up 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 cable 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 of all MDrive23Plus 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 of MDrive23Plus^2 versions include up to 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.

For use in environments where exposure to chemical, dust and liquids may occur, MDrive23Plus^2-65 sealed assembly versions are designed to meet IP65 specifications.

All MDrive23Plus 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) magnetic 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 MDrive23Plus^2 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 producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.

Motor configurations include a single shaft rotary in four lengths, and linear actuators with long life Acme screw**.

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 M12/M23 circular connectors on IP65 sealed versions.

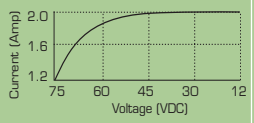
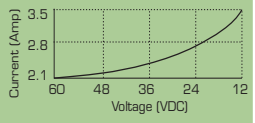
new

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 33.*

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.

MDrive23*Plus* MOTION CONTROL

STANDARD SPECIFICATIONS (Plus Versions)

INPUT VOLTAGE (+V)	Range	**+12 to +75 VDC** ***applicable for motors:*** ***- Single length*** ***- Double length*** ***- Triple length***  *Power supply current requirements = 2A (maximum)*	**+12 to +60 VDC** ***applicable for motor:*** ***- Quad length***  *Power supply current requirements = 3.5A (maximum)*	
AUX. LOGIC INPUT VOLTAGE	Range	+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.		
ANALOG INPUT	Resolution	10 Bit		
	Voltage Range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA		
GENERAL PURPOSE I/O	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		
COMMUNICATION	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)		
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)	
	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 10^9 Steps Per Second^2	
		Resolution	90.9 Steps Per Second^2	
SOFTWARE	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, General Purpose	
		Outputs	Moving, Fault, Stall, Velocity Change, General Purpose	
	Trip Functions	Trip on Input, Trip on Position, Trip on Time, Trip Capture, Trip on Relative Position		
	Party Mode Addresses	62		
	Encoder Functions	Stall Detection, Position Maintenance, Find Index		
THERMAL	Operating Temperature	Heat Sink	–40° to +85°C (non-condensing)	
		Motor	–40° to +100°C (non-condensing)	

EXPANDED SPECIFICATIONS (Plus^2 & Plus^2-65 Versions)

GENERAL PURPOSE I/O	Number/Type	8 Sourcing or Sinking Outputs/Inputs (or 4 when Remote Encoder Option is Selected)		
	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		
MOTION	Electronic Gearing	Range‡/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‡ (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

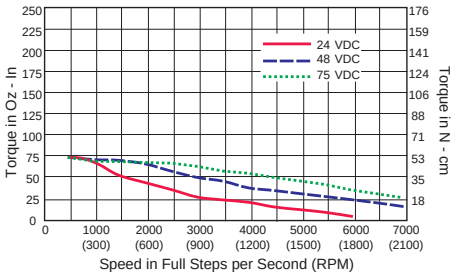
‡ Adjusting the microstep resolution can increase the range.

MOTOR SPECIFICATIONS

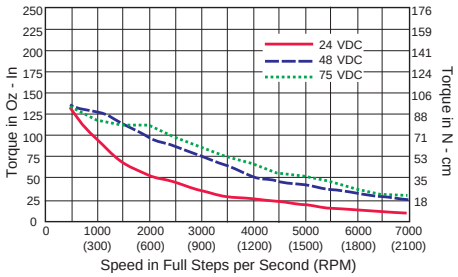
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	90 oz-in / 64 N-cm	3.9 oz-in / 2.7 N-cm	0.0025 oz-in-sec^2 / 0.18 kg-cm^2	21.6 oz / 612.3 g
DOUBLE LENGTH	144 oz-in / 102 N-cm	5.6 oz-in / 3.92 N-cm	0.0037 oz-in-sec^2 / 0.26 kg-cm^2	26.4 oz / 748.4 g
TRIPLE LENGTH	239 oz-in / 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

MOTOR PERFORMANCE — Speed-Torque

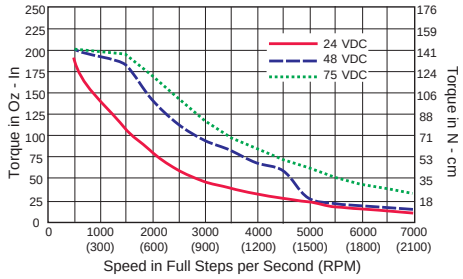
Single Length Rotary Motor



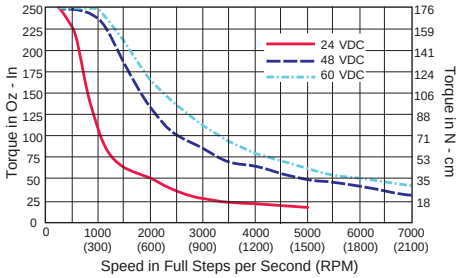
Double Length Rotary Motor



Triple Length Rotary Motor



Quad Length Rotary Motor



WIRE/PIN ASSIGNMENTS — MDrive23Plus Motion Control

Plus

P1: I/O & POWER CONNECTOR		
Pluggable Terminal Strip	Flying Leads Wire Colors	Function
Pin 1	White/Yellow	I/O 1
Pin 2	White/Orange	I/O 2
Pin 3	White/Violet	I/O 3
Pin 4	White/Blue	I/O 4
Pin 5	Green	Analog Input
Pin 6	Black	Power/Aux Ground
Pin 7	Red	Input Voltage*

P2: COMM CONNECTOR				
RS-422/485			CANopen	
10-Pin IDC	*Wire Crimp*	Function	DB9 (Male)	Function
Pin 1	Pin 9	TX +	Pin 1	No Connect
Pin 2	Pin 10	TX –	Pin 2	CAN Low
Pin 3	Pin 7	RX +	Pin 3	CAN –V
Pin 4	Pin 8	RX –	Pin 4	Aux Power
Pin 5	Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	Pin 6	RX +	Pin 6	CAN –V
Pin 7	Pin 3	RX –	Pin 7	CAN High
Pin 8	Pin 4	TX –	Pin 8	No Connect
Pin 9	Pin 1	TX +	Pin 9	CAN +V
Pin 10	Pin 2	Comm Ground		

***Input Voltage**

+12 to +75 VDC – Single, Double & Triple Length Motors
+12 to +60 VDC – Quad Length Motor

Plus^2

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	Channel A +
Pin 8	I/O 10	Channel A –
Pin 9	I/O 11	Channel B +
Pin 10	I/O 12	Channel B –
Pin 11	Capture/Trip I/O	Capture/Trip I/O
Pin 12	Analog In	Analog In
Pin 13	Step/Clock I/O	Index +
Pin 14	Direction/Clock I/O	Index –

P3: POWER CONNECTOR		
Wire Crimp	Function	
	Expanded I/O	Remote Encoder Closed Loop Control
Pin 1	Input Voltage*	Input Voltage*
Pin 2	Power/Aux Ground	Power/Aux Ground

P2: COMM CONNECTOR				
RS-422/485			CANopen	
10-Pin IDC	Wire Crimp	Function	DB9 (Male)	Function
Pin 1	Pin 9	TX +	Pin 1	No Connect
Pin 2	Pin 10	TX –	Pin 2	CAN Low
Pin 3	Pin 7	RX +	Pin 3	CAN –V
Pin 4	Pin 8	RX –	Pin 4	Aux Power
Pin 5	Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	Pin 6	RX +	Pin 6	CAN –V
Pin 7	Pin 3	RX –	Pin 7	CAN High
Pin 8	Pin 4	TX –	Pin 8	No Connect
Pin 9	Pin 1	TX +	Pin 9	CAN +V
Pin 10	Pin 2	Comm Ground		

Plus^2-65 (sealed)

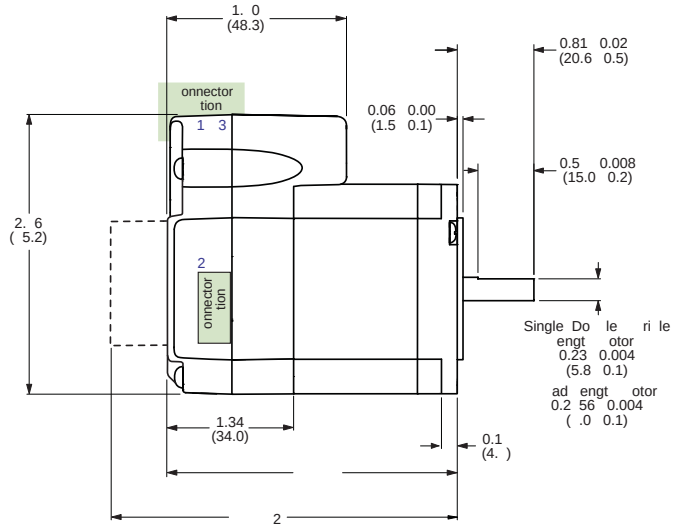
P1: I/O & POWER CONNECTOR		
M23 Circular (Male)	Function	
	Expanded I/O	Remote Encoder Closed Loop Control
Pin 1	I/O 9	Channel A +
Pin 2	I/O 11	Channel B +
Pin 3	Step/Clock I/O	Index +
Pin 4	I/O 1	I/O 1
Pin 5	Direction/Clock I/O	Index –
Pin 6	+V (+12 to +75 VDC)	+V (+12 to +75 VDC)
Pin 7	Aux-Logic (+12 to +24 VDC)	Aux-Logic (+12 to +24 VDC)
Pin 8	Comm Ground	Comm Ground
Pin 9	I/O 3	I/O 3
Pin 10	I/O Ground	I/O Ground
Pin 11	I/O Power	I/O Power
Pin 12	Shell Connect	Shell Connect
Pin 13	I/O 12	Channel B –
Pin 14	Capture/Trip I/O	Capture/Trip I/O
Pin 15	Analog In	Analog In
Pin 16	I/O 2	I/O 2
Pin 17	I/O 4	I/O 4
Pin 18	I/O 10	Channel A –
Pin 19	Power/Aux Ground	Power/Aux Ground

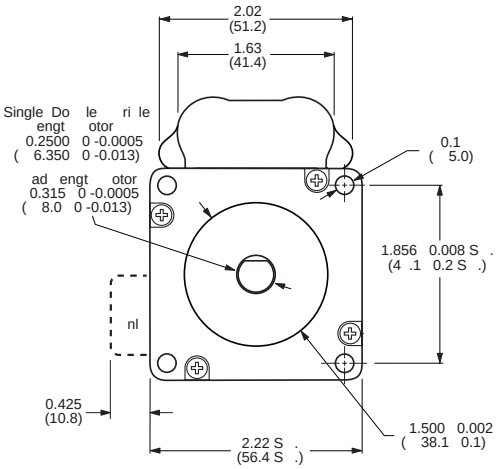
P2: COMM CONNECTOR			
RS-422/485		CANopen	
M12 Circular (Female)	Function	M12 Circular (Male)	Function
Pin 1	TX –	Pin 1	Shield
Pin 2	TX +	Pin 2	CAN +V
Pin 3	RX +	Pin 3	CAN –V
Pin 4	RX –	Pin 4	CAN High
Pin 5	Comm Ground	Pin 5	CAN Low

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

MDrive23Plus & Plus2 Motion Control

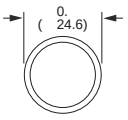




MDrive Lengths Inches (mm)

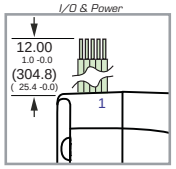
Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	LMAX2 CONTROL KNOB VERSION
Single	2.65 (67.31)	3.36 (85.34)
Double	3.02 (76.71)	3.73 (94.74)
Triple	3.88 (98.55)	4.59 (116.59)
Quad	5.28 (134.15)	5.99 (152.19)

LMAX2 Options

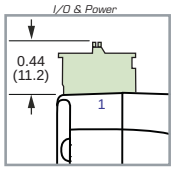


Control Knob

P1 Connector Options MDrivePlus

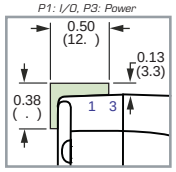


Flying Leads



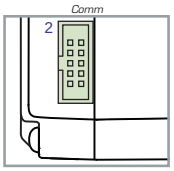
7-Pin Pluggable Clamp Type Terminal Strip

P1/P3 MDrivePlus2

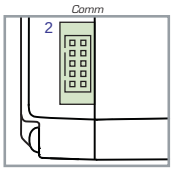


14- & 2-Pin Pluggable Locking Wire Crimps

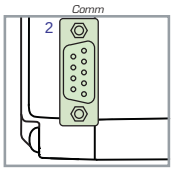
P2 Connector Options MDrivePlus & Plus2



10-Pin IDC

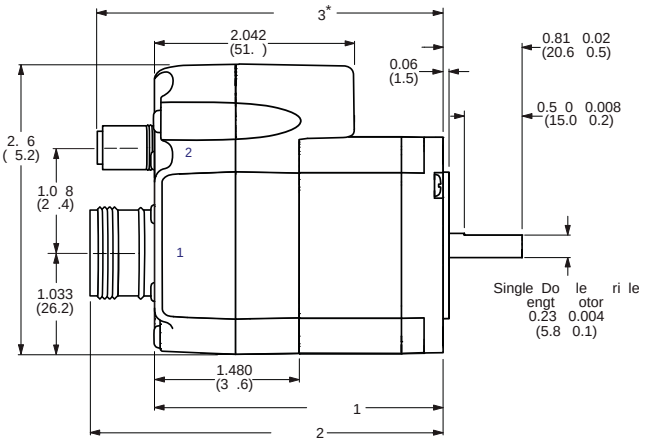


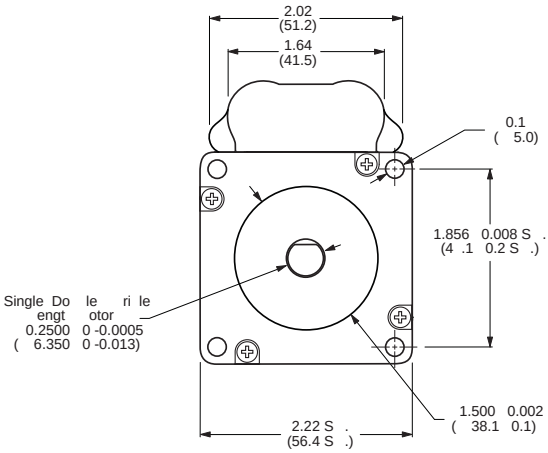
10-Pin Friction Lock Wire Crimp



DB9 (Male) for CANopen Only

MDrive23Plus2-65 Motion Control (sealed)



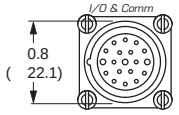


Sealed MDrive Lengths Inches (mm)

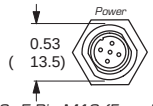
Motor Length	LMAX	LMAX2	LMAX3*
Single	2.82 (71.63)	3.48 (88.39)	3.42 (86.87)
Double	3.16 (80.26)	3.82 (97.03)	3.76 (95.5)
Triple	4.02 (102.11)	4.67 (118.62)	4.62 (117.35)

*CANopen increases measurement by 0.09"/2.0mm

Connectors



P1: 19-Pin M23 (Male)



P2: 5-Pin M12 (Female) (or CANopen – Male)

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

ORDER INFORMATION — MDrive23Plus Motion Control

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-CC400-001
10-Pin Wire Crimp MD-CC402-001
DB9 CANopen MD-CC500-000*
5-Pin M12 CANopen (sealed version) MD-CC500-000*
5-Pin M12 RS-422/485 (sealed version) MD-CC401-001
*Requires mating connector adapter and power supply, not supplied.

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).

Mates to connector:

10-Pin Wire Crimp PD10-1434-FL3
14-Pin Wire Crimp PD14-2334-FL3
2-Pin Wire Crimp PD02-2300-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 Termination MD-CS100-000
Right Angle Termination.....MD-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:

10-Pin Wire Crimp CK-02
14-Pin Wire Crimp CK-09
2-Pin Wire Crimp CK-04

Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.

10-Pin IDC CK-01

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

Internal Encoder
All MDrive23Plus Motion Control versions are available with an optional internal 512-line (2048 count) magnetic encoder with index mark.

Remote Encoder (Plus² versions only)
MDrive23Plus² Motion Control versions are available with differential encoder inputs for use with a remote encoder (not supplied).

Control Knob‡
The MDrive23Plus is available with a factory-mounted rear control knob for manual shaft positioning.

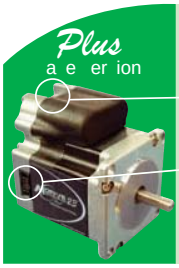
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive23Plus. Refer to details and part numbers beginning on page 69.

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, or contact the factory for custom lengths. For more details, go to page 74.

** Consult Factory for Availability.
‡ Not Available with Sealed –65 Versions.

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

PART NUMBERING



K MD 1 □ □□ 2 □□ – OPTION
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2 o nication
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S-422 485 it 10- in riction oc ire ri
o en it D onnector

Example #1: art er MD 1PRD2 A7 i an Dri e23 l otion ontrol it l gga le o er interface S-422 485 co nication it 10- in D connector and E 23 ingle lengt otor.

K MD □□ 2 □□ – OPTION
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Example #2: art er MD RD2 7 i an Dri e23 l ² otion ontrol it 14- in interface and 2- in o er interface S-422 485 co nication it 10- in D connector and E 23 tri le lengt otor.

K MD 4M □□ 2 □□ – OPTION
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otor
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Example # : art er MD 4MR 2 7 i an Dri e23 l ²-65 otion ontrol ealed it 65 rating 1 - in 23 o er interface S-422 485 co nication it 5- in 12 circ lar connector and E 23 do le lengt otor.

**Consult actor or Availabilit

OPTIONS

Linear Actuator ** –L
or co lete rod ct ecification ee .i o e.co dri e l linear act ator. t l

Internal Encoder –E
E a le MD 4MR 2 7–E add a 512-line internal agnetic encoder it inde ar to e a le 3.

Remote Encoder –EE
E a le MD 4MR 2 7–EE add differential encoder in t for e it re ote encoder (not lied). *Available ith Plus versions onl a not be combined ith internal encoder option*

Control Knob –N
E a le MD RD2 7–N add a rear control no for an al o itioning to e a le 2. *Not available ith sealed 65 versions*

Planetary Gearbox –G □□□ – F
efer to gear o age for co lete ta le of ratio and art n er .
tional E lange
E a le MD RD2 7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 2. dd for o tional E flange.

Linear Slide –R □ □□
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 or 36
or Custom engths Consult actor
E a le MD 1PRD2 A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 1.

MDRIVE 23™ MOTOR+DRIVER Plus

SPEED CONTROL

FEATURES

- Highly Integrated Microstepping Driver, Intelligent Variable Speed Controller and NEMA 23 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 up to +75 VDC*
- Cost Effective
- Extremely Compact
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- 10-bit Analog Speed Control Input Accepts:
  - 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**
  - External Optical Encoder
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 4 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Interface Options:
  - Pluggable Terminal Strip
  - 12.0” (30.5cm) Flying Leads
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

* 12–75 VDC single, double & triple length motors; 12–60 VDC quad length motor.

**Consult Factory for Availability.

DESCRIPTION

The **MDrive23Plus Speed Control** offers system designers cost effective, programmable velocity control integrated with a NEMA 23 high torque 1.8° brushless step motor and a +12 up to +75 VDC* microstepping driver.

The MDrive23Plus 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. This allows the MDrive23Plus Speed Control to be driven by a wide variety of sensors and control devices.

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 MDrive23Plus Speed Control has 18 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 MDrive23Plus Speed Control is available in multiple configurations to fit various system needs. Rotary motor versions come in four lengths and may include an optical encoder, control knob, planetary gearbox or linear slide. 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 pluggable terminal strip.

new

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 37.*

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

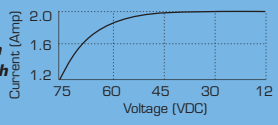
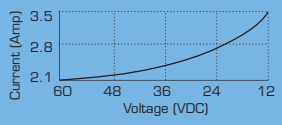
The IMS Analog Speed Control is a software GUI for quick and easy parameter setup of the MDrivePlus Speed Control from a computer's USB port. GUI access is via the IMS SPI Motor Interface available at www.imshome.com. The IMS interface is also used to upgrade MDrivePlus Speed Control firmware.

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.

MDrive23*Plus* SPEED CONTROL

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	**+12 to +75 VDC** ***applicable for motors:*** ***- Single length*** ***- Double length*** ***- Triple length***  *Power supply current requirements = 2A (maximum)*	**+12 to +60 VDC** ***applicable for motor:*** ***- Quad length***  *Power supply current requirements = 3.5A (maximum)*
SPEED CONTROL	Input	0 to +5 VDC*, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA or 15 to 25 kHz PWM	
	A/D Resolution	10 bit	
LOGIC INPUT	Start/Stop and Direction	Low Level	0 to +0.8 VDC
		High Level	+2.0 to +5.0 VDC
		Internal Pull-up Resistance (to +3.3 VDC)	20 kΩ
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 +85°C (non-condensing)
		Motor	–40° to +100°C (non-condensing)

**10 kΩ potentiometer resistance.*

SETUP PARAMETERS

	Function	Range	Units	Default
A1	Analog Input Mode	0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA, 15 to 25 kHz PWM	—	0 to +5 VDC
ACCL	Acceleration	91 to 1.5 X 10^9	steps/second^2	1,000,000
C	Joystick Center	1 to 1022	counts	0
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
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
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
USER ID	User ID	Customizable	1–3 characters	IMS

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
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

ENCODER SPECIFICATIONS

Pin Assignments

	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
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 +	

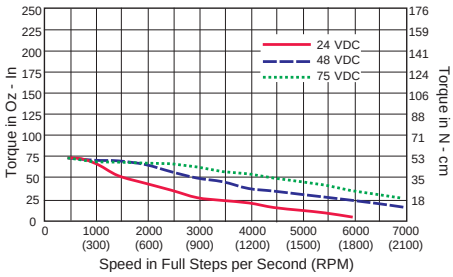
Optional encoder cables are available.

Line Counts and Part Numbers

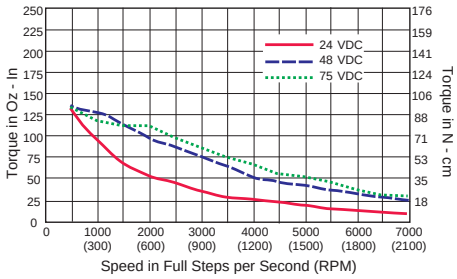
	DIFFERENTIAL ENCODER *with locking connector feature*	**SINGLE-END ENCODER**
Line Count	**Part Number**	**Part Number**
100	EAL	E1
200	EBL	E2
250	ECL	E3
256	EWL	EP
400	EDL	E4
500	EHL	E5
512	EXL	EQ
1000	EJL	E6
1024	EYL	ER

MOTOR PERFORMANCE — Speed-Torque

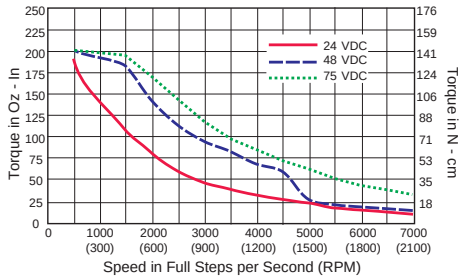
Single Length Rotary Motor



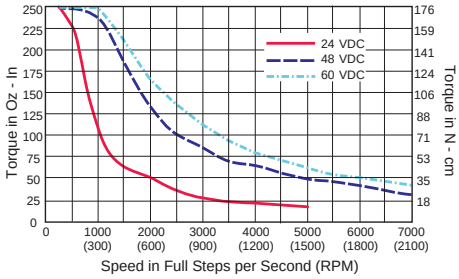
Double Length Rotary Motor



Triple Length Rotary Motor



Quad Length Rotary Motor



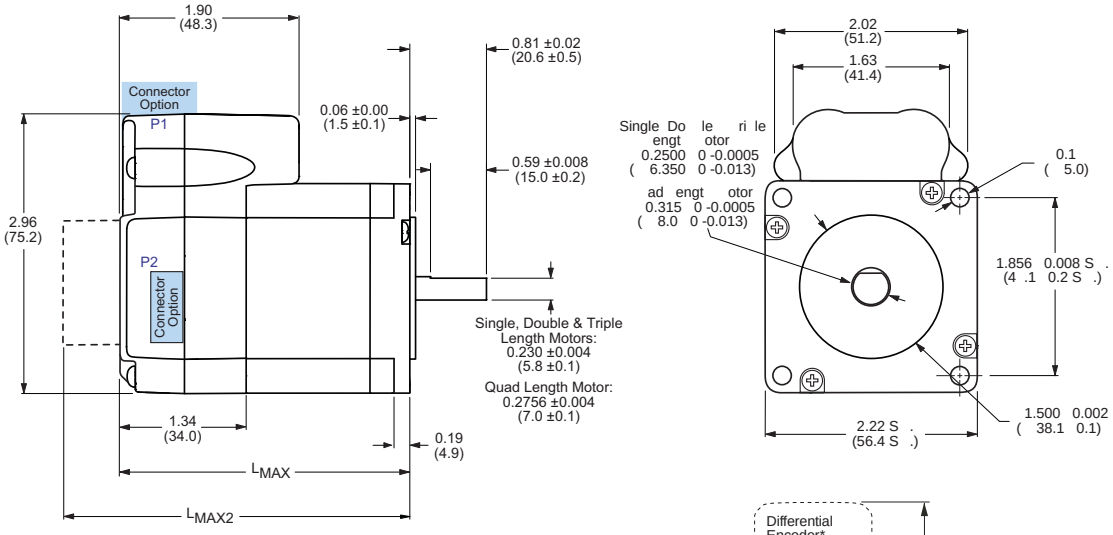
WIRE/PIN ASSIGNMENTS

P1: I/O & POWER CONNECTOR		
Pluggable Terminal Strip	**Flying Leads** Wire Colors	**Function**
Pin 1	Violet	Start/Stop Input
Pin 2	Blue	CW/CCW Direction Input
Pin 3	Green	Speed Control Input
Pin 4	Yellow	+5 VDC Output
Pin 5	Gray	Logic Ground
Pin 6	Black	Power Ground
Pin 7	Red	Input Voltage: +12 to +75 VDC – Single, Double & Triple Motors +12 to +60 VDC – Quad Motor

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

MECHANICAL SPECIFICATIONS — MDrive23Plus Speed Control

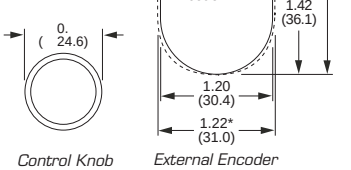
Dimensions in Inches (mm)



MDrive Lengths *Inches (mm)*

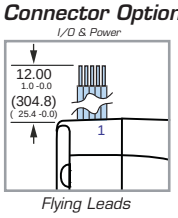
Motor Length	LMAX SINGLE SHAFT or LINEAR ACTUATOR	LMAX2 CONTROL KNOB or EXTERNAL ENCODER
Single	2.65 (67.31)	3.36 (85.34)
Double	3.02 (76.71)	3.73 (94.74)
Triple	3.88 (98.55)	4.59 (116.59)
Quad	5.28 (134.15)	5.99 (152.19)

LMAX2 Options

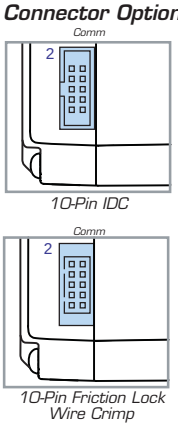


Control Knob *External Encoder*

P1 Connector Options



P2 Connector Options



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

ORDER INFORMATION — MDrive23Plus Speed Control

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

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:
10-Pin Wire Crimp CK-02
Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.
10-Pin IDC CK-01

**Consult Factory for Availability.

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

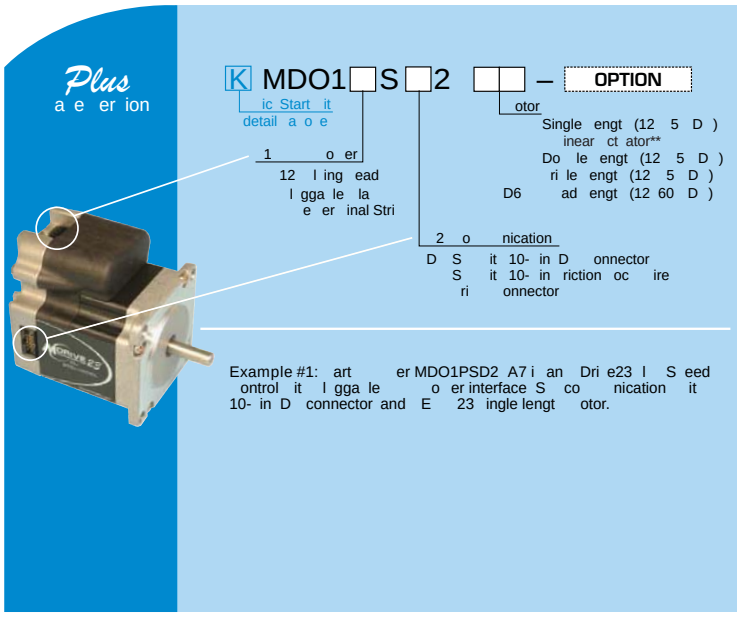
External Encoder
External optical encoders, single-end or differential, are offered factory-mounted with the MDrive23Plus. Refer to the Encoder Specifications section for available line counts. All encoders come with an index mark.
Optional encoder cables are available. Order separately.
Single-end Cable (12.0"/30.5cm).....ES-CABLE-2
Differential Locking Cable (6.0'/1.8mm).....ED-CABLE-6

Control Knob
The MDrive23Plus 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 MDrive23Plus. Refer to details and part numbers beginning on page 69.

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, or contact the factory for custom lengths. For more details, go to page 74.

PART NUMBERING



Consult actor or Availabilit

OPTIONS

Linear Actuator** –L
or co lete rod ct ecification ee
.i o e.co dri e l linear act ator. t l

External Encoder –E
efer to encoder ecification ection for line co nt and art n er .
E a le MDO1PSD2 A7–EHL add an e ternal 500-line co nt differential o tical encoder it inde ar to e a le 1.

Control Knob –N
E a le MDO1PSD2 A7–N add a rear control no for an al o itioning to e a le 1.

Planetary Gearbox – G – F tional E lange
efer to gear o age for co lete ta le of ratio and art n er .
E a le MDO1PSD2 A7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 1. dd for o tional E flange.

Linear Slide –R
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 or 36
or Custom engths Consult actor
E a le MDO1PSD2 A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 1.

MDRIVE 34™ MOTOR+DRIVER Plus

MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver 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
- 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
  - Programmable Digital Filtering for Clock and Direction Inputs
- Available Options:
  - Long Life Linear Actuators**
  - Internal Optical Encoder
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 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 **MDrive34Plus 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 MDrive34Plus 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 MDrive34Plus 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 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 +75°C provides long life, trouble free service in demanding environments.

The MDrive34Plus uses a NEMA 34 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.

The versatile MDrive34Plus 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.

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 42.*

The MDrive34Plus 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 MDrive34Plus 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.

MDrive34*Plus* MICROSTEPPING

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.	
ISOLATED INPUT	Step Clock, Direction and Enable		
	Voltage Range	+5 to +24 VDC Sourcing or Sinking	
MOTION	Digital Filter Range	50 nS to 12.9 µS	
	Clock Types	Step/Direction, Quadrature, Step Up/Step Down	
	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/µstep), 21600 (1 arc minute/µstep), 25400 (0.001mm/µstep)
TEMP OUTPUT WARNING	Open-Drain Type	+5 to +24 VDC	50mA Current
THERMAL	Operating Temperature	Heat Sink	–40° to +75°C (non-condensing)
		Motor	–40° to +90°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	µsteps per 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	—	Step/Dir
CLK IOF	Clock and Direction Filter	50 nS to 12.9 µS (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 High	High/Low	—	High
WARN TEMP	Over Temperature Warning	0 to 125°C	°C	80°C

All parameters are set using the supplied IMS 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

ENCODER SPECIFICATIONS

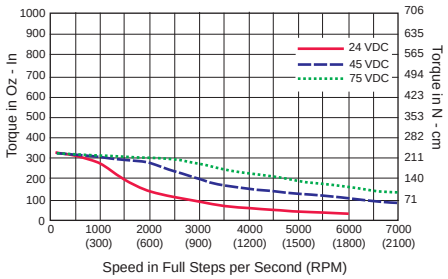
Line Counts and Part Numbers

		DIFFERENTIAL ENCODER	SINGLE-END ENCODER
INTERNAL OPTICAL ENCODER	**Line Count**	**Part Number**	**Part Number**
	100	EA	E1
	200	EB	E2
	250	EC	E3
	256	EW	EP
	400	ED	E4
	500	EH	E5
	512	EX	EQ
	1000	EJ	E6
	1024	EY	ER

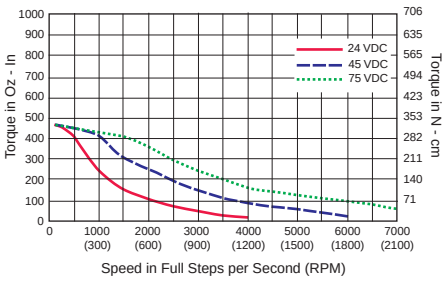
NOTE:
MDrive34Plus with Pluggable Interface – available with Differential Encoder only.
MDrive34Plus with Flying Leads Interface – available with Differential or Single-End Encoder.

MOTOR PERFORMANCE — Speed-Torque

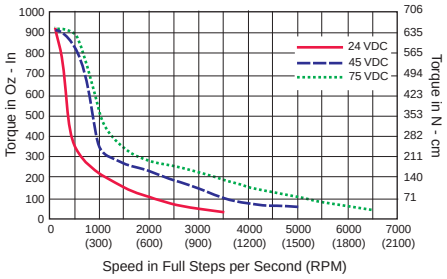
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



WIRE/PIN ASSIGNMENTS — MDrive34Plus Microstepping

Flying Leads Interface

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

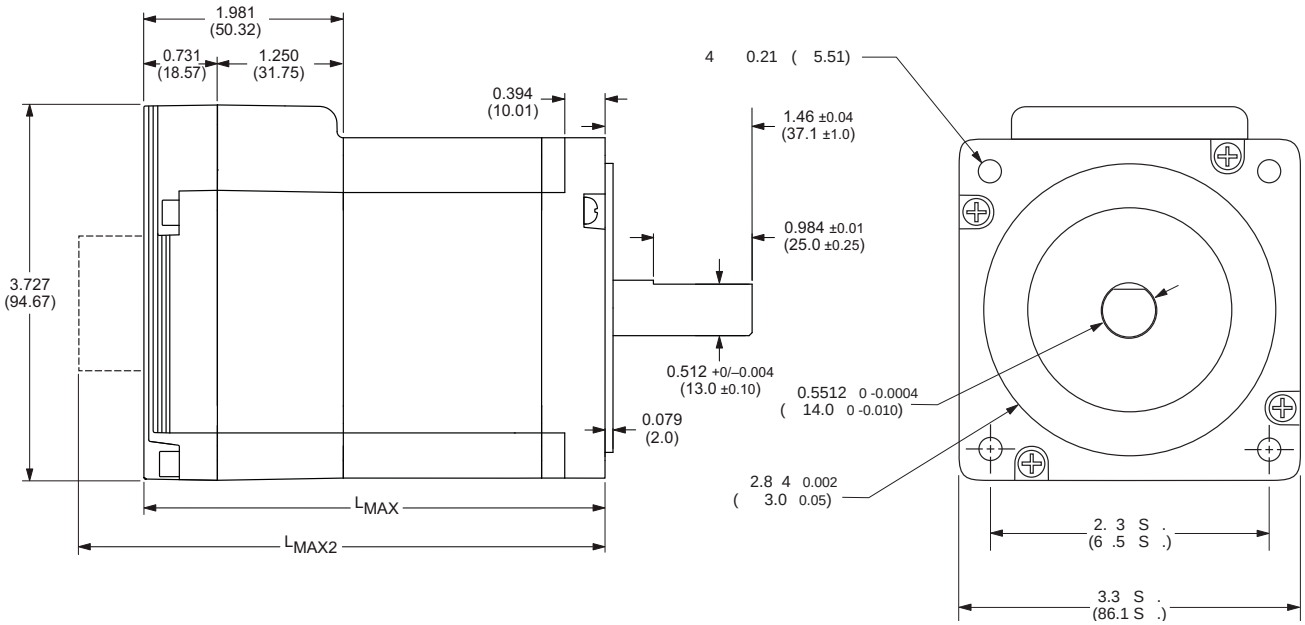
P3: POWER CONNECTOR	
Pluggable Locking Wire Crimp	Function
Pin 1	+V (+12 to +75 VDC)
Pin 2	Power Ground

P4: DIFFERENTIAL INTERNAL ENCODER (OPTIONAL)	
Friction Lock 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	+5 VDC Input
Pin 9	No Connect
Pin 10	No Connect

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

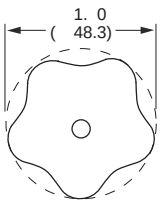
MDrive34Plus Microstepping



MDrive Lengths *Inches (mm)*

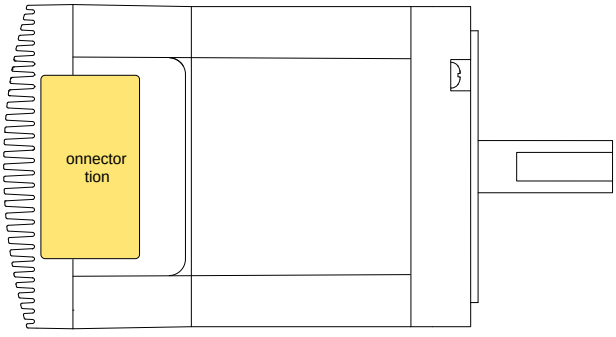
Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	LMAX2 CONTROL KNOB VERSION
Single	3.81 (96.77)	4.52 (114.81)
Double	4.60 (116.84)	5.31 (134.87)
Triple	6.17 (156.72)	6.88 (174.75)

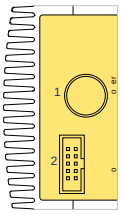
L_{MAX2} Option



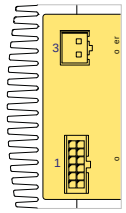
Control Knob

Connector Options

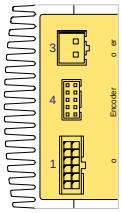




Flying Leads



Pluggable Locking Wire Crimp



Pluggable Locking Wire Crimp with Internal Encoder

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

ORDER INFORMATION — MDrive34Plus 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 IDC MD-CC300-001
12-Pin Wire Crimp MD-CC303-001

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0" (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12-1434-FL3
10-Pin Wire Crimp PD10-3400-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:
12-Pin Wire Crimp CK-03
10-Pin Wire Crimp CK-02
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 MDrive34Plus 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 are offered factory-mounted with the MDrive34Plus Microstepping. Refer to the Encoder Specifications section for available styles, line counts and part numbers. All encoders come with an index mark.

Control Knob
The MDrive34Plus is available with a factory-mounted rear control knob for manual shaft positioning.

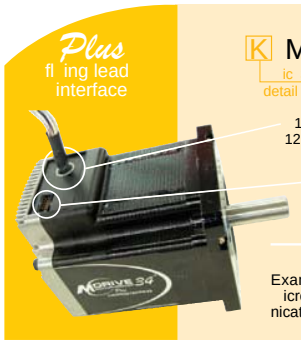
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive34Plus. Refer to details and part numbers beginning on page 69.

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 42.0" (106.7cm) long, or contact the factory for custom lengths. For more details, go to page 76.

** Consult Factory for Availability.

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

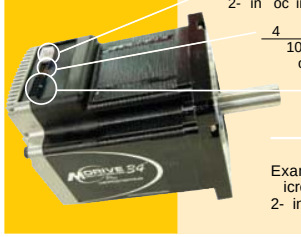
PART NUMBERING



Plus
fl ing lead
interface

K MDM1FSD 4☐7 – OPTION
ic Start it
detail a o e
otor
Single engt inear ct ator**
Do le engt
ri le engt
1 o er
12 l ing ead
2 o nication
10- in D onnector

Example #1: art er MDM1FSD 4A7 i an Dri e34 l icro te ing it 12 fl ing lead o er interface S co - nication it 10- in D connector and E 34 ingle lengt otor.



Plus
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interface

K MDM1 S☐ 4☐7 – OPTION
ic Start it
detail a o e
otor
Single engt inear ct ator**
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10- in Encoder nterface
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12- in oc ing ire ri

Example #2: art er MDM1 SL 4A7 i an Dri e34 l icro te ing it 12- in co nication interface 2- in o er connector and E 34 ingle lengt otor.

''Consult actor or Availabilit

OPTIONS

Linear Actuator** –L
or co lete rod ct ecification ee .i o eco dri e l linear act ator. t l

Internal Encoder –E☐
efer to encoder ecification ection for line co nt and art n er .
E a le MDM1 SL 4A7–EH add an internal 500-line co nt differential o tical encoder it inde ar to e a le 2 ic i interfaced ia a 10- in friction loc ire cri connector.

Control Knob –N
E a le MDM1 SL 4A7–N add a rear control no for an al o itioning to e a le 2.

Planetary Gearbox –G☐☐☐–F
efer to gear o age for co lete tional E lange
ta le of ratio and art n er .
E a le MDM1 SL 4A7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 2. dd for o tional E flange.

Linear Slide –R☐☐☐
Scre ead
(inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 36 or 42
or Custom engths Consult actor
E a le MDM1 SL 4A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 2.

MDRIVE 34™ MOTOR+DRIVER Plus

MOTION CONTROL
(with optional CANopen)

STANDARD FEATURES

- Highly Integrated Microstepping Driver, Intelligent Motion 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
- Available Options:
  - Long Life Linear Actuators**
  - Internal Optical Encoder for Closed Loop Control
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - Linear Slide
- 3 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 +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 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^2 FEATURES

- 8 I/O Lines, +24 VDC Tolerant Sourcing or Sinking, Inputs and Outputs
- Electronic Gearing
- High Speed Position Capture Input or Trip Output
- Pluggable Locking Wire Crimp Interface

**Consult Factory for Availability.

DESCRIPTION

The **MDrive34Plus Motion Control** offers system designers a cost effective, full featured programmable motion controller integrated with a NEMA 34 high torque 1.8° brushless step 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 cable runs and multiple drive systems. An extended operating range of –40° to +75°C provides long life, trouble free service in demanding environments.

Standard features of all 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 of MDrive34Plus^2 versions include up to 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^2 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 producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.

Motor configurations include a single shaft rotary in three lengths, and linear actuators with long life Acme screw**.

Interface connections are accomplished for standard MDrivePlus versions using 12.0” (30.5cm) flying leads, and for expanded MDrive34Plus^2 versions using pluggable locking wire crimp connectors.

new
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 47.*

The MDrive34Plus 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.

MDrive34*Plus* MOTION CONTROL

STANDARD SPECIFICATIONS (Plus Versions)

INPUT VOLTAGE (+V)	Range		+12 to +75 VDC Power suppy current requirements = 4A (maximum) per MDrive34Plus. Actual power supply current will depend on voltage and load.	
AUX. LOGIC INPUT VOLTAGE	Range		+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.	
ANALOG INPUT	Resolution		10 Bit	
	Voltage Range		0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA	
GENERAL PURPOSE I/O	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	
COMMUNICATION	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)	
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)
	Closed Loop Configuration (Optional)	Internal Encoder	Type	Internal, Optical
			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 10^9 Steps Per Second^2
			Resolution	90.9 Steps Per Second^2
SOFTWARE	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, General Purpose
			Outputs	Moving, Fault, Stall, Velocity Change, General Purpose
	Trip Functions		Trip on Input, Trip on Position, Trip on Time, Trip Capture, Trip on Relative Position	
	Party Mode Addresses		62	
	Encoder Functions		Stall Detection, Position Maintenance, Find Index	
THERMAL	Operating Temperature		Heat Sink	–40° to +75°C (non-condensing)
			Motor	–40° to +90°C (non-condensing)

EXPANDED SPECIFICATIONS (Plus^2 Versions)

GENERAL PURPOSE I/O	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		
MOTION	Electronic Gearing		Range‡/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‡ (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

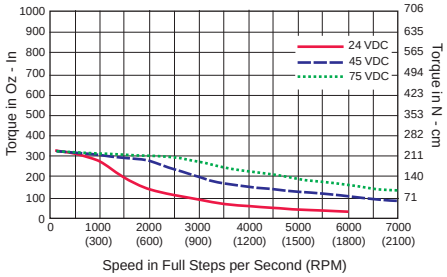
‡ Adjusting the microstep resolution can increase the range.

MOTOR SPECIFICATIONS

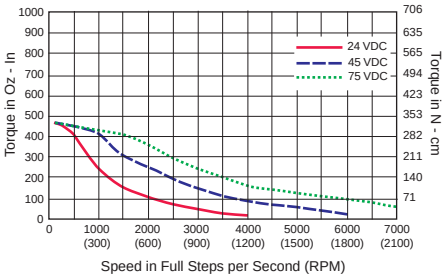
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	381 oz-in / 269 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec^2 / 1.0 kg-cm^2	4.1 lb / 1.9 kg
DOUBLE LENGTH	575 oz-in / 406 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec^2 / 1.6 kg-cm^2	5.5 lb / 2.5 kg
TRIPLE LENGTH	1061 oz-in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

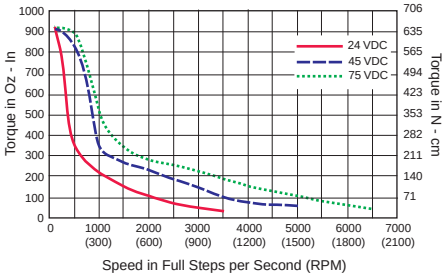
Single Length Rotary Motor



Double Length Rotary Motor



Triple Length Rotary Motor



WIRE/PIN ASSIGNMENTS — 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	**Wire Crimp**	**Function**
Pin 1	Pin 9	TX +
Pin 2	Pin 10	TX –
Pin 3	Pin 7	RX +
Pin 4	Pin 8	RX –
Pin 5	Pin 5	Aux-Logic (+12 to +24 VDC)
Pin 6	Pin 6	RX +
Pin 7	Pin 3	RX –
Pin 8	Pin 4	TX –
Pin 9	Pin 1	TX +
Pin 10	Pin 2	Comm Ground

Plus^2

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 –

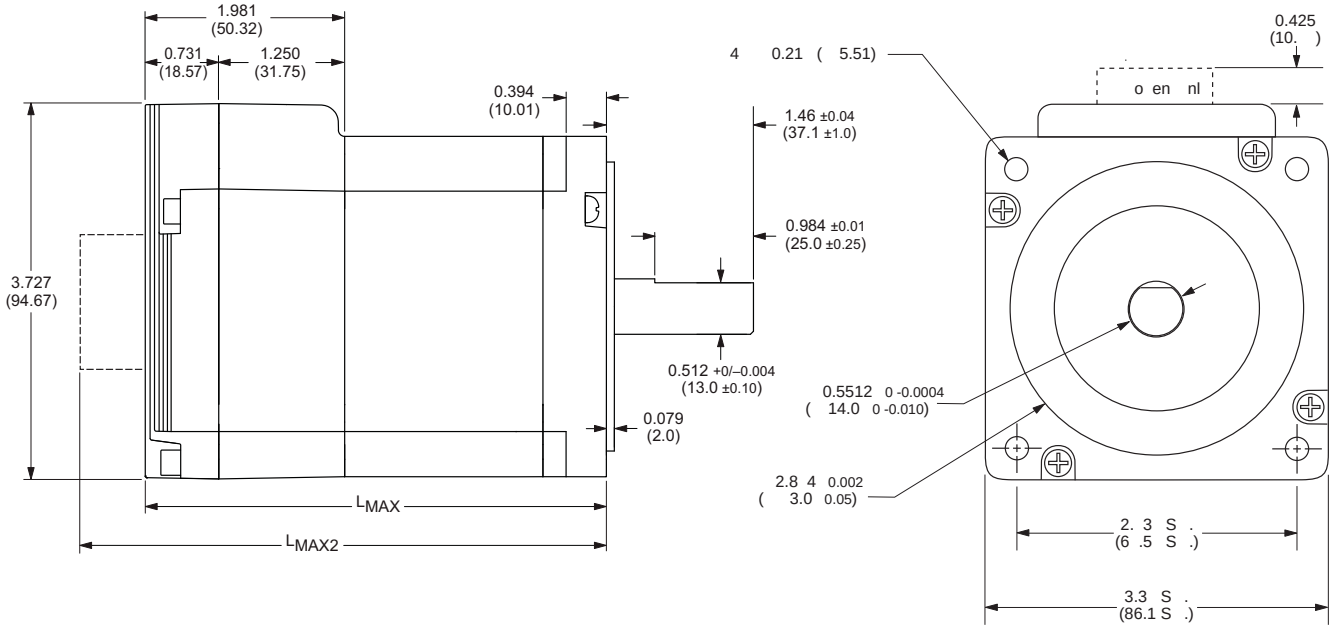
P2: COMM CONNECTOR			
RS-422/485		CANopen	
Wire Crimp	**Function**	**DB9 (Male)**	**Function**
Pin 1	TX +	Pin 1	No Connect
Pin 2	Comm Ground	Pin 2	CAN Low
Pin 3	RX –	Pin 3	CAN –V
Pin 4	TX –	Pin 4	Aux Power
Pin 5	Aux-Logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	RX +	Pin 6	CAN –V
Pin 7	RX +	Pin 7	CAN High
Pin 8	RX –	Pin 8	No Connect
Pin 9	TX +	Pin 9	CAN +V
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)

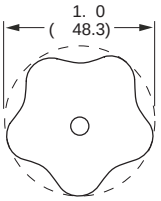
MDrive34Plus Motion Control



MDrive Lengths *Inches (mm)*

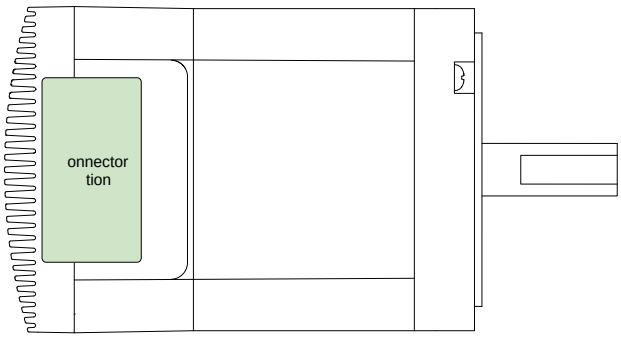
Motor Length	LMAX SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	LMAX2 CONTROL KNOB VERSION
Single	3.81 (96.77)	4.52 (114.81)
Double	4.60 (116.84)	5.31 (134.87)
Triple	6.17 (156.72)	6.88 (174.75)

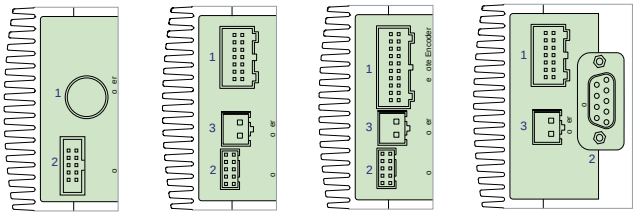
L_{MAX2} Option



Control Knob

Connector Options





Flying Leads | *Pluggable Locking Wire Crimp* | *Pluggable Locking Wire Crimp with Remote Encoder* | *Pluggable Locking Wire Crimp with CANopen DB9 (Male)*

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

ORDER INFORMATION — MDrive34Plus Motion Control

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-CC400-001
10-Pin Wire Crimp MD-CC402-001
DB9 CANopen MD-CC500-001*
*Requires mating connector adapter and power supply, not supplied.

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Length 10.0' (3.0m).

Mates to connector:

10-Pin Wire Crimp PD10-1434-FL3
14-Pin Wire Crimp PD14-2334-FL3
20-Pin Wire Crimp PD20-3400-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
14-Pin Wire Crimp CK-09
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 MDrive34Plus 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
All MDrive34Plus Motion Control versions are available with an optional internal 512-line (2048 count) optical encoder with index mark.

Remote Encoder (Plus² versions only)
MDrive34Plus² Motion Control versions are available with differential encoder inputs for use with a remote encoder (not supplied).

Control Knob
The MDrive34Plus Motion 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 beginning on page 69.

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 42.0" (106.7cm) long, or contact the factory for custom lengths. For more details, go to page 76.

** Consult Factory for Availability.

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

PART NUMBERING

K MDI1F ☐☐ 34 ☐ 7 – OPTION

ic Start it
detail a o e

otor
Single engt inear ct ator**
Do le engt
ri le engt

1 o er
12 l ing ead

2 o nication
D S-422 485 it 10- in D onnector
S-422 485 it 10- in riction oc ire ri

Example #1: art er MD 1FRD 4A7 i an Dri e34 l otion ontrol it 12 fl ing lead o er interface S-422 485 co nication it 10- in D connector and E 34 ingle lengt otor.

K MDI3C ☐☐ 34 ☐ 7 – OPTION

ic Start it
detail a o e

otor
Single engt inear ct ator**
Do le engt
ri le engt

1
14- in oc ing ire ri
(20- in it e ote Encoder)

3 o er
2- in oc ing ire ri

2 o nication
S-422 485 it 10- in riction oc ire ri
o en it D onnector

Example #2: art er MD RL 4A7 i an Dri e34 l ² otion ontrol it 14- in interface 2- in o er interface S-422 485 co nication it 10- in friction loc ire cri connector and E 34 ingle lengt otor.

**Consult actor or Availabilit

OPTIONS

Linear Actuator ** –L
or co lete rod ct ecification ee .i o eco dri e l linear act ator. t l

Internal Encoder –E
E a le MD 1FRD 4A7–E add a 512-line internal o tical encoder it inde ar to e a le 1.

Remote Encoder –EE
E a le MD RL 4A7–EE add differential encoder in t for e it re ote encoder (not lied) to e a le 2 increa ing t e ire cri connector fro 14- in to 20- in . *Available ith Plus versions onl a not be combined ith internal encoder option*

Control Knob –N
E a le MD RL 4A7–N add a rear control no for an al o itioning to e a le 2.

Planetary Gearbox –G ☐☐☐ – F
efer to gear o age for co lete tional E lange
ta le of ratio and art n er .
E a le MD RL 4A7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 2. dd for o tional E flange.

Linear Slide –R ☐ ☐☐
Scre ead
(inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 36 or 42
or Custom engths Consult actor
E a le MD RL 4A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 2.

MDRIVE 34™ MOTOR+DRIVER Plus²

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
  - Linear Slide
- 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 **MDrive34Plus² 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, planetary gearbox or linear slide. 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.

new

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 52.*

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/second²	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/second²	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.*

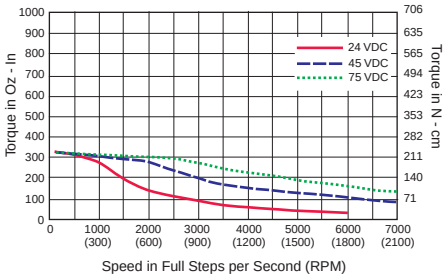
All parameters are set using the supplied IMS SPI Motor Interface GUI and may be changed on-the-fly.
An optional Communication Converter is recommended with first orders.

MOTOR SPECIFICATIONS

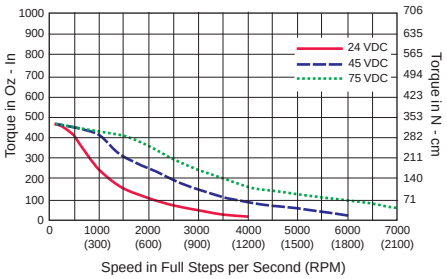
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	381 oz-in / 269 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec² / 1.0 kg-cm²	4.1 lb / 1.9 kg
DOUBLE LENGTH	575 oz-in / 406 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec² / 1.6 kg-cm²	5.5 lb / 2.5 kg
TRIPLE LENGTH	1061 oz-in / 749 N-cm	19.83 oz-in / 14.0 N-cm	0.04815 oz-in-sec² / 3.4 kg-cm²	8.8 lb / 4.0 kg

MOTOR PERFORMANCE — Speed-Toruqe

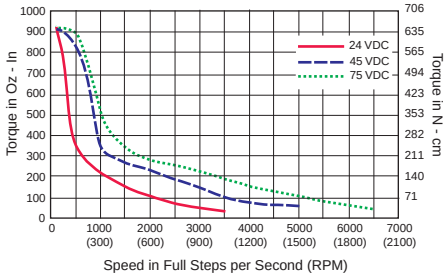
Single Length Rotary Motor



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

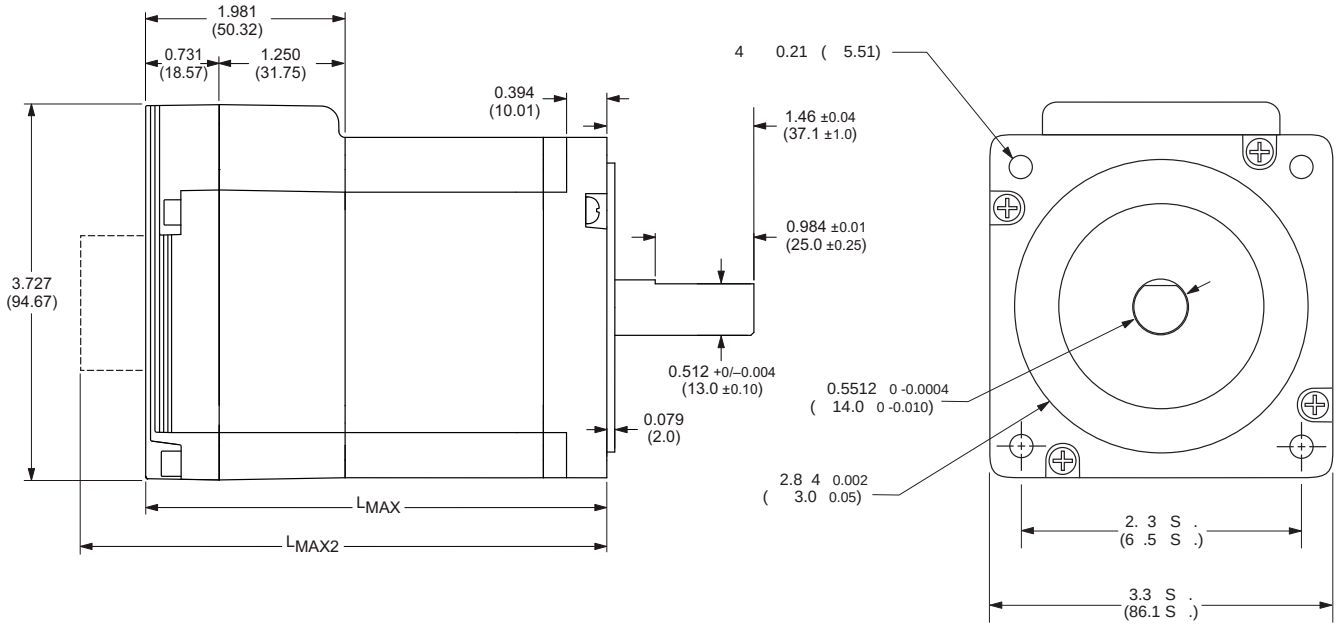
P2: COMM CONNECTOR (SPI)	
Wire Crimp	**Function**
Pin 1	No Connect
Pin 2	SPI Master In – Slave Out
Pin 3	SPI Master Out – Slave In
Pin 4	SPI Clock
Pin 5	Communications Ground
Pin 6	+5 VDC Output
Pin 7	No Connect
Pin 8	SPI Chip Select
Pin 9	No Connect
Pin 10	No Connect

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

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

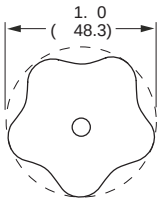
MDrive34Plus2 Speed Control



MDrive Lengths *Inches (mm)*

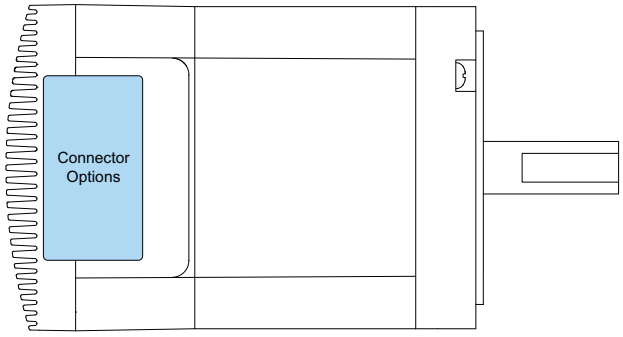
Motor Length	L_{MAX} SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION	L_{MAX2} CONTROL KNOB VERSION
Single	3.81 (96.77)	4.52 (114.81)
Double	4.60 (116.84)	5.31 (134.87)
Triple	6.17 (156.72)	6.88 (174.75)

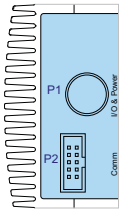
L_{MAX2} Option



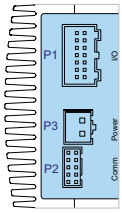
Control Knob

Connector Options

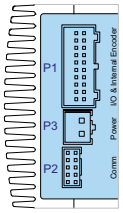




Flying Leads



Pluggable Locking Wire Crimp



Pluggable Locking Wire Crimp with Internal Encoder

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

ORDER INFORMATION — MDrive34Plus Speed Control

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 ying 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.

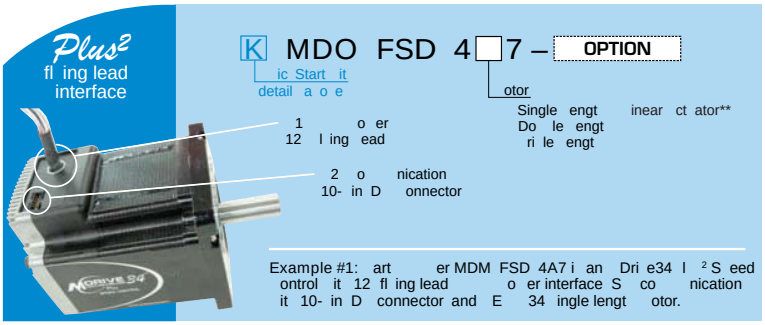
Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive34Plus. Refer to details and part numbers beginning on page 69.

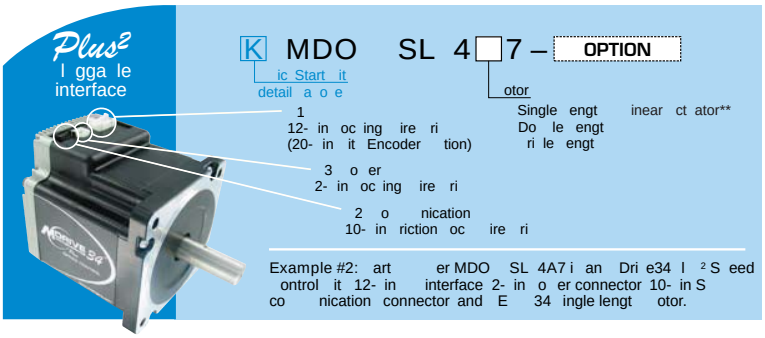
Linear Slide
Integrated linear slides are available factory installed for precision linear movement. Screw leads are 0.1", 0.2", 0.5" or 1.0" of travel per rev. Slides are 12.0" (30.5cm) to 42.0" (106.7cm) long, or contact the factory for custom lengths. For more details, go to page 76.

**Consult Factory for Availability.

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

PART NUMBERING





***Consult actor or Availabilit*

OPTIONS

Linear Actuator** –L
or co lete rod ct ecification ee
.i o eco dri e l linear act ator. t l

Internal Encoder –E □
efer to encoder ecification ta le for line co nt and art n er .
E a le MDO SL 4A7–EH add an internal 500-line co nt differential o tical encoder it inde ar to e a le 2 ic i interfaced ia a 20- in friction loc ire cri connector at 1.

Control Knob –N
E a le MDO SL 4A7–N add a rear control no for an al o itioning to e a le 2.

Planetary Gearbox –G □□□ – F
efer to gear o age for co lete tional E lange
ta le of ratio and art n er .
E a le MDO SL 4A7–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 2. dd for o tional E flange.

Linear Slide –R □ □□
Scre ead: (inc e re) 0.10 (2.54) 0.20 (5.08) 0.50 (12.) D 1.00 (25.4)
Standard Scre engt: 12 18 24 36 or 42 *or Custom engths Consult actor*
E a le MDO SL 4A7–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 2.

MDRIVE 34™ MOTOR+DRIVER
AC Plus
MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver and NEMA 34 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: 120 or 240 VAC
- Cost Effective
- Extremely Compact
- High Positioning Accuracy
- No Tuning Required
- Stable at Low Speeds
- No Dithering at Zero Speed
- High Starting Torque
- Allows for Greater Inertia Mismatch
- Built-in Regeneration Circuitry
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- Optically Isolated Logic Inputs will Accept +5 to +24 VDC Signals, Sourcing or Sinking
- 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
  - Programmable Digital Filtering for Clock and Direction Inputs
- Available Options:
  - Long Life Linear Actuators**
  - Internal Differential Optical Encoder
  - Integrated Planetary Gearbox
  - Control Knob for Manual Positioning
  - IP65 Sealed Configuration
  - Linear Slide
- 3 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Standard Industrial Connectors:
  - Circular 19-Pin M23
  - Circular 3-Pin Euro AC
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

**Consult Factory for Availability.

DESCRIPTION

The **MDrive34AC Plus 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 MDrive34AC Plus 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 MDrive34AC 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 MDrive34AC Plus accepts a broad input voltage range from 95 to 264 VAC, 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 +75°C provides long life, trouble free service in demanding environments.

The MDrive34AC Plus uses a NEMA 34 frame size high torque brushless step motor combined 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 MDrive34AC Plus Microstepping unit with circular connectors meets IP65 specifications.**

The versatile MDrive34AC Plus Microstepping is available in multiple configurations to fit various system needs. Three rotary motor lengths are available and may include an internal optical encoder, a control knob for manual positioning, an integrated planetary gearbox or a linear slide. Long life Acme screw linear actuator versions are also available.**

new

Interface connections are accomplished using standard industrial circular connectors. And connectivity has never been easier with options ranging from **all-inclusive QuickStart Kits** to **individual interfacing cables**. *See pg 56.*

The MDrive34AC Plus is a compact, powerful and cost effective 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 MDrive34AC Plus 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.

MDrive34*AC Plus* MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE	Range	120 V MDrive – 95 to 132 VAC @ 50/60 Hz 240 V MDrive – 95 to 264 VAC @ 50/60 Hz	
ISOLATED INPUT	Step Clock, Direction and Enable		
	Voltage Range	+5 to +24 VDC Sourcing or Sinking	
MOTION	Digital Filter Range	50 nS to 12.9 µS (10 MHz to 38.8 kHz)	
	Clock Types	Step/Direction, Quadrature, Step Up/Step Down	
	Step Frequency (Max)	2 MHz	
	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)
TEMP OUTPUT WARNING	Open-Drain Type	+5 to +24 VDC	50 mA Current
THERMAL	Operating Temperature	Heat Sink	–40° to +75°C (non-condensing)
		Motor	–40° to +90°C (non-condensing)
PROTECTION	Type	Thermal, Internal Fuse†	

† Designed for line-neutral systems.

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	µsteps 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	—	Step/Dir
CLK IOF	Clock and Direction Filter	50 nS to 12.9 µS (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
WARN TEMP	Over Temperature Warning	0 to 125°C	°C	80°C

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	330 oz-in / 233 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec^2 / 1.0 kg-cm^2	6.4 lb / 2.9 kg
DOUBLE LENGTH	500 oz-in / 353 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec^2 / 1.6 kg-cm^2	7.7 lb / 3.5 kg
TRIPLE LENGTH	750 oz-in / 529 N-cm	19.83 oz-in / 14.0 N-cm	0.04815 oz-in-sec^2 / 3.4 kg-cm^2	11.0 lb / 5.0 kg

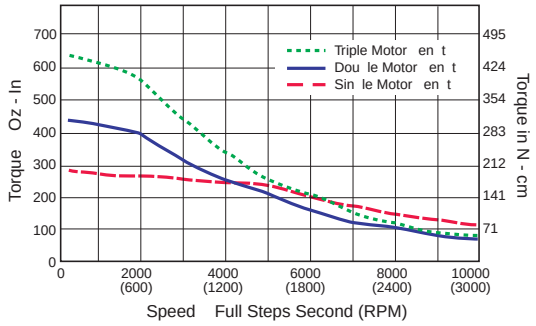
ENCODER SPECIFICATIONS

	Pin Assignments	
	19-Pin M23 Connector	**Function**
INTERNAL DIFFERENTIAL OPTICAL ENCODER	Pin 3	Index +
	Pin 4	Channel B +
	Pin 5	Channel B –
	Pin 7	Channel A +
	Pin 14	Index –
	Pin 15	Channel A –

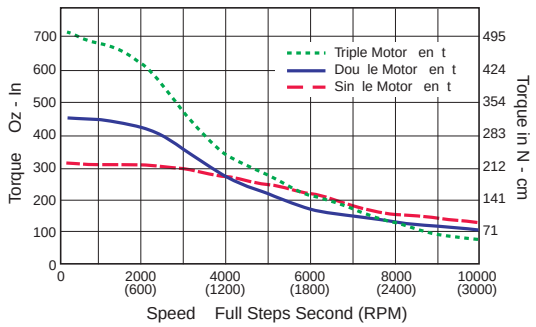
Line Count	Part Number
100	EA
200	EB
250	EC
256	EW
400	ED
500	EH
512	EX
1000	EJ
1024	EY

SPEED-TORQUE

MDrive34AC – 120VAC



MDrive34AC – 240VAC



PIN ASSIGNMENTS

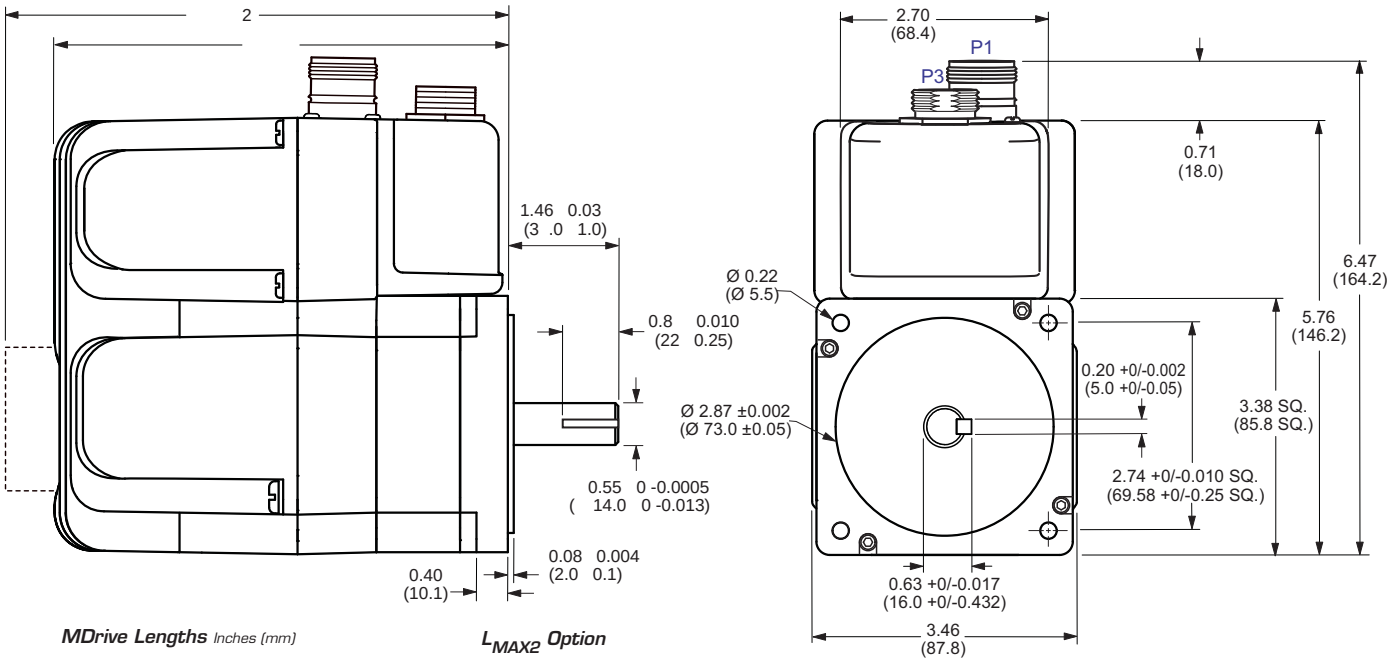
P1: I/O & COMM (SPI) CONNECTOR		
M23 Circular (Male)	**Function**	**Function with Encoder**
Pin 1	Optocoupler Reference	Optocoupler Reference
Pin 2	Enable Input	Enable Input
Pin 3	No Connect	Index +
Pin 4	No Connect	Channel B +
Pin 5	No Connect	Channel B –
Pin 6	No Connect	No Connect
Pin 7	No Connect	Channel A +
Pin 8	SPI Master Out – Slave In	SPI Master Out – Slave In
Pin 9	SPI Chip Select	SPI Chip Select
Pin 10	+5 VDC Output	+5 VDC Output
Pin 11	Communications Ground	Communications Ground
Pin 12	Shell Connect	Shell Connect
Pin 13	CW/CCW Direction Input	CW/CCW Direction Input
Pin 14	No Connect	Index –
Pin 15	No Connect	Channel A –
Pin 16	SPI Clock	SPI Clock
Pin 17	SPI Master In – Slave Out	SPI Master In – Slave Out
Pin 18	Step Clock Input	Step Clock Input
Pin 19	Temp Output Warning	Temp Output Warning

P3: POWER CONNECTOR	
Euro AC (Male)	**Function**
Pin 1	Chassis Ground
Pin 2	AC Power Line
Pin 3	AC Power Neutral

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

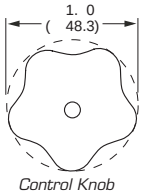
MDrive34AC Plus



MDrive Lengths *Inches (mm)*

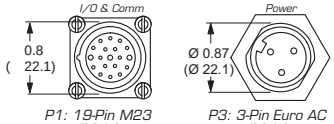
Motor Length	L_{MAX} SINGLE SHAFT, ENCODER or LINEAR ACTUATOR VERSION	L_{MAX2} CONTROL KNOB VERSION
Single	6.1 (155.0)	7.1 (180.4)
Double	6.9 (174.3)	7.9 (199.7)
Triple	8.4 (214.3)	9.4 (239.7)

L_{MAX2} Option



Control Knob

Connectors



P1: 19-Pin M23 (Male)

P3: 3-Pin Euro AC (Male)

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

ORDER INFORMATION — MDrive34AC Plus 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 Converter
Electrically isolated, in-line converter pre-wired with mating connector to conveniently set/program communication parameters for a single MDrivePlus via a PC's USB port. Length 12.0' (3.6m).
Mates to connector:
19-Pin M23 .....MD-CC301-001

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).
Mates to connector:
19-Pin M23
Straight Termination MD-CS100-000
Right Angle Termination MD-CS101-000
3-Pin Euro AC
Straight Termination MD-CS200-000
Right Angle Termination MD-CS201-000

**Consult Factory for Availability.
‡ Not Available with Sealed –65 Versions.

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

OPTIONS

Linear Actuator**
The MDrive34AC Plus 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 differential optical encoders are offered factory-mounted with the MDrive34AC Plus Microstepping. Refer to the Encoder Specifications section for available line counts. All encoders come with an index mark.

Control Knob‡
For manual shaft positioning, a factory-mounted rear control knob is available.

Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered factory-mounted. Refer to details and part numbers beginning on page 69.

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 42.0" (106.7cm) long, or contact the factory for custom lengths. For more details, go to page 76.

PART NUMBERING

Plus
a e er ion

Plus-65
65 ealed

K MDM □ MS 4 □ □ – OPTION

ic Start it
detail a o e

Dri e er ion
1 l
2 l -65 (ealed)

n t oltage
1 120 olt
2 240 olt

otor
Single engt
inear ct ator**
Do le engt
ri le engt

3 o er 3- in E ro onnector

1 o nication
1 - in 23 irc lar onnector

Example #1: art er MDM1MS 4 2 i an Dri e34 l icro te ing it 1 - in 23 circ lar S co nication interface E 34 do le lengt otor and 240 in t oltage.

**Consult actor or Availabilit

OPTIONS

Linear Actuator –L**
or co lete rod ct ecification ee .i o e.co dri e l linear act ator. t l

Internal Encoder –E□
efer to encoder ecification ection for line co nt and art n er .
E a le MDM1MS 4 2–E add an internal 512-line differential o tical encoder it inde ar to e a le 1.

Control Knob –N
E a le MDM1MS 4 2–N add a rear control no to e a le 1. *Not available ith sealed 65 versions*

Planetary Gearbox –G□□□–F
efer to gear o age for co lete tional E lange ta le of ratio and art n er .
E a le MDM1MS 4 2–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 1. dd for o tional E flange.

Linear Slide –R□□
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 36 or 42
or Custom engths Consult actor
E a le MDM1MS 4 2–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 1.

INTELLIGENT MOTION SYSTEMS, INC.

Excellence in Motion™

MDRIVE 34™ MOTOR+DRIVER

AC Plus²

MOTION CONTROL

(with optional CANopen)

FEATURES

- Highly Integrated Microstepping Driver/ Intelligent Motion Controller with Optional Encoder/NEMA 34 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: 120 or 240 VAC
- Cost Effective
- Extremely Compact
- High Positioning Accuracy
- No Tuning Required
- Stable at Low Speeds
- No Dithering at Zero Speed
- High Starting Torque
- Allows for Greater Inertia Mismatch
- Built-in Regeneration Circuitry
- Available Options:
  - Long Life Linear Actuators**
  - Integral Optical Encoder for Closed Loop Control
  - External/Remote Encoder (not supplied) for Closed Loop Control
  - Control Knob for Manual Positioning
  - Integrated Planetary Gearbox
  - IP65 Sealed Configuration
  - Linear Slide
- 3 Motor Lengths Available
- Auxiliary Logic Power Supply Input
- Up to 5 MHz Step Clock Rate
- 20 Microstep Resolutions up to 51,200 Steps Per Rev Including: Degrees, Metric, Arc Minutes
- Open or Optional Closed Loop Control
- Programmable Motor Current
- Up to Eight +24 VDC Tolerant I/O Lines, Sourcing or Sinking
- One 10 Bit Analog Input Selectable: 0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA
- RS-422/485 or Optional CANopen Communications
- 62 Software Addresses for Multi-Drop Communications
- High Speed Position Capture Input or Trip Output
- Electronic Gearing

**Consult Factory for Availability.

DESCRIPTION

The **MDrive34AC Plus2 Motion Control** system offers designers a cost effective, full featured programmable motion controller integrated with a NEMA 34 high torque 1.8° brushless step motor and a microstepping driver operating at 120 or 240 VAC.

Unsurpassed smoothness and performance delivered by the MDrive34AC 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 MDrive34AC accepts a broad input voltage range from 95 to 264 VAC, delivering enhanced performance and speed. Oversized input capacitors are used to minimize power line surges, reducing problems that can occur with long cable runs and multiple drive systems. An extended operating range of –40° to +75°C provides long life, trouble free service in demanding environments.

The MDrive34AC Plus² Motion Control system adds a versatile array of functions by combining a full featured programmable motion controller with our compact and cost effective MDrive34AC Microstepping products, adding little cost and no increase in size. Standard offerings include up to 8 general purpose I/O lines (sourcing or sinking) that operate to +24 VDC, one 10 bit analog input, electronic gearing, high speed position capture input/trip output, microstep resolutions up to 51,200 steps per revolution, 0 to 5 MHz step clock rate, and a full featured easy-to-program instruction set.

The MDrive34AC Plus² Motion Control system communicates over RS-422/485 which allows for point-to-point or multiple unit configurations utilizing one communication port. Addressing and hardware support multiple uniquely addressed units communicating over a single line.

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 10 kHz to 1 MHz. CANopen features include node guarding, heartbeat producer, SDOs and PDOs. Highlights include variable PDO mapping and extended node identifier.

The MDrive34AC Plus² Motion Control is 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 MDrive34AC so there is no increase in length. Or, for an expanded choice of line counts and resolutions, closed loop control is available with an interface to a remotely mounted user-supplied external encoder.

In addition to encoder options, the MDrive34AC Plus² Motion Control has 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.

A sealed version designed to meet IP65 specifications is also available. The sealed assembly allows the MDrive34AC to be used in environments where exposure to chemical, dust and liquids may occur.

Three rotary motor lengths are available as are linear actuators with long life Acme screw**.

new

Interface connections are accomplished using standard industrial circular connectors. And connectivity has never been easier with options ranging from **all-inclusive QuickStart Kits** to **individual interfacing cables**. *See pg 60.*

MDrive34*AC Plus²* MOTION CONTROL

GENERAL SPECIFICATIONS

INPUT VOLTAGE	Range		120 V MDrive – 95 to 132 VAC @ 50/60 Hz 240 V MDrive – 95 to 264 VAC @ 50/60 Hz	
AUX. LOGIC INPUT VOLTAGE	Range		+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.	
ANALOG INPUT	Resolution		10 Bit	
	Voltage Range		0 to +5 VDC, 0 to +10 VDC, 0-20 mA or 4–20 mA	
GENERAL PURPOSE I/O	Number/Type		8 Sourcing or Sinking (or 4 when Remote Encoder Option is Selected)	
	Logic Range		+5 to +24 VDC – Inputs and Sinking Outputs; Inputs TTL Level Compatible +12 to +24 VDC – Sourcing Outputs	
	Output Sink/Source Current		Up to 600 mA per Channel	
	Protection		Over Temp, Short Circuit, Transient Over Voltage, Over Voltage, Inductive Clamp	
COMMUNICATION	Type (Standard)		RS-422/485	
	Baud Rate		4800 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)	
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)
	Closed Loop Configuration (Optional)	Internal Encoder	Type	Internal, Optical
			Steps Per Revolution	51200
			Resolution	512 Lines/2048 Edges Per Rev
		Remote Encoder	Type	User-Supplied Differential Encoder
			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)
			Resolution	User-Defined Note: µstep/rev 2X the encoder count/rev minimum
	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 10^9 Steps Per Second^2
			Resolution	90.9 Steps Per Second^2
	Electronic Gearing		Range‡/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‡ (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)
			Position Capture – Resolution	32 Bit
			Trip Output – Speed/Resolution/ Threshold	150 nS/32 Bit/TTL
SOFTWARE	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	
THERMAL	Operating Temperature		Heat Sink	–40° to +75°C (non-condensing)
			Motor	–40° to +90°C (non-condensing)
PROTECTION	Type		Thermal, Internal Fuse†	

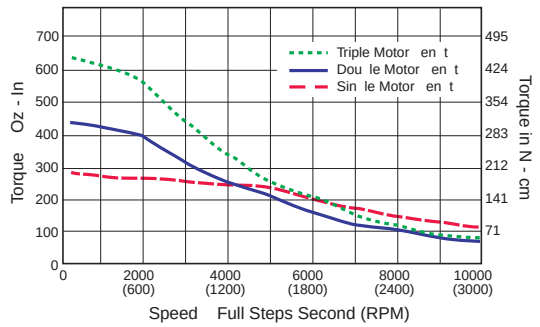
† Designed for line-neutral systems.
‡ Adjusting the microstep resolution can increase the range.

MOTOR SPECIFICATIONS

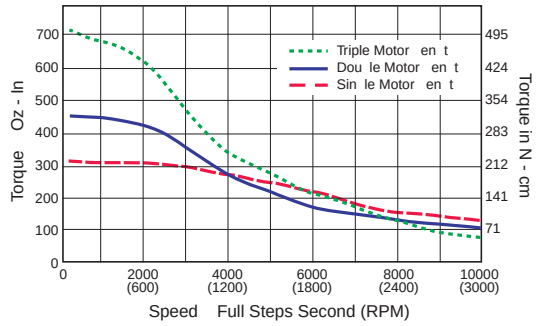
	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	330 oz-in / 233 N-cm	10.9 oz-in / 7.7 N-cm	0.01416 oz-in-sec^2 / 1.0 kg-cm^2	6.4 lb / 2.9 kg
DOUBLE LENGTH	500 oz-in / 353 N-cm	14.16 oz-in / 10.0 N-cm	0.02266 oz-in-sec^2 / 1.6 kg-cm^2	7.7 lb / 3.5 kg
TRIPLE LENGTH	750 oz-in / 529 N-cm	19.83 oz-in / 14.0 N-cm	0.04815 oz-in-sec^2 / 3.4 kg-cm^2	11.0 lb / 5.0 kg

SPEED-TORQUE

MDrive34AC – 120VAC



MDrive34AC – 240VAC



PIN ASSIGNMENTS

P1: I/O CONNECTOR		
M23 Circular (Male)	Function	
	Expanded I/O	Remote Encoder Closed Loop Control
Pin 1	I/O 9	Channel A +
Pin 2	I/O 11	Channel B +
Pin 3	Step/Clock I/O	Index +
Pin 4	I/O 1	I/O 1
Pin 5	Direction/Clock I/O	Index –
Pin 6	No Connect	No Connect
Pin 7	Aux-Logic (+12 to +24 VDC)	Aux-Logic (+12 to +24 VDC)
Pin 8	Aux-Ground	Aux-Ground
Pin 9	I/O 3	I/O 3
Pin 10	I/O Ground	I/O Ground
Pin 11	I/O Power	I/O Power
Pin 12	Shell Connect	Shell Connect
Pin 13	I/O 12	Channel B –
Pin 14	Capture/Trip I/O	Capture/Trip I/O
Pin 15	Analog In	Analog In
Pin 16	I/O 2	I/O 2
Pin 17	I/O 4	I/O 4
Pin 18	I/O 10	Channel A –
Pin 19	No Connect	No Connect

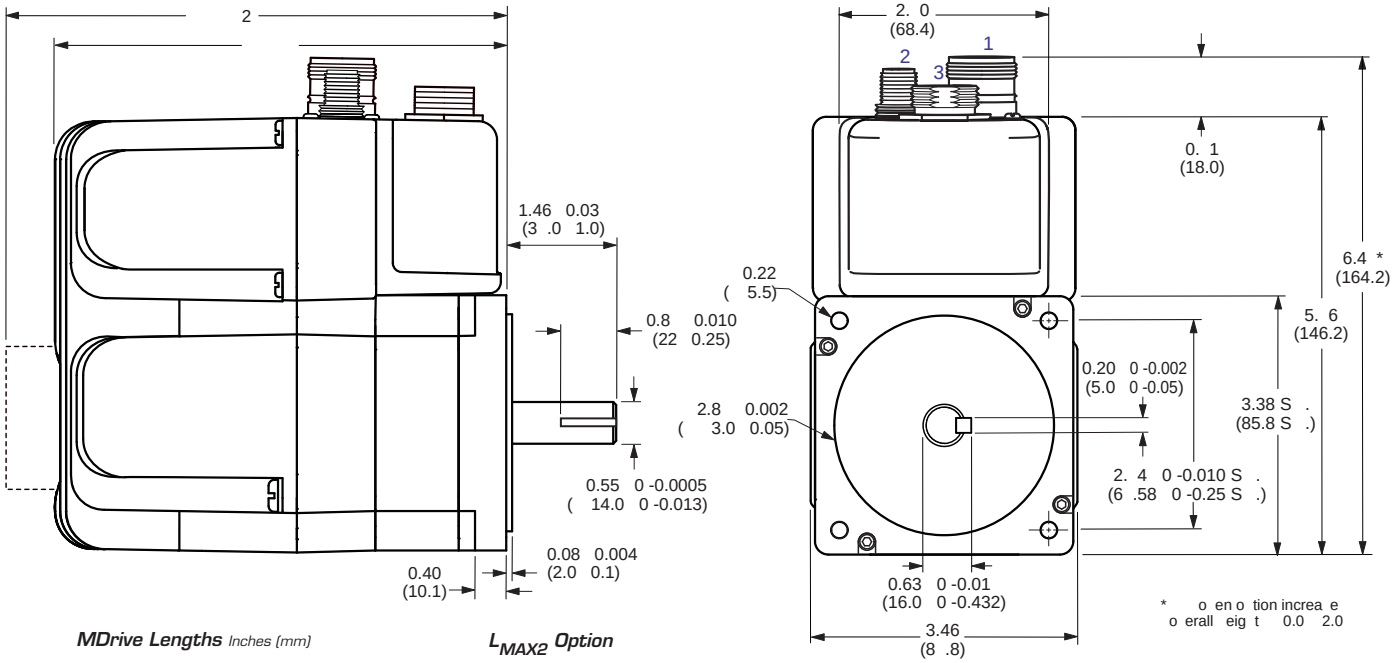
P2: COMM CONNECTOR			
RS-422/485		CANopen	
M12 Circular (Female)	Function	M12 Circular (Male)	Function
Pin 1	TX –	Pin 1	Shield
Pin 2	TX +	Pin 2	CAN +V
Pin 3	RX +	Pin 3	CAN –V
Pin 4	RX –	Pin 4	CAN High
Pin 5	Comm Ground	Pin 5	CAN Low

P3: POWER CONNECTOR	
Euro AC (Male)	Function
Pin 1	Chassis Ground
Pin 2	AC Power Line
Pin 3	AC Power Neutral

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

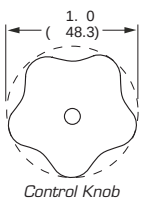
MDrive34AC Plus²



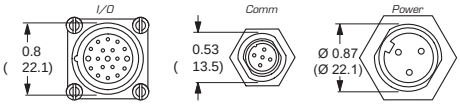
MDrive Lengths *Inches (mm)*

Motor Length	LMAX SINGLE SHAFT, ENCODER or LINEAR ACTUATOR VERSION	LMAX2 CONTROL KNOB VERSION
Single	6.1 (155.0)	7.1 (180.4)
Double	6.9 (174.3)	7.9 (199.7)
Triple	8.4 (214.3)	9.4 (239.7)

L_{MAX2} Option



Connectors



P1: 19-Pin M23 (Male) *P2: 5-Pin M12 (Female) (or CANopen – Male)* *P3: 3-Pin Euro AC (Male)*

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

ORDER INFORMATION — MDrive34AC Plus² Motion Control

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 Converter
Electrically isolated, in-line converter pre-wired with mating connector to conveniently set/program communication parameters for a single MDrivePlus via a PC's USB port. Length 12.0' (3.6m).
Mates to connector:
5-Pin M12 .....MD-CC401-001
5-Pin M12 CANopen MD-CC500-000*
*Requires mating connector adapter and power supply, not supplied.

Prototype Development Cables
Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).
Mates to connector:
19-Pin M23
Straight Termination MD-CS100-000
Right Angle Termination MD-CS101-000
3-Pin Euro AC
Straight Termination MD-CS200-000
Right Angle Termination MD-CS201-000

**Consult Factory for Availability.
‡ Not Available with Sealed –65 Versions.

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

OPTIONS

Linear Actuator**
The MDrive34AC Plus² 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
An internal 512-line (2048 count) differential optical encoder with index mark is available factory-mounted.

Remote Encoder
This MDrivePlus Motion Control is offered with differential encoder inputs for use with a remote encoder (not supplied).

Control Knob‡
For manual shaft positioning, a factory-mounted rear control knob is available.

Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered factory-mounted. Refer to details and part numbers beginning on page 69.

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 42.0" (106.7cm) long, or contact the factory for custom lengths. For more details, go to page 76.

PART NUMBERING

Plus² e anded feat re

Plus²-65 65 ealed

K MD □M□ — 4□□ — OPTION

ic Start it detail a o e

Dri e er ion
3 l
4 l -65 (ealed)

o nication
S-422 485 o en

n t oltage
1 120 olt
2 240 olt

otor
Single engt inear ct ator**
Do le engt ri le engt

3 o er 3- in E ro onnector

1 1 - in 23 irc lar onnector

2 o nication 5- in 12 irc lar onnector

Example #1: art er MD MR 4A2 i an Dri e34 l ² otion ontrol it 1 - in 23 circ lar interface S-422 485 co nication it 5- in 12 circ lar connector E 34 ingle lengt otor and 240 in t oltage.

**Consult actor or Availabilit

OPTIONS

Linear Actuator —L**
or co lete rod ct ecification ee .i o e.co dri e l linear act ator. t l

Internal Encoder —E
E a le MD MR 4A2–E add a 512-line internal o tical encoder it inde ar to e a le 1.

Remote Encoder —EE
E a le MD MR 4A2–EE add differential encoder in t for e it re ote encoder (not lied).
a not be combined ith internal encoder option

Control Knob —N
E a le MD MR 4A2–N add a rear control no to e a le 1. *Not available ith sealed 65 versions*

Planetary Gearbox —G□□□—F
efer to gear o age for co lete ta le of ratio and art n er . tional E lange
E a le MD MR 4A2–G1A2 add a 1- tage lanetar gear o it 5.18 1 ratio to e a le 1. dd for o tional E flange.

Linear Slide —R□□□
Scre ead (inc e re)
0.10 (2.54)
0.20 (5.08)
0.50 (12.)
D 1.00 (25.4)
Standard Scre engt
12 18 24 36 or 42
or Custom engths Consult actor
E a le MD MR 4A2–RA12 add a inear Slide it 0.10 cre lead 12 long to e a le 1.

CONNECTIVITY

MDrive34AC Plus Microstepping

Communication Converter

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

Mates to connector:

19-Pin M23 .....MD-CC301-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).

Mates to connector:

19-Pin M23

Straight Termination MD-CS100-000

Right Angle Termination MD-CS101-000

3-Pin Euro AC

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

MDrive34AC Plus Motion Control

Communication Converter

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

Mates to connector:

5-Pin M12 .....MD-CC401-001

5-Pin M12 CANopen MD-CC500-000**

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).

Mates to connector:

19-Pin M23

Straight Termination MD-CS100-000

Right Angle Termination MD-CS101-000

3-Pin Euro AC

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

MDrive42AC Plus Microstepping

Communication Converter

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

Mates to connector:

19-Pin M23 .....MD-CC301-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).

Mates to connector:

19-Pin M23

Straight Termination MD-CS100-000

Right Angle Termination MD-CS101-000

3-Pin Euro AC

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

MDrive42AC Plus Motion Control

Communication Converter

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

Mates to connector:

5-Pin M12 .....MD-CC401-001

5-Pin M12 CANopen MD-CC500-000**

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have ying leads other end. Single-ended cordsets are PVC jacketed with foil shield and unconnected drain wire. Length 13.0' (4.0m).

Mates to connector:

19-Pin M23

Straight Termination MD-CS100-000

Right Angle Termination MD-CS101-000

3-Pin Euro AC

Straight Termination MD-CS200-000

Right Angle Termination MD-CS201-000

** Requires mating connector adapter and power supply, not supplied.

Details at: www.imshome.com/cables_cordsets.html

Warranty

TWENTY-FOUR MONTH LIMITED WARRANTY

Intelligent Motion Systems, Inc. (“IMS”), warrants only to the purchaser of the Product from IMS (the “Customer”) that the product purchased from IMS (the “Product”) will be free from defects in materials and workmanship under the normal use and service for which the Product was designed for a period of 24 months from the date of purchase of the Product by the Customer. Customer’s exclusive remedy under this Limited Warranty shall be the repair or replacement, at Company’s sole option, of the Product, or any part of the Product, determined by IMS to be defective. In order to exercise its warranty rights, Customer must notify Company in accordance with the instructions described under the heading “Obtaining Warranty Service.”

This Limited Warranty does not extend to any Product damaged by reason of alteration, accident, abuse, neglect or misuse or improper or inadequate handling; improper or inadequate wiring utilized or installed in connection with the Product; installation, operation or use of the Product not made in strict accordance with the specifications and written instructions provided by IMS; use of the Product for any purpose other than those for which it was designed; ordinary wear and tear; disasters or Acts of God; unauthorized attachments, alterations or modifications to the Product; the misuse or failure of any item or equipment connected to the Product not supplied by IMS; improper maintenance or repair of the Product; or any other reason or event not caused by IMS.

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Include a copy of the RMA Authorization Form, contact name and address, and any additional notes regarding the Product failure with shipment. Return Product in its original packaging, or packaged so it is protected against electrostatic discharge or physical damage in transit. The RMA number MUST appear on the box or packing slip. Send to: Intelligent Motion Systems, Inc., 370 N. Main St., Marlborough, CT 06447.

Customer shall prepay shipping charges for Products returned to IMS for warranty service and IMS shall pay for return of Products to Customer by ground transportation. However, Customer shall pay all shipping charges, duties and taxes for Products returned to IMS from outside the United States.

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