

MForce

Step / direction stepper motor drive, SPI interface

Product overview

MForce products are universally applicable stepper motor drives with on-board control electronics. Step/direction signals of a master controller, e.g. a motion controller, are converted directly into motion. Together with selected Schneider Electric Motion USA stepper motors, MForce is a very compact, high performance drive system that can be setup and controlled via SPI (Serial Peripheral Interface).

MForce operating voltage ranges are:

- 12 to 48 VDC — MForce MicroDrive
- 12 to 75 VDC — MForce PowerDrive



MForce MicroDrive (above left) and PowerDrive (above right) Step/direction input with SPI interface

Connection technologies

MForce with step/direction connections include:

- Power input
- Communication interface
- Motor interface
- Multifunction interface

The multifunction interface operates at the following signal levels:

- 5 to 24 VDC opto-isolated, sinking or sourcing

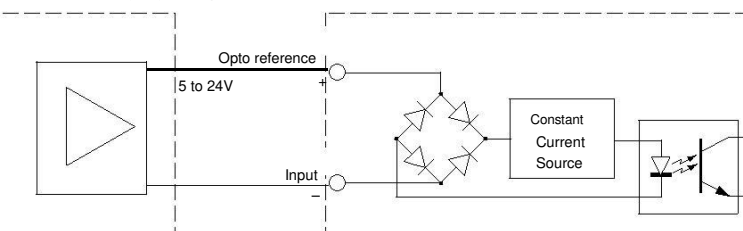
The reference pulses are supplied via two of the signal inputs as pulse/direction signals. The remaining signal inputs have the function “power amplifier enable/pulse blocking” and optocoupler reference, which establishes the inputs as sinking or sourcing. See illustration below.

Communication interface

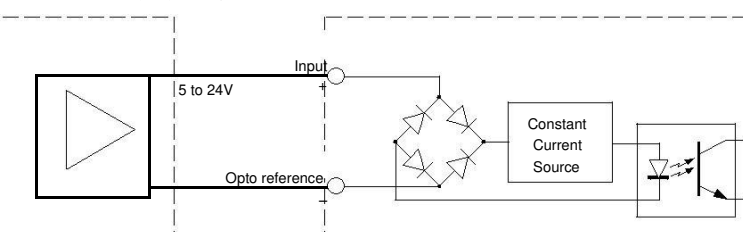
The communication interface is used to connect SPI communications for configuring purposes. A PC can be connected to the communication interface via a USB to SPI converter. The MForce Step/Direction software can be used to set:

- Motor run/reduction current
- Step size
- Signal input filtering
- Input pulse type: step/direction, cw/ccw or quadrature
- Current reduction delay
- Motor direction override
- Enable active high/low

Circuit of sinking signal inputs



Circuit of sourcing signal inputs



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Electrical data

Power supply connection (1)

		MForce MicroDrive	MForce PowerDrive
Supply voltage range (absolute limit values)	VDC	12 ... 48	12 ... 75
Nominal supply voltage	VDC	24 ... 48	24 ... 48
Ripple at nominal voltage	V _{PP}	2	2
Motor drive output current	A rms	3.0	5.0
Max. current consumption	A	4.2	7.0
Inrush current		C=94 µF	C=200 µF

(1) Not protected against reverse polarity

SPI interfaces			Min.	Max.
Signal inputs	High level input voltage / V _{ih}	VDC	2.0	
	Low level input voltage / V _{il}	VDC		1.2
	High level input current / I _{ih}	µA		10
	Low level input current / I _{il}	µA	-10	
Signal outputs	Signal inputs/outputs / V _{oh}	VDC	2.1	
	Transmission rate / Vol	VDC		0.5
	Transmission rate / I _{os}	mA	-7	8

Universal inputs: Step Clock, Direction, Enable

Type		Opto-isolated
High level output voltage	VDC	+5 to +24
Low level output voltage	VDC	8.7
Output SC current	mA	14.6

Differential inputs: Clockwise / Counterclockwise

Type	5V, TTL, Non-isolated

Mechanical data

		MForce MicroDrive	MForce PowerDrive
Dimensions (W x H x D)	inch	1.8 x 1.3 x 2.3	3.0 x 2.1 x 3.9
	mm	45 x 33 x 59	76 x 54 x 99
Mass	oz	3	12
	kg	0.08	0.34
Type of cooling		Convection and conduction	Convection

Ambient conditions

Ambient temperature (2)	°C	0 ... 65; power reduction by 2%/°C at 50 ... 65
Transport and storage temperature	°C	-25 ... +70
Installation height without power reduction	m	< 1000 m above mean sea level
Relative humidity	%	15 ... 85 (not condensing)

(2) Limit values with flanged motor mounted on a steel plate 300 x 300 x 10 mm

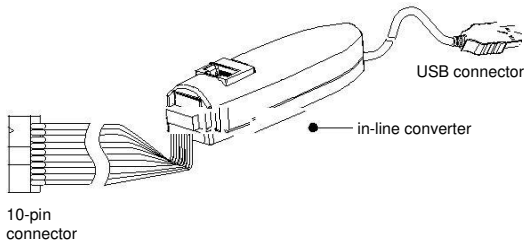
Certifications

Conformity to standards		MForce drives have been developed to conform to the requirements of EN 55011:2007, A2:2007 for Group 1, Class A, conducted and radiated emissions EN 61000-3-2:2006 harmonic current emissions EN 61000-3-3:1995, A1:2001, A2:2005 voltage fluctuation emissions. (Proper use of power supply/mains filters and shielding on power and interface cables is necessary to meet these requirements.)
EMC immunity		IEC 61000-4-2, electrostatic discharge immunity IEC 61000-4-3, radiated electromagnetic field immunity IEC 61000-4-4, electrical fast transient / burst immunity IEC 61000-4-5, surge immunity IEC 61000-4-6, immunity to conducted disturbances induced by RF fields IEC 61000-4-11, immunity to voltage dips and interruptions
Conducted and radiated EMC emissions		EN 55011:2007, A2:2007 for Group 1, Class A
CE marking		The MForce drives are CE marked in accordance with the European EMC Directive (2004/108/EEC).

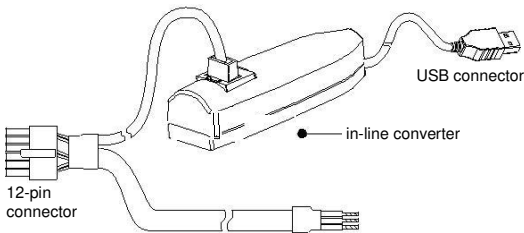
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Connectivity



MD-CC300-001



MD-CC303-001

MicroDrive



Connector	Style	Assignment
P1	7-pin terminal strip or 12" flying leads	Power and multifunction
	12-pin wire crimp*	Power, multifunction and communication
P2	10-pin IDC or none*	Communication
P3	4-pin wire crimp	Motor

*With a P1 12-pin connector, the P2 connector is eliminated

PowerDrive



Connector	Style	Assignment
P1	12-pin wire crimp	Multifunction and communication
P3	2-pin wire crimp	Power
P4	4-pin wire crimp	Motor

Communication converter

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

	length feet (m)	part number
Mates to 10-pin non-locking IDC connector	12.0 (3.6)	MD-CC300-001
Mates to 12-pin locking wire crimp connector	12.0 (3.6)	MD-CC303-001

Cables

To speed your test/development, these cables are pre-wired with mating connectors.

	length feet (m)	part number
MicroDrive		
P1 mate Power, multifunction and communication interface	10.0 (3.0)	PD12-1434-FL3
P3 mate Motor interface	10.0 (3.0)	PD04-MF17-FL3
PowerDrive		
P1 mate Multifunction and communication interface	10.0 (3.0)	PD12-1434-FL3
P3 mate Power interface	10.0 (3.0)	PD02-3400-FL3
P4 mate Motor interface	10.0 (3.0)	PD04-MF34-FL3

Connector kits

Connectors for assembly of cables. Cable not supplied.

	Sold in lots of	part number
MicroDrive		
P1 mate Power, multifunction and communication interface	5	CK-03
P2 mate Communication interface	5	CK-01
P3 mate Motor interface	5	CK-06
PowerDrive		
P1 mate Multifunction and communication interface	5	CK-03
P3 mate Power interface	5	CK-05
P4 mate Motor interface	5	CK-07

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MForce MicroDrive stepper motor drive step/direction with SPI interface



MForce PowerDrive stepper motor drive step/direction with SPI interface

Part numbers

MicroDrive

example part number	M F M 1 F S D 1 7 N 4			
Product designation MFM = Step/direction input	M F M 1	F S D 1	7 N 4	
Input 1 = universal - step clock, direction, enable 5 = differential - clockwise/counterclockwise	M F M 1	F S D 1	7 N 4	
P1 connector style FSD = flying leads PSD = terminal strip CSZ = wire crimp	M F M 1	F S D 1	7 N 4	
MForce version 17 = MicroDrive	M F M 1	F S D 1	7 N 4	
Supply voltage N4 = 48 VDC	M F M 1	F S D 1	7 N 4	

PowerDrive

example part number	M F M 1 C S Z 3 4 N 7			
Product designation MFM = Step/direction input	M F M 1	C S Z 3	4 N 7	
Interface 1CZS = standard connector interface	M F M 1	C S Z 3	4 N 7	
MForce version 34 = PowerDrive	M F M 1	C S Z 3	4 N 7	
Supply voltage N7 = 75 VDC	M F M 1	C S Z 3	4 N 7	

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Optional motors

2-phase stepper motors

Full steps per revolution	200
Step angle α	1.8 °
Number of leads	4
Ambient temperature	-25 ... +40 °C
Thermal class	130 (B)

Electrical and mechanical data

NEMA14	M-1410-0.75* (1)																	
Stack length	single																	
Phase current	amps	0.75																
Holding torque	oz-in / N-cm	10 / 7																
Rotor inertia	oz-in-sec ²	0.00017																
	kg-cm ²	0.012																
Phase inductance	mH	4.0																
Phase resistance	Ω	4.3																
Weight	oz / grams	4.2 / 120																
NEMA17	M-1713-1.5* (1)			M-1715-1.5* (1)			M-1719-1.5* (1)											
Stack length	single	double	triple															
Phase current	amps	1.5	1.5	1.5														
Holding torque	oz-in / N-cm	32 / 23	60 / 42	75 / 53														
Rotor inertia	oz-in-sec ²	0.000538	0.0008037	0.0011562														
	kg-cm ²	0.038	0.057	0.082														
Phase inductance	mH	2.1	5.0	3.85														
Phase resistance	Ω	1.3	2.1	2.0														
Weight	oz / grams	7.4 / 210	8.1 / 230	12.7 / 360														
NEMA23	M-2218-2.4S (2)		M-2222-2.4S (2)		M-2231-2.4S (2)		M-2218-3.0* (2)		M-2222-3.0* (2)		M-2231-3.0* (2)		M-2218-6.0* (3)		M-2222-6.0* (3)		M-2231-6.0* (3)	
Stack length	single	double	triple	single	double	triple	single	double	triple	single	double	triple	single	double	triple			
Phase current	amps	2.4	2.4	2.4	3.0	3.0	3.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0			
Holding torque	oz-in / N-cm	90 / 64	144 / 102	239 / 169	90 / 64	144 / 102	239 / 169	100 / 71	150 / 106	257 / 181								
Rotor inertia	oz-in-sec ²	0.00255	0.00368	0.0065	0.00255	0.00368	0.0065	0.0017	0.00397	0.0068								
	kg-cm ²	0.18	0.26	0.46	0.18	0.26	0.46	0.12	0.28	0.48								
Phase inductance	mH	2.4	4.0	5.4	1.5	2.6	3.36	0.47	0.73	1.04								
Phase resistance	Ω	0.95	1.2	1.5	0.65	0.85	0.95	0.16	0.19	0.23								
Weight	oz / grams	16.9 / 480	21.2 / 600	35.3 / 1000	16.9 / 480	21.2 / 600	35.3 / 1000	16.6 / 470	24.7 / 700	35.3 / 1000								
NEMA34	M-3424-6.3* (3)			M-3431-6.3* (3)			M-3447-6.3* (3)											
Stack length	single	double	triple															
Phase current	amps	6.3	6.3	6.3														
Holding torque	oz-in / N-cm	408 / 288	574 / 405	1090 / 770														
Rotor inertia	oz-in-sec ²	0.01275	0.01924	0.03849														
	kg-cm ²	0.90	1.35	2.70														
Phase inductance	mH	1.9	3.3	6.2														
Phase resistance	Ω	0.30	0.32	0.56														
Weight	oz / grams	60.0 / 1700	84.7 / 2400	141.1 / 4000														

(1) Recommended for use with MForce MicroDrives.

(2) Recommended for use with MForce MicroDrives and PowerDrives.

(3) Recommended for use with MForce PowerDrives.

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