POWERFUL. INTELLIGENT. EFFICIENT.

COOL MUSCLE

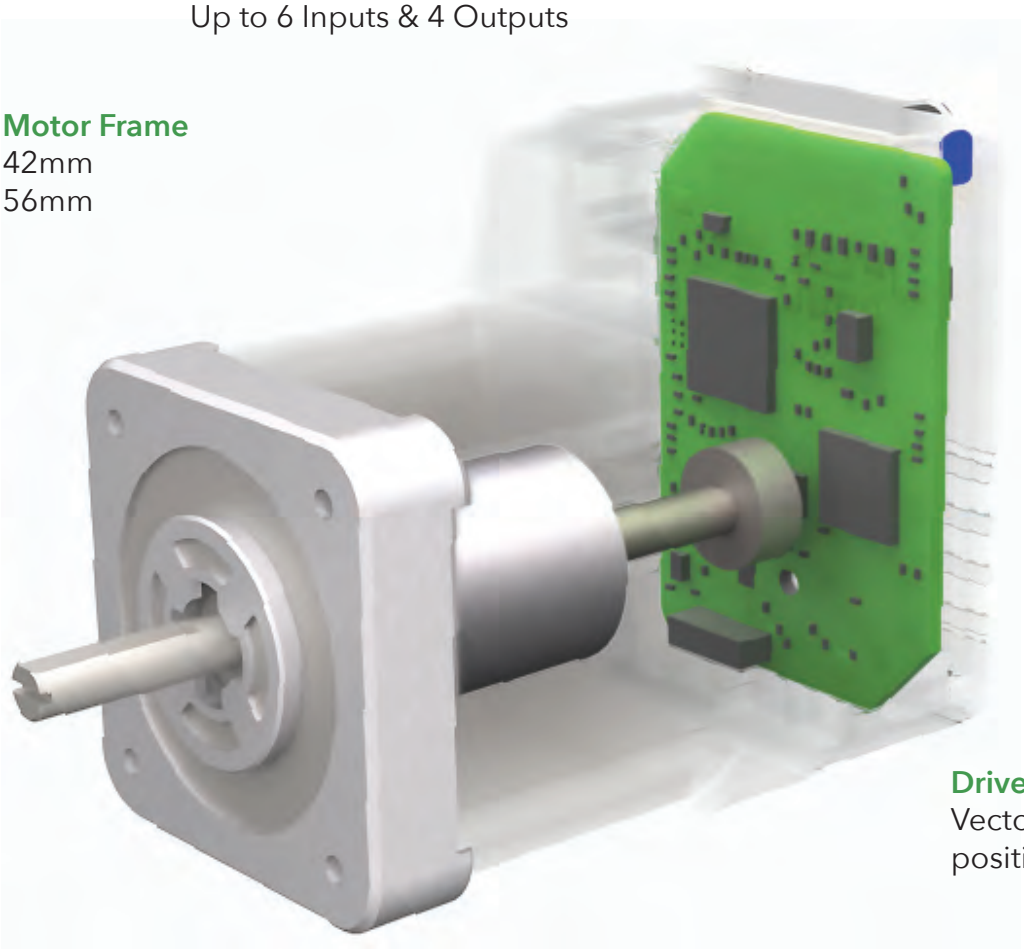
CM3 | CM3+ CATALOGUE

Motor performance that drives you to **success.**

Integration of the components necessary for high performance closed loop servo systems creates efficiencies and optimizes motion performance. The CM3 Cool Muscle achieves 100W of power with only 24Vdc.

Communication Interface
RS-232C
Optional: RS-485, EtherCAT, MODBUS

I/O Interface
Up to 6 Inputs & 4 Outputs



Motor Frame
42mm
56mm

Status LED
Multi-colored
status indication

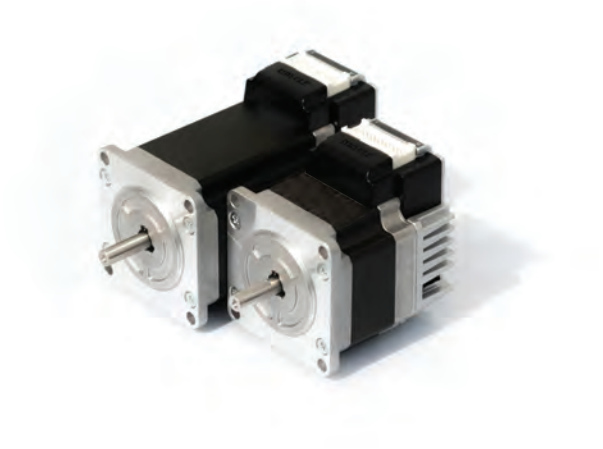
Controller
Tuningless or
Adjustable

PLC Function
Programmable I/O
Arithmetic &
Logic commands

Driver
Vector drive with closed loop
position and current feedback

High-Precision Absolute Encoder
Single turn with optional
Multi-rotation location retention

COOL MUSCLE™
INTEGRATED SERVO SYSTEMS



COOL MUSCLE™

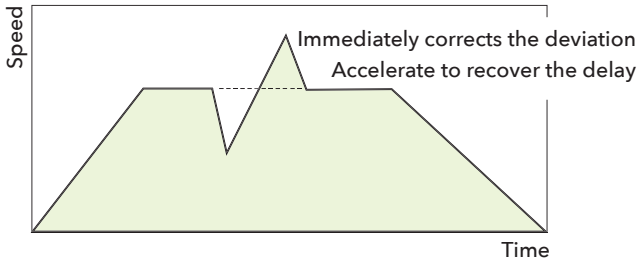
MOTION CONTROL TECHNOLOGY

Expanding on the established Cool Muscle technologies from the CM1 and CM2 lines, Muscle Corp has implemented a new drive design allowing for higher speed and power while the modern control algorithms, embedded PLC functionality, and energy efficiency that has made the Cool Muscle an industry leader.

Closed-Loop Control

HIGH ACCURACY AND REPEATABILITY

The closed-loop control system maintains a minimal deviation between the encoder feedback and the commanded position within a defined range. Speed ripple is reduced, positional repeatability is increased, and heat generation is managed by tightly controlling the current in the motor's windings.



COOL MUSCLE 3

CLOSED-LOOP CONTROL

1. Improved positioning repeatability.

2. Reduced speed ripple results in quieter operation, and higher energy efficiency.

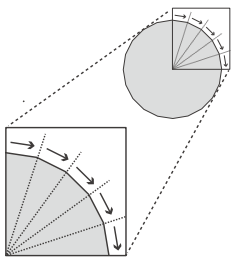
3. Responsive motor correction to dynamic load changes or collisions.

Vector Control

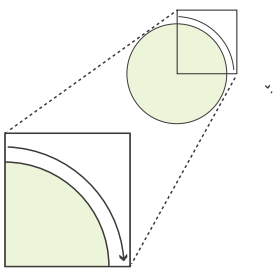
SMOOTHER, QUIETER MOTION

The CM3 utilizes vector control which enables seamless motion without microstepping between angular increments; resulting in reduced vibration and noise. Torque is optimized in real time and responds to dynamic loading conditions which drastically improves the torque/power density, and efficiency of the motor.

DRIVING PRINCIPLE



Stepping motor



COOL MUSCLE

VECTOR CONTROL

1. Energy savings through precise torque control

2. Efficient and consistent control though the entire speed range of the motor.

3. Accurate control during acceleration resulting in higher rates and cycling frequencies.

CM3 FEATURES AND FUNCTIONS

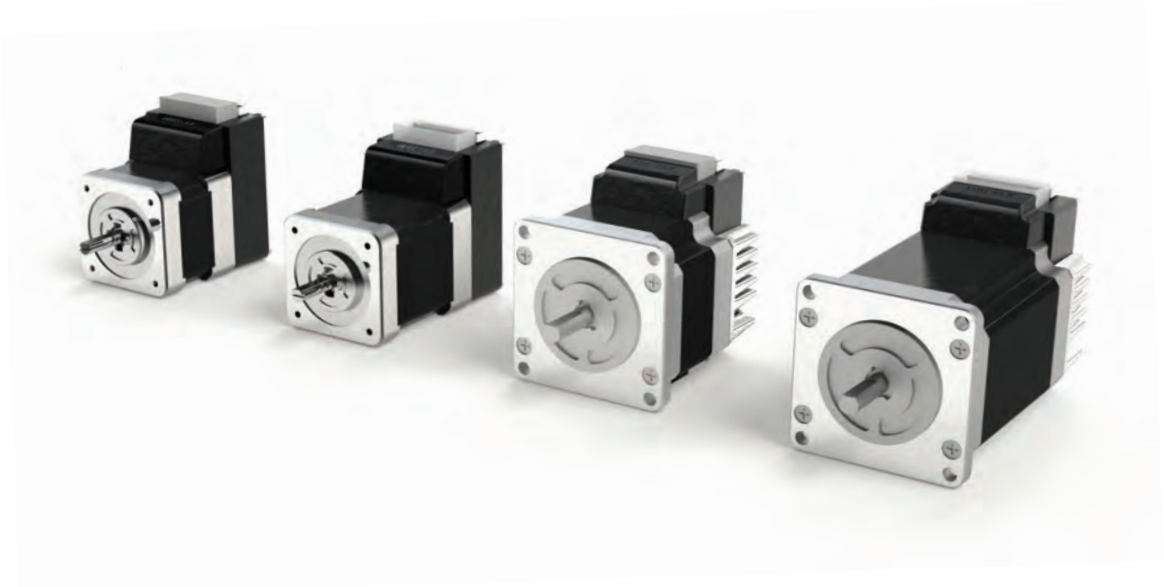
CM3
Standard Functions

Point to point motion, triggered by either digital inputs or by ASCII commands across the RS-232 port. STEP/DIRECTION or CW/ CCW pulse input with programmable resolutions. Up to 32 definable positions, speeds, and accelerations.

CM3+
Logic and Networking

The built-in real time controller allows for programming and system construction. The simultaneous control of multiple axes and Cyclic Logic Operation Program can be used to maximize the performance of COOL MUSCLE CM3+.

	CM3			CM3+
Control Method	Direct	I/O	Pulse	
Number of Points	32	8	0	250
RSE232 Communication (settings and monitoring)	●	●	●	●
RS-232 Communication	●			●
I/O Control		●		●
Pulse control	●			●
Program Control				●
Daisy Chain				●
Cyclic Logic Operation				●



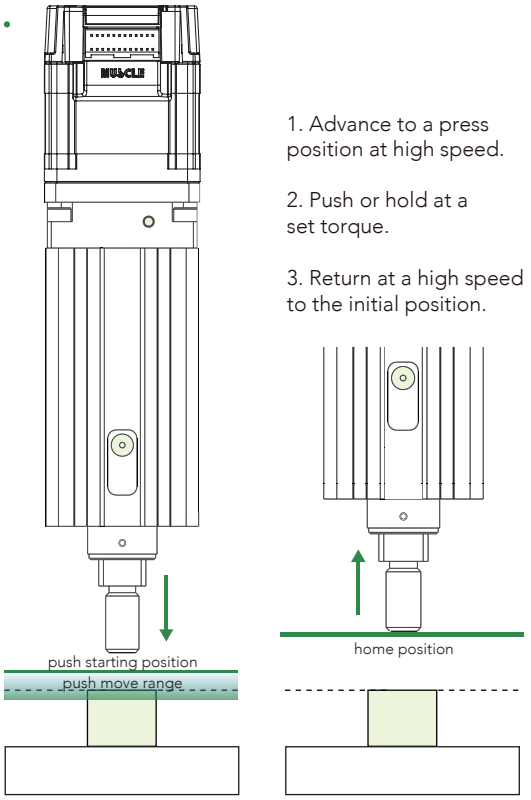
FUNCTIONS - CM3 & CM3+ Examples

MOTION FOR PRESS FITTING, FIXTURING, or LAB PROCESSES

Torque Limiting

Utilizing the motor's control of output torque, the CM3 can be used in torque sensitive applications such as fixturing, gripping, pressing, and winding with limiting force.

Push Motion: A push move can be included into a motion program between two high speed moves. A gripper or rod cylinder can quickly move into place, hold a part for a fixed amount of time, then release. This program can be triggered with a digital input, or over a serial port.



Programmed Soft Limits

To reduce the risk of collision the motor has definable position limits that are relative to the home position.

A definable offset from a sensor or mechanical home position also allows more flexibility in machine calibration.

Origin Search

The Cool Muscle includes built-in homing functions. A combination of mechanical stops, origin sensors, and the encoder's Z-phase signal are available to home each axis.

Homing Options

0	Mechanical Stop Detection
1	Mechanical Stop Detection on power up
2	Home Sensor
3	Home Sensor of power up
4	Mech. Stop Detection & Z Phase
5	Mech. Stop Detection & Z Phase on power
6	Home Sensor & Z Phase
7	Home Sensor & Z Phase on power up
8	Z Phase Signal
9	Z Phase Signal on power up

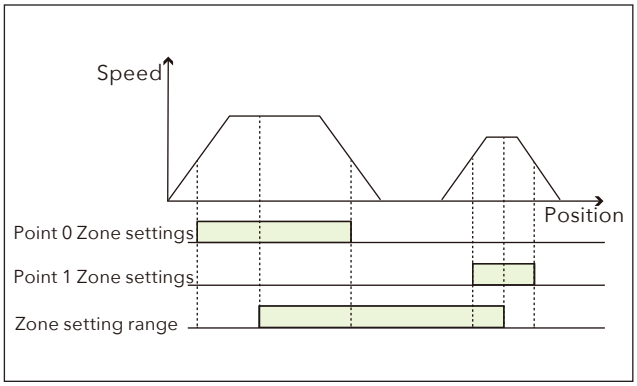
Zone Output Function

A signal can be output within the specified position range for use as a trigger or status output.

INDIVIDUAL ZONE OUTPUT:
The signal is output only within the range set by each point data.

ZONE OUTPUT:
The signal is always output within the range set by the parameter regardless of the point data.

ZONE OUTPUT RANGE



I/O Functions

DIGTAL I/O

The CM3 provides access to configurable digital inputs and outputs for use as triggers.

COOL MUSCLE 3 : 6 Inputs, 4 Outputs, 1 STO Input
COOL MUSCLE 3+ : 4 Inputs, 4 Outputs, 1 STO Input

CM3

Common to each type	Limit sensor, Home to Hard Stop
Direct type	Origin sensor, Manual mode, Inching/Feed, Jog, Servo on/off, Stop
I/O type	Origin sensor, Point data specification, Point data excution/stop
Pulse type	Torque limit on/off, Position reset

CM3+

Origin sensor, Limit sensor, Home to Hard Stop, Manual mode, Inching/Feed, Jog, Servo on/off, Origin sensor, Stop

Output Function Examples

CM3	General, in-position, warning, individual zone, zone, move, busy, end, servo on/off, torque limit, origin search completed, **ABZ encoder**
CM3+	General, in-position, warning, individual zone, zone, move, busy, end, servo on/off, torque limit, origin search completed

Warning Indicators

If the motor temperature or load factor exceeds a preset value, a warning can be output before the motor stops in an alarm state. Detecting approaching device limitations in advance helps reduce downtime.

STO Function

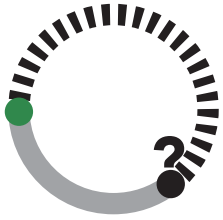
Safe Torque Off (STO) capability built into CM3 . This implemenation a safety function to cut power ro the motor's drive using an input signal from a safety controller or circuit.

Gain Tuning & Tuningless Options

Selecting the tuningless function enables large inertia drive and belt mechanisms to be driven without additional gain adjustments. Selecting the PPI control function allows for precisetuning of critical load conditions.

1-Turn Absolute

The CM3 rotary encoder provides absolute positioning within 1 rotation. For applications such as cammechanics and turntables, repeatedly moving to an origin sensor on power-up may not be required, simplifying recovery or calibration after power loss.



Cyclic Logic Operation Program

Cool Muscle logic banks are analogous to PLC logic. Programs within the CM3 can link I/O and motion to logic functions, while also monitoring and reacting to internal motor states.

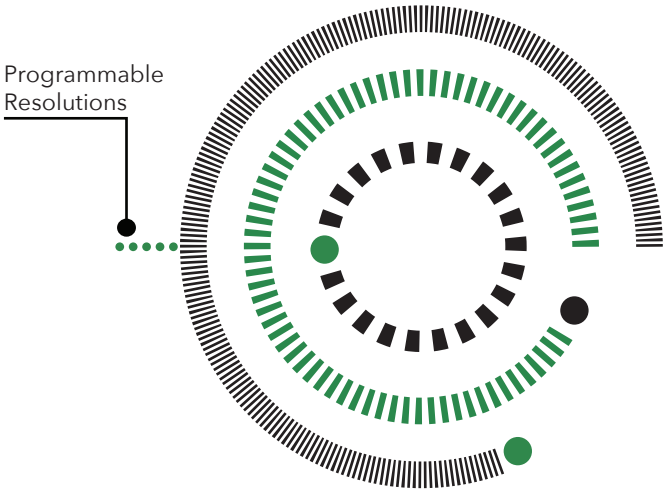
Variable	Current position, current speed, current torque, current status, position deviation, target position, target speed
Mathematical Operation	Addition, subtraction, multiplier, divisor, sine, cosine, square root
Logical Operation	AND, OR, NOT
Comparison Operation	=, NOT=,>,<,≧ ,≦
Input Branch	Conditional branch depending on the state of the input signal

Programmable Resolution

Motor resolution is programmble, with settings between 300ppr and 12000ppr.

Resolution Setting Increments in Pulses per Rotation (ppr)

0： 300	5： 3000
1： 600	6： 5000
2： 1000	7： 6000
3： 1200	8：10000
4： 2000	9：12000



The Cool Muscle uses a magnetic rotary postion encoder reducing the risk of failure and extending system life span.

SPECIFICATIONS

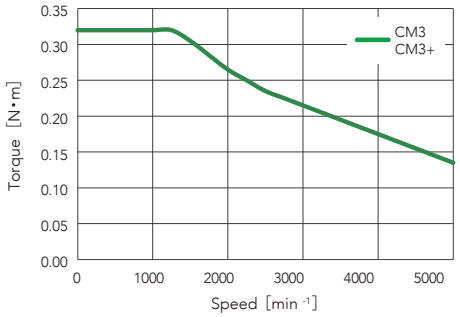
Model: CM3 - 17L50A

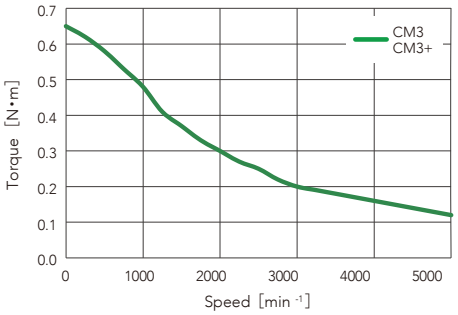
Model	Motor Size	Motor Length	Max. Speed	Hardware Revision
CM3 CM3+	17... 42□ 23... 56□	S ... Short L ... Long	50... 5000rpm	A

CM3-17S50A | CM3+-17S50A

CM3-17L50A | CM3+-17L50A

Imput Supply Voltage		+24V dc			
Rated Current / Peak Current		3.5 [A] / 4.8 [A]		4 [A] / 5 [A]	
Motor Output		60 [W]		60 [W]	
Max. Speed		5000 [min^{-1}]			
Rated Torque		0.25 [N•m]		0.42 [N•m]	
Max. Torque		0.32 [N•m]		0.65 [N•m]	
Rotor Inertia Moment		0.036 x 10^{-4} [kg•m^2]		0.074 x 10^{-4} [kg•m^2]	
Allowable Inertia Moment of Load		Less than 10 times of Rotor Inertia			
Allowable Radial Load		37 [N]		32 [N]	
Allowable Thrust Load		10 [N]		10 [N]	
Encoder		High-precision incremental magnetic rotation angle sensor			
Resolution		From 300~12,000 [ppr] set by parameter			
Control Method		Closed Loop Vector Control			
I/O	Control Input	Digital Input: 6 (Includes 2 pulse inputs)	Digital Input:4	Digital Input: 6 (Includes 2 pulse inputs)	Digital Input:4
	Control Output	Digital Output:4 (Includes 1 error output)			
	STO Input	1			
Communication Port		RS-232C	RS-232C 2port	RS-232C	RS-232C 2port
Mass		295 [g]		435 [g]	
Operating/Storage Temperature		-10℃ ~ 50℃ (non-freezing) / -20℃ ~ 65℃ (non-freezing)			
Operating/Storage Humidity		5 ~ 95% RH / 20 ~ 90% RH			

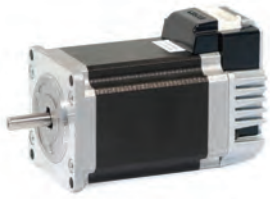




Model: CM3 - 23L50A

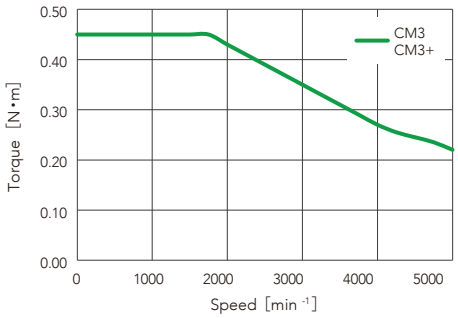
Model	Motor Size		Motor Length	Max. Speed	Hardware Revision
CM3 CM3+	17... 42 23... 56	□ □	S ... Short L ... Long	50 ... 5000rpm	A

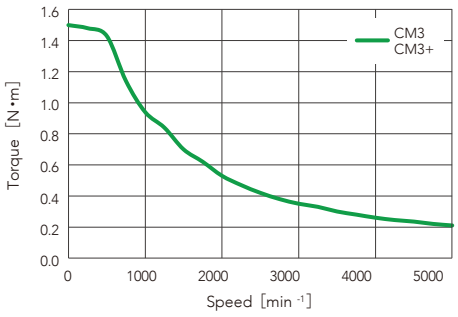
CM3-23S50A | CM3+-23S50A



CM3-23L50A | CM3+-23L50A

Imput Supply Voltage		+24V dc			
Rated Current / Peak Current		4 [A] / 5 [A]		5 [A] / 6 [A]	
Motor Output		80 [W]		100 [W]	
Max. Speed		5000 [min^{-1}]			
Rated Torque		0.36 [N•m]		1.20 [N•m]	
Max. Torque		0.45 [N•m]		01.50 [N•m]	
Rotor Inertia Moment		0.1 x 10^{-4} [kg•m^2]		0.36 x 10^{-4} [kg•m^2]	
Allowable Inertia Moment of Load		Less than 10 times of Rotor Inertia			
Allowable Radial Load		77 [N]		70 [N]	
Allowable Thrust Load		15 [N]		15 [N]	
Encoder		High-precision incremental magnetic rotation angle sensor			
Resolution		From 300~12,000 [ppr] set by parameter			
Control Method		Closed Loop Vector Control			
I/O	Control Input	Digital Input: 6 (Includes 2 pulse inputs)	Digital Input:4	Digital Input: 6 (Includes 2 pulse inputs)	Digital Input:4
	Control Output	Digital Output:4 (Includes 1 error output)			
	STO Input	1			
		RS-232C	RS-232C 2port	RS-232C	RS-232C 2port
Mass		525 [g]		1050 [g]	
Operating/Storage Temperature		-10℃ ~ 50℃ (non-freezing) / -20℃ ~ 65℃ (non-freezing)			
Operating/Storage Humidity		5 ~ 95% RH / 20 ~ 90% RH			

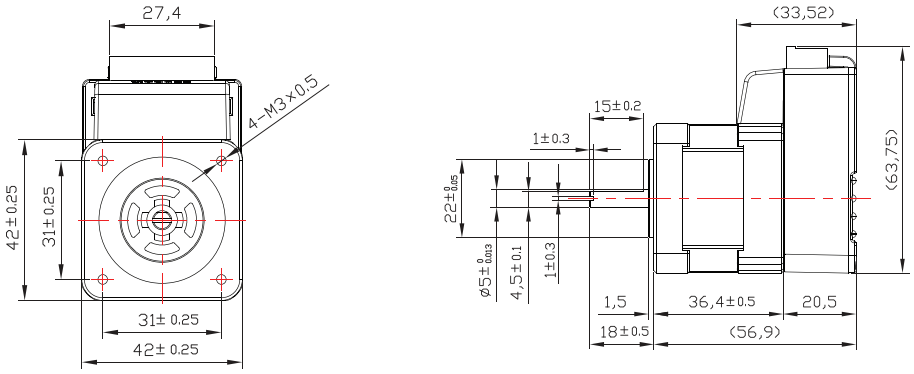




DIMENSIONS

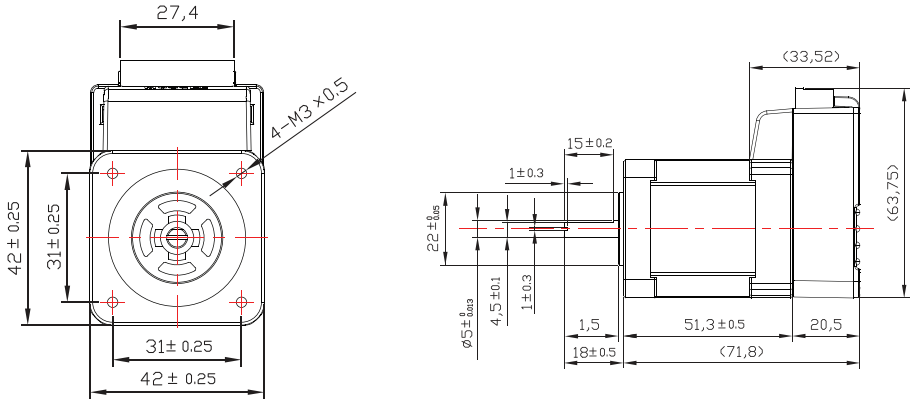
CM3-17L50A
CM3+-17L50A

- NEMA 17/42mm Square
- 5mmOD shaft with D cut
- M3 threaded mount
- Top exiting cable connector
- 60W, 0.32Nm, 5000rpm



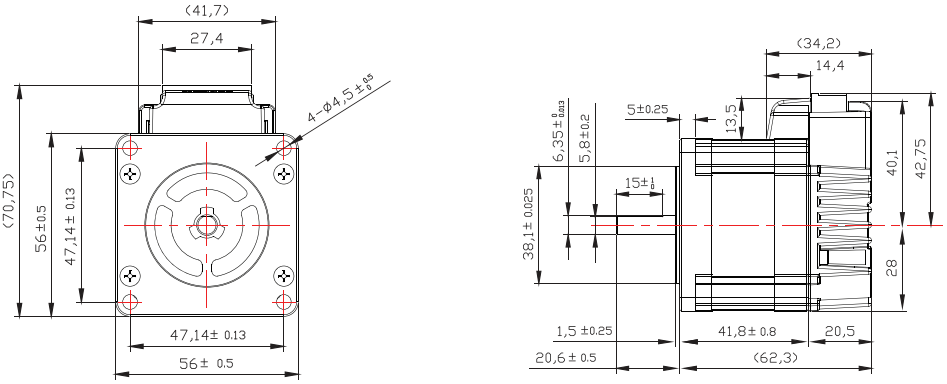
CM3-17L50A
CM3+-17L50A

- NEMA 17/42mm Square
- 5mmOD shaft with D cut
- M3 threaded mount
- Top exiting cable connector
- 60W, 0.65Nm, 5000rpm



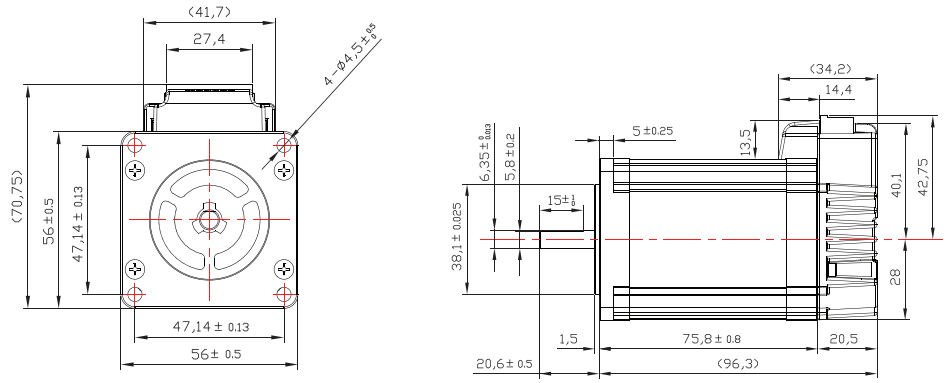
CM3-23S50A
CM3+-23S50A

- NEMA 23/56mm Square
- 6.35mmOD shaft with D cut
- M4 through hole mount
- Top exiting cable connector
- 80W, 0.45Nm, 5000rpm



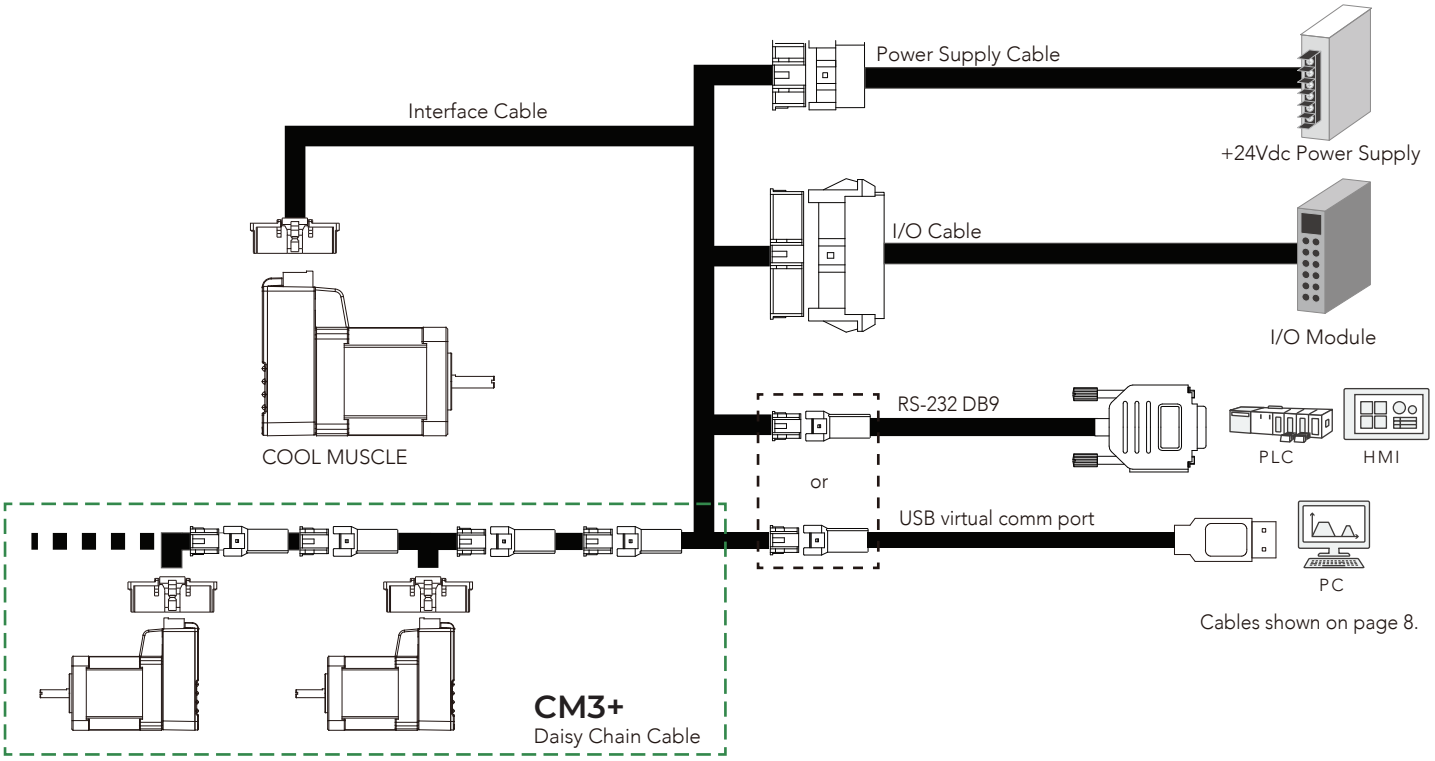
CM3-23L50A
CM3+-23L50A

- NEMA 23/56mm Square
- 6.35mmOD shaft with D cut
- M4 through hole mount
- Top exiting cable connector
- 100W, 1.5Nm, 5000rpm



CONNECTION

Wiring options - CM3 and CM3+



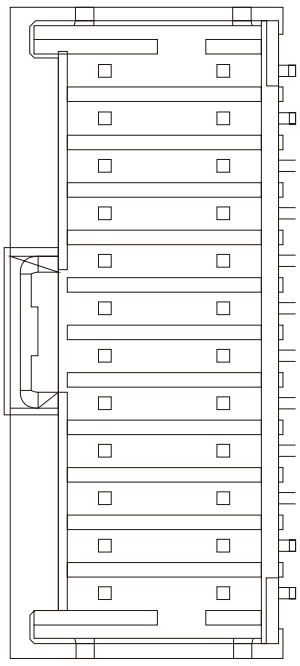
Cables shown on page 8.

Pin Configuration

Connection via a 24-pin connector at the top of the CM3.

CM3 24 Pin Connector - Molex 55959-2430

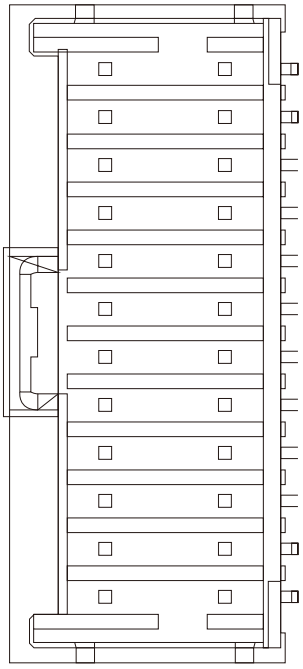
	PIN No
GND	2
ERROR	4
OUT3 / Z Phase	6
OUT2 / B Phase	8
OUT1 / A Phase	10
STO_IN+	12
INPUT6- / PULSE B-	14
INPUT5- / PULSE A-	16
INPUT4	18
INPUT2	20
P-GND	22
POWER	24



PIN No	
1	FG
3	GND
5	RXD0
7	TXD0
9	STO_IN-
11	INPUT6+ / PULSE B+
13	INPUT5+ / PULSE A+
15	IN-COM
17	INPUT3
19	INPUT1
21	P-GND
23	POWER

CM3+ 24 Pin Connector - Molex 55959-2430

	PIN No
+5Vdc	2
D_GND	4
RXD1	6
TXD1	8
OUT3	10
OUT1	12
D_GND	14
STO_IN+	16
INPUT3	18
INPUT1	20
P-GND	22
POWER	24



PIN No	
1	FG
3	D_GND
5	RXD0
7	TXD0
9	ERROR
11	OUT2
13	STO_IN-
15	INPUT4
17	INPUT2
19	IN_COM
21	P-GND
23	POWER

For more information, please refer to the user's guide.

CABLING

All cables can be ordered to custom lengthes in increments of 50mm.
Max. length dependant on signal type.

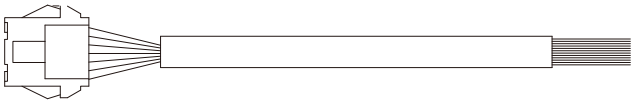
Model: CM3IO1-1000S

Motor	Usage	Type	Length	Cable End
CM3	IO - I/O	CM3	1000 - 1000mm	S - Single Ended
	F - Main Interface	CM3+	1050 - 1050mm	W - All Ends Connectorized
	US - USB		2000 - 2000mm	
	RS - RS-232		*... in 50mm increments*	
	DC - Daisy Chain			
	PW - Power			

CM3

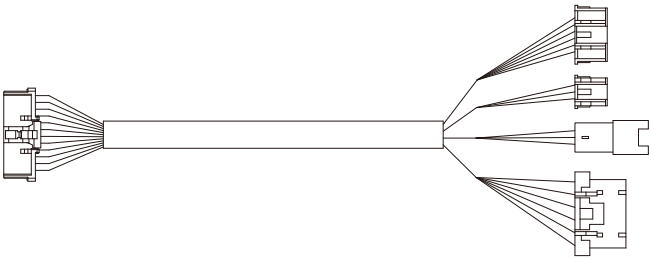
Interface Cable
CM3F1-1000W

I/O Cable
CM3IO1-1000S

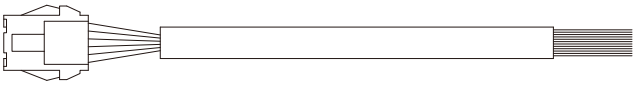


CM3+

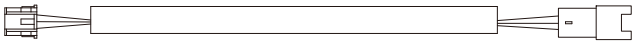
Interface Cable
CM3F1+1000W



I/O Cable
CM3IO1+1000S

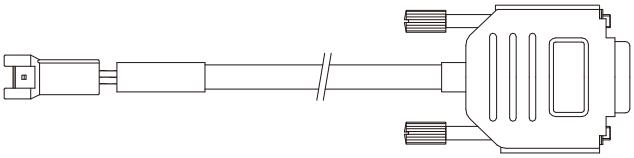


Daisy Chain Cable
CM3DC1-1000W

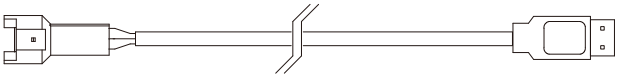


CM3 & CM3+ Common Cables

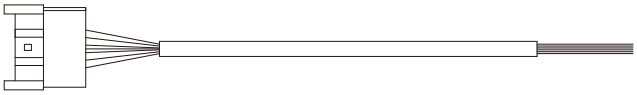
RS-232 Cable
CM3RS1-1000W



USB Cable
CM3US2-1800W



Power Supply Cable
CM3PW1-1000S



Cool Muscle Family

CM1-E
CM1-T
CM1
CM2
CM3
CM3+

ADDITIONAL COOL MUSCLE SERIES

CM1 Series

24Vdc Drive, Programmable Controller, 50Kppr Encoder
Interfaces: Step/Direction, TTL, USB, RS-232, RS-485, Ethernet IP, EtherCAT, MODBUS TCP, MODBUS RTU, Programmable I/O

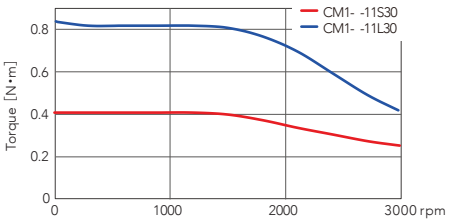
28mm Frame

CM1-C-11S30

Output：9W
Max. Speed 3000rpm
Rated Torque 0.027Nm

CM1-C-11L30

Output：18W
Max. Speed 3000rpm
Rated Torque 0.055Nm

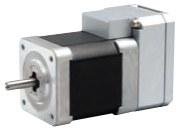


42mm Frame

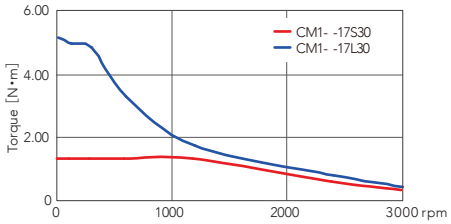
CM1-C-17S30

Output：18W
Max. Speed 3000rpm
Rated Torque 0.082Nm

CM1-C-17L30



Output：18W
Max. Speed 3000rpm
Rated Torque 0.36Nm

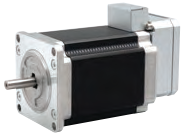


56mm Frame

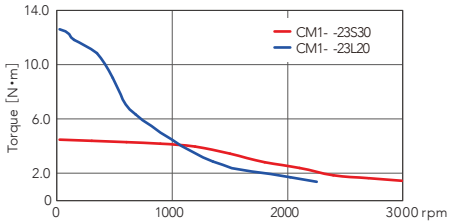
CM1-C-23S30

Output：45W
Max. Speed 3000rpm
Rated Torque 0.29Nm

CM1-C-23L20



Output：30W
Max. Speed 2000rpm
Rated Torque 0.87Nm



CM1-E provides EtherCAT connectivity
CM1-T provides EthernetIP & MODBUS TCP

Connectors:
RJ45 for Ethernet
M9 for 24Vdc Power and I/O
Separate Control and Power inputs
for STO circuits

CM1-E-17S30D
CM1-T-17S30D

CM1-E-17L30D
CM1-T-17L30D

CM1-E-23S30D
CM1-T-23S30D

CM1-E-23L20D
CM1-T-23L20D

CM2 Series

100-240VAC Drive, Programmable Controller, 50Kppr Encoder
Interfaces: Step/Direction, USB, RS-232, EtherCAT, MODBUS TCP, MODBUS RTU, Programmable I/O

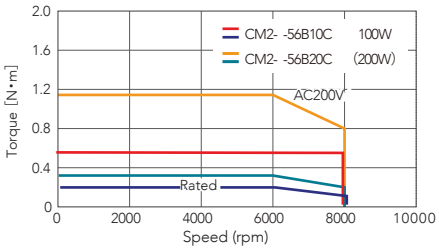
56mm Frame

CM2-C-56B10

Output: 100W
Max. Speed: 8000rpm
Rated Torque: 0.19Nm

CM2-C-56B20

Output: 200W
Max. Speed: 8000rpm
Rated Torque: 0.32Nm



60mm Frame

CM2-C-60A10

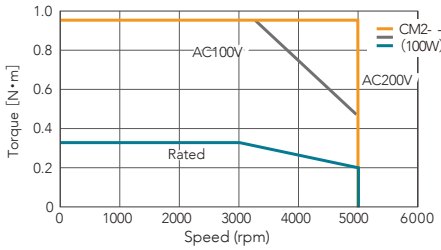
Output: 100W
Max. Speed: 5000rpm
Rated Torque: 0.32Nm

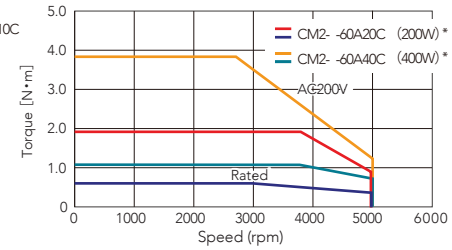
CM2-C-60A20

Output: 200W
Max. Speed: 5000rpm
Rated Torque: 0.64Nm

CM2-C-60A40

Output：400W
Max. Speed：5000rpm
Rated Torque：1.09Nm



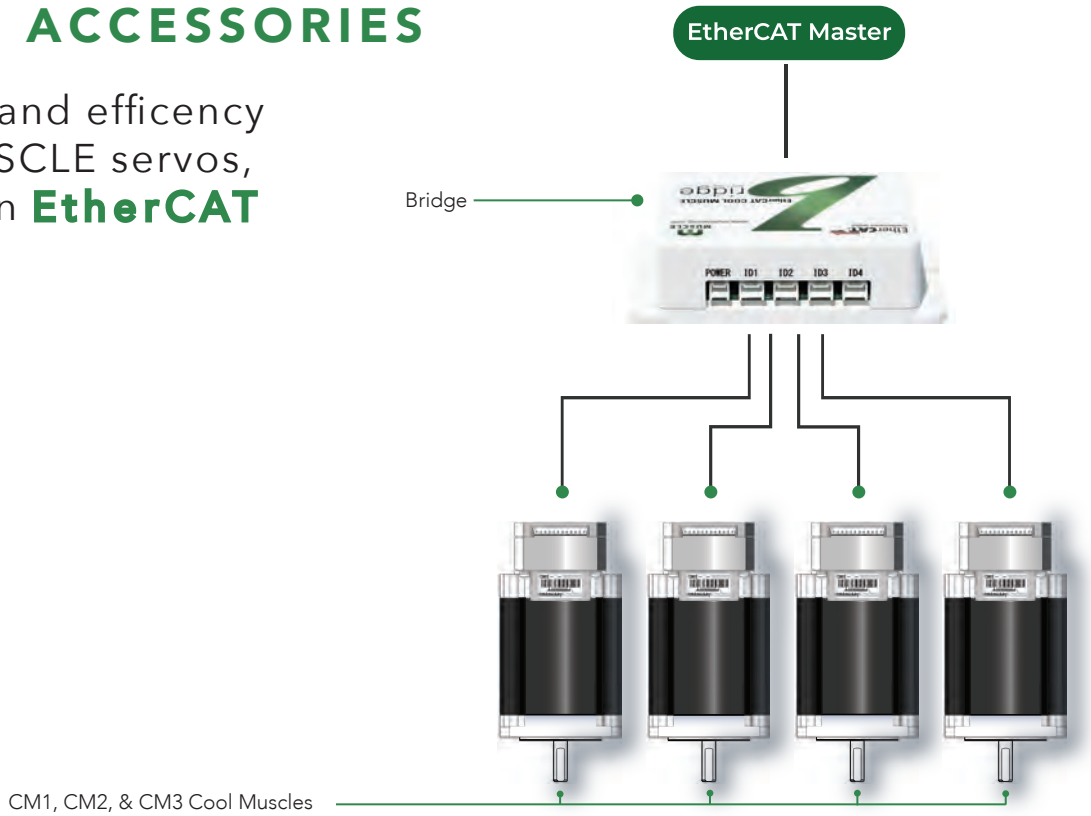


* Input Voltage is AC200-240V

Cool Muscle ACCESSORIES

The intelligence and efficency of the COOL MUSCLE servos, combined with an **EtherCAT** interface

EtherCAT is registered trademark and patented technology licensed by Bekhoff Automation GmbH, Germany.



Ethercat Cool Muscle Bridge

EtherCAT Cool Muscle Bridge is Muscle Corporation, new 4-axis interface for EtherCAT networks. Four CM1, CM2, or CM3 motors can be connected to each bridge allowing for control of the Cool Muscles as an EtherCAT slave from an EtherCAT Master across a high performance network. The application layer conforms to the CiA402 Drive Profile, with unique operation modes including Cyclic Synchronous Position mode (cpm) and Homing mode (hm). The EtherCAT Master sends position commands to, and receives feedback from the EtherCAT Slave at a communications frequency of 1msec.

ETHERCAT FEATURES

1. Implements CiA402 drive profile.

2. CSP, CSV, PV, PP and HM modes are avalible

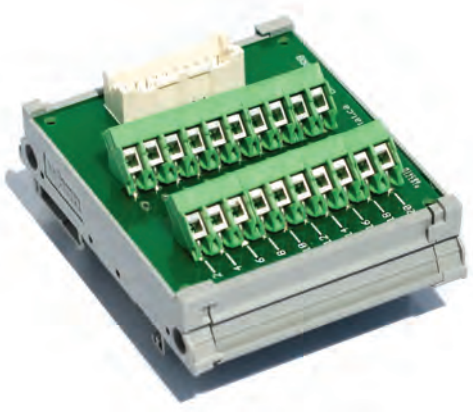
3. Intergrated IO mapped to PDO objects

4. 1ms PDO timing for accurate synchronized motion

5. Explicit Device ID for enhanced device identification

Break-out Boards and Network Cards

Myostat offers a series of breakout boards, cabling adaptors, and network devices for the entire Cool Muscle line. Contact Myostat to identify the right breakout board for your system.



Cool Muscle Gear Series

GEARBOX PERFORMANCE

All gearboxes are pre-matched for Cool Muscle servos. Torque and speed output specifications are dependant on the matched motor. The LS Series gearbox operates at a 95% efficency rating for the single stage model + gearbox combination. Gearbox backlash is measured at 6arc/ min for single stage units and 10arc/min for double stage units. All gearboxes are sealed for use in any orientation and rated to IP65

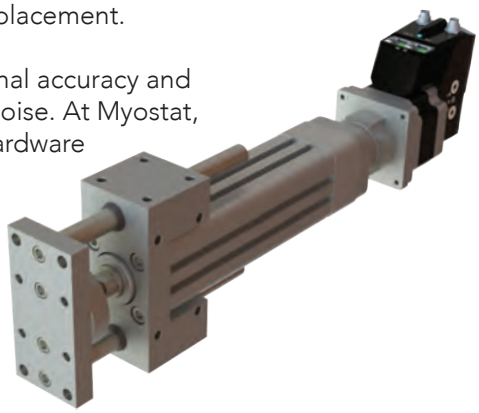
40mm, 60mm and 90mm size frames are available to fit NEMA 17 to 34, or 40mm to 90mm size motor frame sizes. CAD files with full dimensions for each size available at www.myostat.ca

With ratios of 20:1 or greater, please use the LX-090 size gear box with the CM2-X-60A40C

Cool Muscle Acctuator Series

Myostat offers a large range of electric actuators built around ball screws, lead screws and belt drives. The high torque density and top speeds of the CM3 motor make the Cool Muscle an great choice for pick and place gantries, dynamic process machinery, and rapid cycling motion. Matching a Cool Muscle to an ISO15552 compatible ball screw rod style actuator creates an easy to implement, cost effective pneumatic replacement.

Machine builders can quickly enhance an operation, positional accuracy and torque control, while reducing energy consumption and noise. At Myostat, engineers will help you pick the right combination of hardware and provide setup support for your next design.



In-line Brakes

Myostat offers 3 sizes of inline brakes to fit motor sizes between 42mm and 60mm square. Each brake is powered with 24Vdc, engaging in the power off state. Please refer to the data sheets for dimensions, holding torque and power consumption.

IB42

IB56

IB60

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*Specifications subject to change without notice.

Manufactured in Japan by
MUSCLE CORPORATION

MYOSTAT MOTION CONTROL INC.