COOL MUSCLE™
INTEGRATED SERVO SYSTEMS

CREATING INNOVATION WITH MOTION CONTROL

COOL MUSCLE™

Integrated Motion Modules

The Cool Muscle line of servo motors provide all the common components required for motion control embedded into the motor itself. The seamless integration of both software and hardware components creates highly efficient motion modules that can be easily integrated into existing designs, or used to shorten the development cycle of your new machine.

The Cool Muscle outperforms traditional servo and stepper systems by virtue of the controller's multiple closed feedback loops with the driver and high resolution encoder. Short wire lengths reduce susceptibility to EMI and noise, while removing servo and encoder cables that often add considerable cost, inventory, and complexity. On-board PLC functionality also reduces machine component count and costs, and allows for modern, elegant machine design. A variety of industrial buses are available for communications and networking with third party host controllers.

Two Series of Cool Muscle Servos

The Cool Muscle line is comprised of two distinct series. The CM1 is a high performance closed loop servo system based on high torque stepper motors, providing a high torque density package for applications such as pick and place, guiding, dispensing, and medical reseach. The CM2 is based on high speed AC servo motors with high wattages and expanded I/O capabilities, suitable for applications requiring higher running speeds or additional torque through gearing. The CM2 provides the additional benefit of having an integrated AC power supply, compatible with most global voltage standards.

Interface Options

P Type

Replacing your current pulse driven system with the P type Cool Muscle will save space, increase cycle time, and remove the problems associated with open loop steppers. The P type interface accepts Step/Direction or Clock Wise/Counter Clock Wise pulse trains from an external controller. Analog speed or position control functions are also available within the P type interface function set.

C Type

The C type Cool Muscle is the most versatile and feature packed solution among the two types. The C type Cool Muscle can be pre-programmed, dynamically controlled by PC or embedded computer and can be networked for multi-axes applications. Digital signals can also activate stored motion programs, creating a compact, powerful machine with simple controls. The C type Cool Muscle can also vary speeds or positions in proportion to voltage input level. Set the max. speeds or travel distances with ease by parameters. The analog functions in the Cool Muscle provides an ideal solution for constant feed systems, and valves.

R Type

The R Type is an extension to the C type feature set, which adds two axes co-ordinated contouring commands. With a network of R Type motors, two dimensional shapes can be created for applications such as dispensing, cutting, or imaging. Additional networked Cool Muscles can be used for linear motion in a third axes and for other handling or setup axes.

CM1
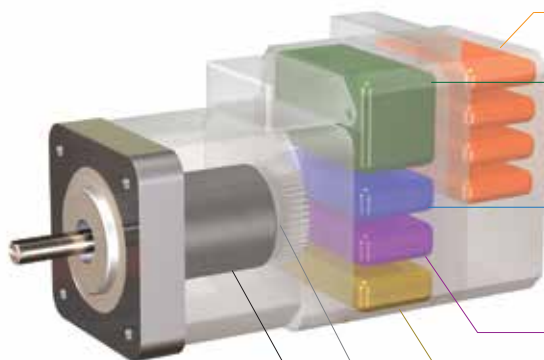
Interface Options: RS-232, RS-485, USB
MODBUS RTU, TCP/IP Ethernet/IP, EtherCAT, CANopen

Driver: 24VDC Closed loop, sinusoidal, vector

Controller: Real-time OS kernel with
torque, speed, and position control.
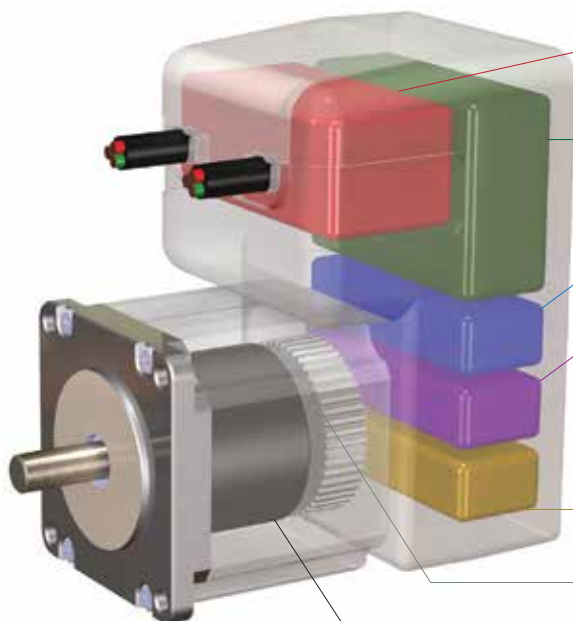2-axes coordinated motion

PLC function: Fixed scanning rate
programmable I/O with PLC like functions
Arithmetic and logic functions

Communication: Two UART ports, daisy chain networkable
Onboard digital and analog I/O

Encoder: Magnetic encoder, 50000ppr

Motor: Brushless multi-pole synchronous motor

CM2

Onboard power supply: Direct AC100V-240V

Driver: Closed-loop sinusoidal vector control
One parameter tuning

Controller: Torque control
Proprietary RT OS
Interpolation functions (option)

PLC function: Arithmetic/Logical operations

Communication: Two RS-232C channels
15 axes daisy chain network

Input/Output (I/O): 6 digital inputs/4 digital
outputs, 1 Analog Input/1 Analog Output

Encoder: Magnetic, 50000ppr

Motor: Brushless AC synchronous motor

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Flexible & Convenient Power Input

The CM1 series Cool Muscle uses industry standard 24VDC input voltage for all of the motor sizes simplifying your low voltage power bus. The CM2 series Cool Muscle accepts 100-240VAC, single or 3 phase, removing the need for additional high voltage AC-DC power supplies.

Expensive High Voltage Drive cables are no longer required!

Full Closed Loop System

All Cool Muscles are fully closed loop systems. With a high resolution magnetic encoder and the intelligent driver board integrated into a single space efficient package, the Cool Muscle constantly monitors its position, eliminating any missed steps.

Higher repeatability, stability, and accuracy.

Closed Loop System

By monitoring position and current values from built-in sensors the Cool Muscle handles both position and current feedback for optimal positioning and power efficiency.

Input → + − Error → H∞ Controller

Feedback
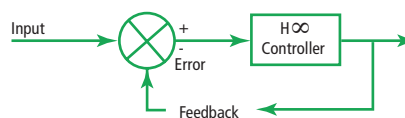
H∞

Using novel modern control technology, the Cool Muscle goes beyond antiquated static PID control by utilizing the robust **H**∞ control system. **H**∞ responds to dynamic loads across the entire speed range, reduces the need to tune gains, and increases the allowable inertia mismatch between motor and load.

Smooth and Accurate Movements

The Cool Muscle's high resolution magnetic encoder gives you an exceptionally fine resolution of 50,000 units per rotation. All Cool Muscles employ Vector Drive control, resulting in incredibly smooth motion and high torque at low speeds.

Aggressive acceleration ramps not possible with microstepping decrease your machine's cycle time and increase output.

POSITION 1   Speed and Direction Vector

POSITION 2
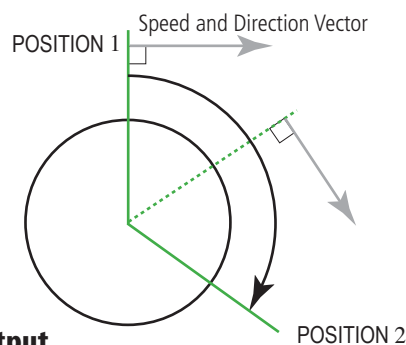
Vector Drive Control

Vector drive uses onboard phase current sensors as feedback in a closed loop current controller. This system optimizes torque in static and dynamic loading conditions, drastically increasing the torque density of the motor system, while micro-managing current for optimum efficiency.

Energy Efficient

The Cool Muscle's power management monitors and provides the optimum current based on load, keeping the motor cool. In addition, using a stepping motor, the CM1 Cool Muscle generates high torque at low speeds in a small space envelope.

Longer motor life. Increased power efficiency with as much as a 75% power savings over other systems. Great for enclosed spaces.

The Cool Muscle applies optimum current to produce motion whereas an open loop stepper typically runs with a fixed current draw.

Traditional Steppers/Servos

Temperature

Cool Muscle

Battery Operation

The CM1 Series Cool Muscle's efficient design technology makes the motor suitable for battery operation.

Contact Myostat Motion Control for further information about operating voltage ranges and current draw.

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Various Interfaces

The Cool Muscle can be controlled via different interfaces, including Pulse trains, Analog, Computer and PLC I/O. Choose The type that best suits your needs. Ethernet, CAN open and other industrial buses are available for the Cool Muscle as an option.

Minimum modification required to improve your existing design and improve performance.

	Control	Variations
P Type	Pulse train	CW/CCW Step/Direction
C Type	PC Embedded Computer PLC Discrete I/O	Pre-Programmed Dynamic Command
	Analog Input	Position, Speed
R Type	CML commands	2-axes Contouring

Programmable

Program the Cool Muscle to create the motion you need. Define motion profiles and create programs using easy-to-understand Cool Muscle Language (CML). Motion programs you create can be stored in the Cool Muscle's EEPROM. The programs can be executed via PC, embedded computer or triggered using I/O.

Great solution for repetitive motion. Simple and compact machines.

CML

Cool Muscle Language is a robust set of ASCII commands that lets you easily create motion programs. Commands include conditional, iterative, and mathematical functions.

Logic Banks

Logic bank programming moves beyond motion programming into logic and mathematical functions, running at a fixed scan rate for PLC type functionality.

```
P1=1000
P2=2000
S1=200
S2=300
A1=50
A2=150
T1=20
```
Define motion profiles such as speed, acceleration, position and timer.

```
B1
A1,S1,P1
S2,P2,P1
C2
END.1
```
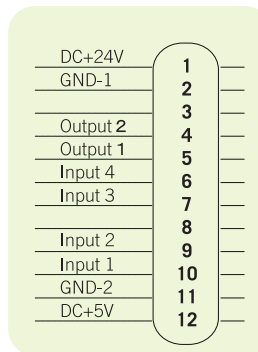Define motion programs using the motion profiles defined above.

Powerful Pre-programmed Functions

The Cool Muscle system comes with over 90 user definable parameters and pre-programmed functions. These remove the need to program typical routines such as Homing, Feeding, Torque based motion, Speed, or Position Control.

Logic Banks are also an excellent way to Program complex I/O interactions

DC+24V	1
GND-1	2
	3
Output **2**	4
Output **1**	5
Input 4	6
Input 3	7
	8
Input 2	9
Input 1	10
GND-2	11
DC+5V	12

Input Functions examples:
Origin Sensor/Homing
Manual Feed
Manual Jog
Execute Bank
Origin Search
Motor Free
Enable Motor
Execute Next Step
Execute Previous Step

Output Functions examples:
Alarm
In-position
Registration

Logic Programming and PLC Functionality

The Cool Muscle's real time operating system precisely controls I/O timing allowing for PLC style I/O operation.
Logic banks provide a flexible logical and mathematical capability analogous to that offered by traditional ladder logic. User defined actions can be triggered by external inputs or by internal motor conditions such as speed, torque, or position.

Create custom tasks to monitor internal system metrics and variables which execute in parallel with other system operations.

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Torque Control and Feedback

The Cool Muscle controller uses the integrated current and position sensors to maintain sophisticated torque control during operation. Peak running torque can be easily set within motion programs, or the built in Push Mode function can be quickly implemented to mimic pneumatic cylinder operations.

Closing the loop with external load cells is also quick and efficient utilizing the analog input's PI controller and the pre-set functions built into the Cool Muscle

Torque

0   Time or Position
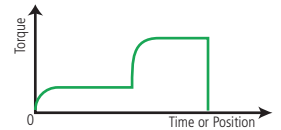
2-Axes Co-ordinated Motion

Both the CM1 and CM2 R Type servos provide 2 axes contouring utilizing a 2+ motor daisy chain network. Additional linear axes can be implemented on the same motor for applications such as dispensing, cutting, or inspection. Programs can be run directly from the motor without the need for a host controller, or can be streamed from a PC for greater flexibility.

Start

Radius

End

Straight forward adhesive dispensing
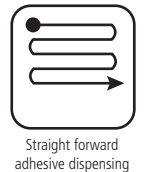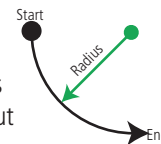
3D Printing can be optimised by switching to the P Type Cool Muscle. Ghosting and noise are drastically decreased, while linear print speed, filament resolution and retraction speeds are dramatically increased

CM1 Communications/Network Interface Options

Network Communications

The Cool Muscle offers you multiple networking solutions. Connect multiple Cool Muscles in a daisy chain style network. In the daisy chain network Cool Muscles can tell other motors to activate programs as well as receive commands from a computer or an embedded controller.
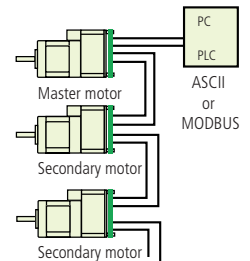
Network options such as CANopen and Ethernet fieldbuses are now available.

EtherCAT®

EtherNet/IP™

CANopen

Modbus

Master motor

Secondary motor

Secondary motor

PC
PLC
ASCII
or
MODBUS

Muscle Corporation's EtherCAT bridge allows 4 Cool Muscles to be attached to any EtherCAT network. Multple bridges can be used on one network to expand the number and types Cool Muscles on the network. The EtherCAT bridge reduces the per axis cost of adding EtherCAT, and helps in applications where motor space is restricted.

Industrial Buses

RS-232, RS-485, MODBUS RTU, Ethernet TCP/IP, Ethernet IP, MODBUS TCP, EtherCAT, CANopen, and other industrial interfaces are available as options for the Cool Muscle servo systems. Our engineers provide technical support based on extensive experience integrating the Cool Muscle with third party controllers, HMIs, and PLCs.

Drawings and technical specifications for each interface are avaliable from www.coolmuscle.com or from your local distributor.
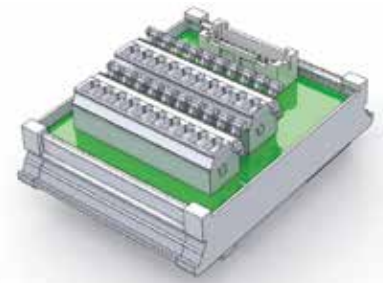
By using MODBUS RTU, compliant PLCs and touch panels can be directly connected to a Cool Muscle, economically extending the system I/O count for demanding applications.
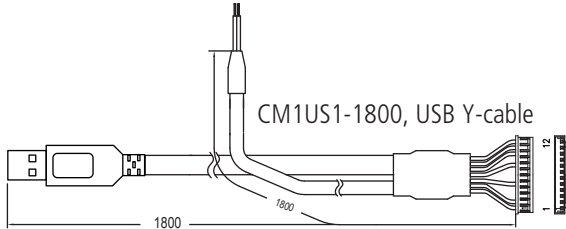
COOL MUSCLE™
Networking Interfaces, Breakout Boards, and Cabling

CM1M9-2F-2000, M9 power cable

8.70
[0.34]

2000

25.70
[1.01]
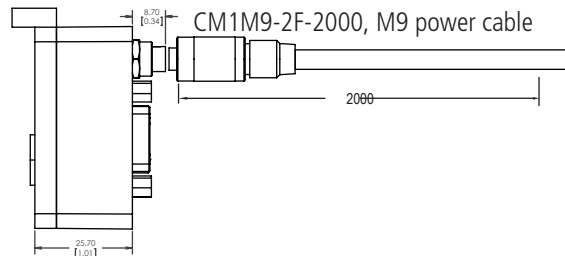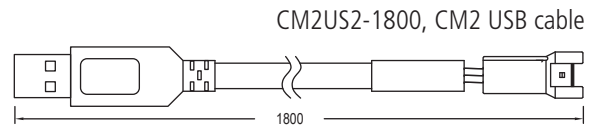
-SRLM DB9 RS-232 or -EIO Expanded I/O interface option

CM2IO2-DRBP, CM2 breakout board

CM1US1-1800, USB Y-cable

CM2US2-1800, CM2 USB cable

1800

1800

12

1

1800

1800

Interface & Cabling Options

A wide range of communications, I/O, and Power cables are available for the CM1 and CM2 motors. Series specific DIN rail breakout boards and prototyping boards are also supplied by Myostat Motion Control from standard stock or as custom build to order items. Please contact us to ensure that you recieve the best cables for your application.

For a full listing of cables, breakout boards, and interfaces. Visit www.coolmuscle.com/interfaceoptions

Each motor comes with 40cm or 50cm single ended cables to help you get started.

Integrated Linear Actuators

Integrated Actuators

Myostat offers a wide range of Cool Muscle integrated actuators based on ball screws, lead screws, belt drives, and rack & pinion assemblies. Rod style actuators with force ratings up to 2000LbsF are also bundled with both CM1 and CM2 servo systems.

For full specifications, please review the Integrated Actuators Brochure or look to www.coolmuscle.com
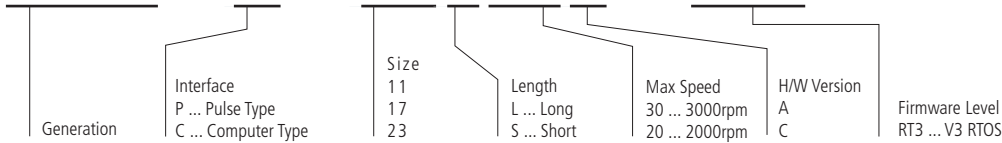
PA Series

RL Series
ball screw actuators

CSR-17 Lead Screw Rod Actuator

CM1 SPECIFICATIONS

■ Model Name

CM1 - C - 11L30C - RT3

Generation	
Interface P ... Pulse Type C ... Computer Type	
Size 11 17 23	
Length L ... Long S ... Short	
Max Speed 30 ... 3000rpm 20 ... 2000rpm	
H/W Version A C	
Firmware Level RT3 ... V3 RTOS	

■ Specifications

MODEL	CM1-☐-11L30	CM1-☐-11S30	CM1-☐-17L30C	CM1-☐-17S30C	CM1-☐-23L20C	CM1-☐-23S30C
Mass lbs (kg)	2.4 (1.08)	1.2 (0.54)	1.05 (0.48)	0.7 (0.32)	0.65 (0.29)	0.5 (0.23)
Maximum Speed	3000rpm	3000rpm	3000rpm	3000rpm	2000rpm	3000rpm
Continuous Torque Nm(oz.in)	0.055 (7.78)	0.027 (3.8)	0.36 (50.98)	0.084 (11.89)	0.89 (126)	0.3 (42.48)
Peak Torque Nm(oz.in)	0.078 (11.1)	0.039 (5.5)	0.53 (75)	0.12 (16.56)	1.24 (175.6)	0.42 (65.14)
Load Inertia Allowance g-cm^2 (oz-in-s^2)	180 (2.5×10^{-3})	80 (1.1×10^{-3})	760 (1.07×10^{-2})	380 (5.38×10^{-3})	4.6×10^3 (6.5×10^{-2})	1.4×10^3 (1.9×10^{-2})
Motor Inertia g-cm^2 (oz-in-s^2)	18 (2.5×10^{-4})	8 (1.1×10^{-4})	74 (1.04×10^{-3})	36 (5.09×10^{-4})	3.6×10^2 (5.09×10^{-3})	1.0×10^2 (1.4×10^{-3})
Encoder	Incremental magnetic encoder (50,000 pulses per rotation)					
Control Method	Closed loop vector control					
Input Supply Voltage	DC24V±10%					
Input Supply Current Rated (Continuous Torque/Rated Peak Torque)	1.2A/1.5A	0.8A/1.0A	1.5A/1.8A	0.8A/1.0A	2.6A/3.4A	3.9A/5.1A
Resolution Pulse Rotation (Pulse/Rotation)	200, 400, 500, 1000(default), 2000, 2500, 5000, 10000, 25000,50000, Select by parameter					
Environmental Conditions Operating/Storage Temperature	between 0 °C and 40°C/ between -20°C and +60°C					
Operating Humidity	Less than 90% Relative Humidity					
Shock/Vibration	Less than 10G /Less than 1G					

■ I/O Specifications

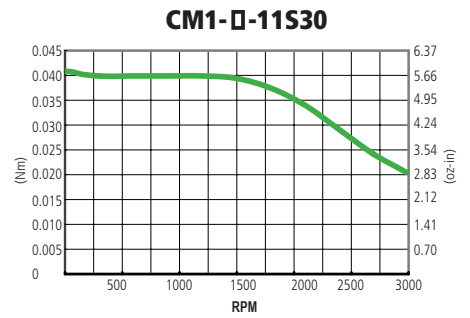| SIGNAL	Parameter	MIN.	MAX.	UNIT.
Digital Input 1 & 2	Voltage Range	0	24	Vdc
Photo-coupled	Low Level	0	0.8	Vdc
Sinking/Sourcing	High Level	2.4	24	Vdc
	Operating Current	7	15	mA
	ƒ	-	500	KHz
	Pulse Width	0.8	-	µs
UART 0 & 1 RX/TX	Voltage Range	0	5	Vdc
	Communications Speed	9600	512000	Kbps
Digital Input 3 & 4	Voltage Range	0	5	Vdc
Sourcing	Low Level	0	0.8	Vdc
	High Level	2.4	5	Vdc
	Pulse Width	120	-	µs
Analog Functions (IN4)	Hardware A/D Resolution	-	10	bits
	Software Oversampling	-	13	bits
Output 1 & 2	Maximum Voltage	-	24	Vdc
	Current - see note	-	20	mA
5Vdc Output	Voltage Range	4.5	5	Vdc
	Output Current - see note	-	50 *	mA

*Note: Combined current draw of O1, O2, IN3, IN4 and 5Vdc source should not exceed 200mA. O1 & O2 should not exceed 50mA each.

CM1 DRAWINGS
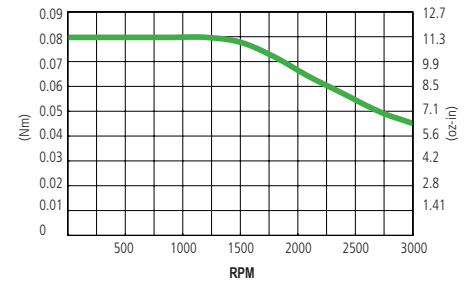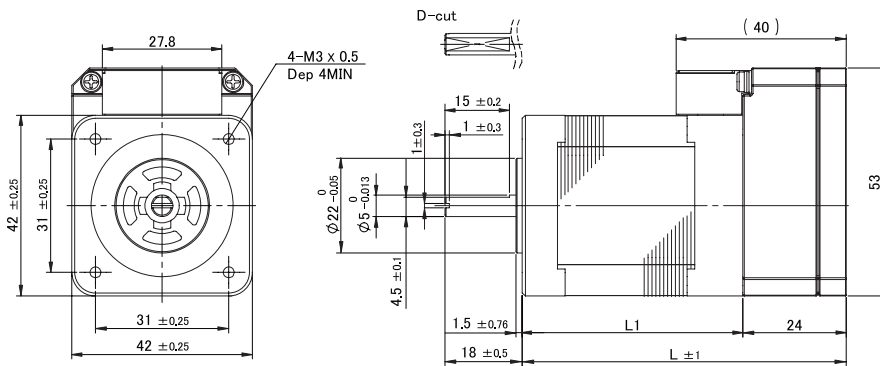
■ **CM1 - □ -** 11S30/11L30   DIMENSIONS (UNIT:mm)

38. 6
4-M2. 6
Dep 3MIN
D-cut
53
28 ±0.3
23 ±0.2
ϕ22 −0.025
ϕ5 −0.012
10 ±0.5
53
4. 5 ±0. 2
23 ±0. 2
28 ±0. 3
1. 5 ±0. 2
15 ±0. 5
18. 6   19
L

■ **Torque Curve**

CM1-□-11S30

	(Nm)			(oz-in)
0.045				6.37
0.040				5.66
0.035				4.95
0.030				4.24
0.025				3.54
0.020				2.83
0.015				2.12
0.010				1.41
0.005				0.70

500   1000   1500   2000   2500   3000
RPM
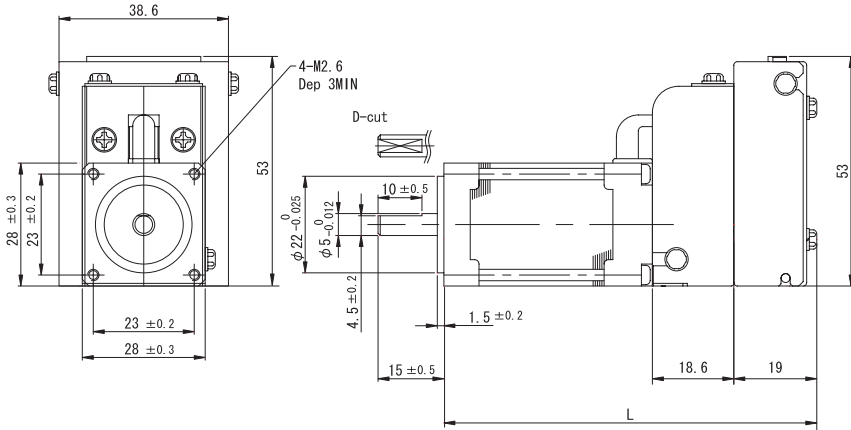
■ **Motor Length**

MODEL	L mm
CM-X-11L30	85 ±1
CM-X-11S30	71 ±1

CM1-X-11S30

CM1-X-11L30

CM1-□-11L30

(Nm)				(oz-in)
0.09				12.7
0.08				11.3
0.07				9.9
0.06				8.5
0.05				7.1
0.04				5.6
0.03				4.2
0.02				2.8
0.01				1.41

500   1000   1500   2000   2500   3000
RPM

■ **CM1 - □ -** 17S30C/17L30C   DIMENSIONS (UNIT:mm)

27.8
4-M3 x 0.5
Dep 4MIN
D-cut
(40)
42 ±0.25
31 ±0.25
15 ±0.2
1 ±0.3
1±0.3
ϕ22 −0.05
ϕ5 −0.013
53
4.5 ±0.1
31 ±0.25
42 ±0.25
1.5 ±0.76
L1   24
18 ±0.5
L ±1

■ **Motor Length**

MODEL	L inch(mm)
CM-X-17L30C	3 (76.5)
CM-X-17S30C	2.38 (60.5)

CM1-X-17S30C

CM1-X-17L30C

CM1-□-17S30C

(Nm)				(oz-in)
0.14				19.83
0.12				16.99
0.10				14.16
0.08				11.33
0.06				8.49
0.04				5.66
0.02				2.83
0				0

300 600   900 1200   1500 1800   2100 2400 2700 3000
RPM

CM1-□-17L30C

(Nm)				(oz-in)
0.56				80.0
0.49				70.0
0.42				60.0
0.65				50.0
0.28				40.0
0.21				30.0
0.14				20.0
0.07				10.0
0				0

500   1000   1500   2000   2500   3000
RPM
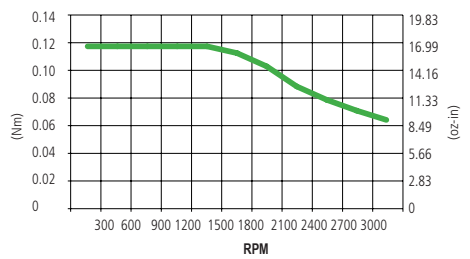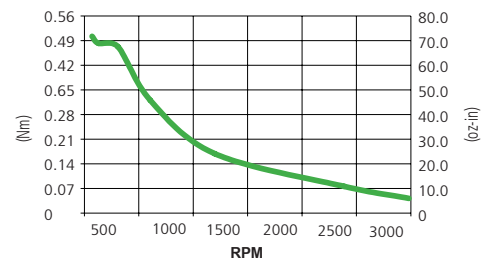
CM1 DRAWINGS

■ **CM1 - ☐ -** 23S30C/23L20C DIMENSIONS (UNIT:mm)
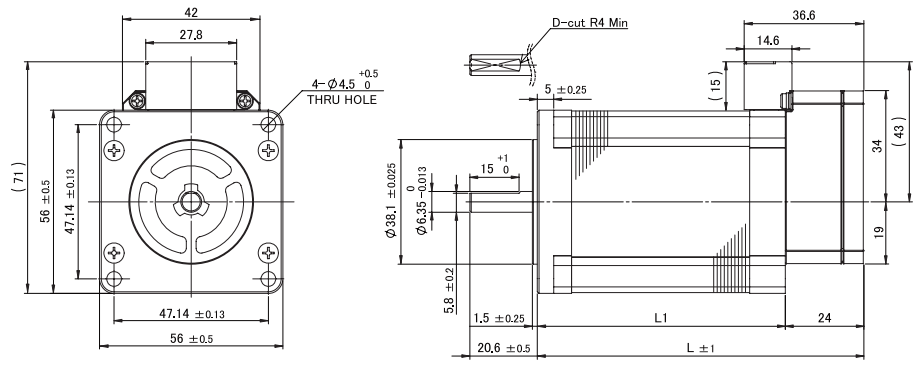
■ **Torque Curve**

MODEL	L inch(mm)
CM-X-23S30C	2.6 (66)
CM-X-23L20C	3.93 (100)

CM1-☐-23S30C

CM1-☐-23L20C

CM1-X-23S30C

CM1-X-23L20C
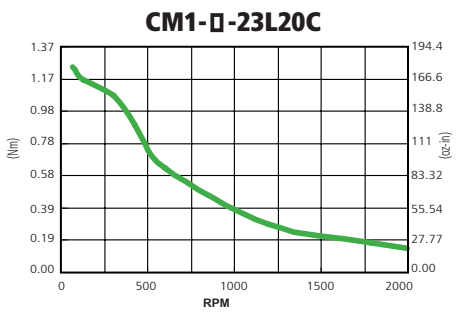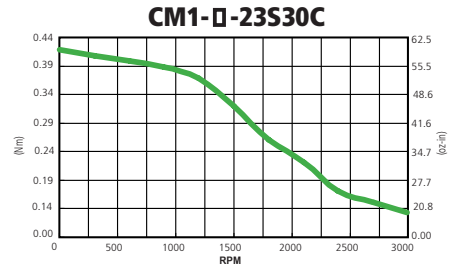
■ **Connector Pin Configurations**

Motor Cable Receptacle Housing   51065-1200 (Molex)
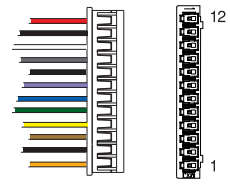
No	Wire Color	Function
1	Orange	+24Vdc
2	Black	Power Ground
3	Brown	Input 2-
4	Yellow	Output 2
5	Green	Output 1
6	Blue	Input 4
7	Violet	Input 3
8	Black	Input 1-
9	Grey	Input 2+
10	White	Input 1-
11	Black	Signal 5Vdc Ground
12	Red	+5Vdc Ouput

■ **Connection Example**

Controller

Cool Muscle

External Power Supply Source DC+24V

DC+24V（IN） 1 DC+24V
GND1 2
INPUT1+ 10 10mA Current Limiter 1kΩ
INPUT1- 8
INPUT2+ 9 10mA Current Limiter 1kΩ
INPUT2- 3
INPUT3 7 4.7kΩ DC+5V 470Ω
INPUT4 6 4.7kΩ DC+5V 470Ω 470pF
OUTPUT1 (6mA MAX) 5 470pF
OUTPUT2 (6mA MAX) 4
DC+5V(OUT) (10mA MAX) 12 DC+5V
GND2 11

DC+24V *R
*R
DC+24V

*R=4,7kΩ
(An example of using with the power DC24V)
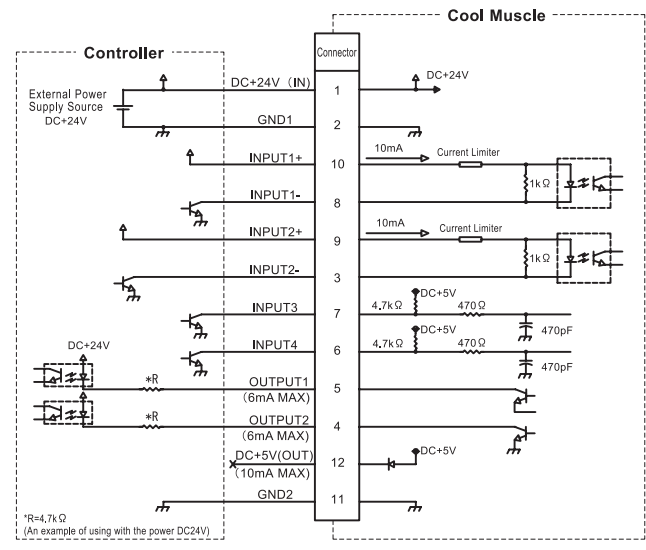
CM2 SPECIFICATIONS

◼ Model Name

CM2 - C - 56B 20C - R

Control Type
P ... Pulse Type
C ... Computer Type
R ... Circular Interpolation Type

Motor Size
56 ... 56☐
60 ... 60☐

Motor Output
10 ... 100 W
40 ... 400 W

Hardware Revision
C

Shaft Style
R ... Round shaft
K ... Keyway
D ... D-cut
W ... Double D-cut

◼ Specifications

MODEL	CM2-☐-56B10C	CM2-☐-56B20C	CM2-☐-60A10C	CM2-☐-60A20C	CM2-☐-60A40C
Input AC Voltage [V]	Single-phase or Three-phase AC100 - 240 ± 10% (Frequency: 50/60Hz ± 5%)			Single-phase or Three-phase AC200 - 240 ± 10% (Frequency: 50/60Hz ± 5%)	
Rated Current[Arms] 100VAC Single Phase (3 Phase)	2.2 (1.3)	3.6 (2.3)	1.9 (1.3)	—	—
Rated Current[Arms] 200VAC Single Phase (3 Phase)	1.2 (0.7)	2.2 (1.6)	1.0 (0.7)	1.6 (1.2)	3.0 (2.4)
Motor Output[W]	100	200	100	200	400
Rated Speed [min^{-1}]	5,000	6,000	3,000	3,000	3,500
Max. Speed [min^{-1}]	8,000	8,000	5,000	5,000	5,000
Rated Torque[N-m] (kgf-cm)	0.19 (1.95)	0.32(3.25)	0.32 (3.25)	0.64 (6.5)	1.09 (11.1)
Max.Torque[N-m] (kgf-cm)	0.57 (5.85)	1.15 (11.7)	0.95 (9.7)	1.91 (19.5)	3.82 (39)
Rotor Inertia Moment (kg- m^2)	0.091 x 10^{-4}	0.18 x 10^{-4}	0.09 x 10^{-4}	0.18 x 10^{-4}	0.34 x 10^{-4}
Allowable Inertia Moment of Load	Less than 10 times of Rotor Inertia				
Allowable Radial Load[N-m] (kgf-cm) 20mm off from the mounting surface	58.8(6)	58.8(6)	196(20)	196(20)	196(20)
Allowable Thrust Load[N-m] (kgf-cm)	29.4(3)	29.4(3)	68.6(7)	68.6(7)	68.6(7)
Encoder	Incremental Magnetic Encoder				
Resolution (ppr)	From 200 to 50,000 set by parameter				
Control Method	Closed Loop Sinusoidal Vector Control				
Memory Capacity	Number of Program banks / Ladder Logic banks : Each up to 30				
	Number of Commands : Up to 1000				
	Number of data : Position 200/ Speed 15/Acceleration 8/Timer 8/Torque limit 8/General variable 15				
Protective Functions	Position error overflow, over voltage, overload, temperature error, push motion error, emergency stop				
I/O — Control Input	Digital Input : 6 (including pulse Input 2), Analog Input : 1				
I/O — Control Output	Digital Output : 4, Analog Output : 1				
I/O — Communication port	Host and Slave communications 2 port. Conforming to RS-232C.				
Cooling Method	Passive Air Cooled				
Mass[kg]	1.2	1.7	1.1	1.3	2.0
Environment — Operating Temperature	0 - +40ºC (non-freezing)				
Environment — Storage Temperature	-20 - +60ºC (non-freezing)				
Environment — Operating/ Storage Humidity	90% relative humidity or less (non-freezing, non-condensing)				
Environment — Atmosphere	Indoor use only (no direct sunlight). No corrosive gas, inflammable gas, oil or dust.				
Environment — Altitude	1,000m above sea level or lower				
Environment — Shock	10G (98m/s^2) or less				
Environment — Vibration	1G (9.8m/s^2) or less				

CM2 SPECIFICATIONS

■ **I/O Specifications**

All ratings at 25 degrees C ambient air temperature unless otherwise noted.

	ITEMS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Digital Input 1 (IN1+ - IN1-/IN2+ - IN2-) *1	Applied voltage	IN1+ - IN1-, IN2+ - IN2-	0	-	24	V
	Lower-level input voltage		0	-	0.8	
	High-level input voltage		3	-	24	
	Pulse input frequency		-	-	500	KHz
	Input pulse width		0.8	-	-	μs
	Input pulse rise/fall time		-	-	0.1	μs
Digital Input 2 (IN3,4,5,6/INCOM) *2	Applied voltage	IN3,4,5,6 - INCOM	0	-	24	V
	Low-level input voltage		0	-	0.8	
	High-level input voltage		3	-	24	
Analog Input (ANALOG IN)	Input voltage	ANALOG IN - GND	0	-	5	V
	Operating voltage	Position control or Speed control (one direction)	0.2	-	4.8	
		Torque control or Torque feedback control	0.2	-	4.8	
		Speed control (CW direction)	2.6	-	4.8	
		Speed control (CCW direction)	0.2	-	2.4	
Digital Output (OUT1,2,3,4/OUTCOM) *3	Withstand voltage	OUT1,2,3,4 - OUTCOM	-	-	30	V
	Continuous load current		-	-	20	mA
	OFF AE Leak current		-	0.1	1	nA
Analog Output (ANALOG OUT)	Output voltage	ANALOG OUT - GND	1	-	4	V
	Output current		-	-	7	mA
+5V Output (+5VOUT)	Output voltage	+5V - GND	4.5	5	5.5	V
	Output current		-	-	200	mA
Communitaion Line (RXD0/TXD0) (RXD1/TXD1)	Baud rate		9.6	-	230.4	Kbps
	Input voltage	RXD0,RXD1 - GND	-25	-	25	V
	Positive-going input threshold voltage		-	1.8	2.4	
	Negative-going input threshold voltage		0.8	1.5	-	
	Input resistance		3	5	7	KΩ
	Output voltage (MAX)	TXD0,TXD1 - GND	-13.2	-	13.2	V
	Output voltage swing range		±5	±5.4	-	

*1 The polarity of input voltage for IN1+(IN2+) is plus(+) to IN1-(IN2-).
As each input (IN1-, IN2-) is equipped with current regulative diode, the input current can be 8 - 12 mA.
*2 Plus or minus polarity is acceptable for the input voltage between IN3,4,5,6 and INCOM.
Each input (IN3,4,5,6) is equipped with resistor 10KΩ in series.
*3 Plus or minus polarity is acceptable for the applied voltage between OUT1,2,3,4 and OUTCOM.
Each output (OUT1,2,3,4) is equipped with resistor 1KΩ in series.

■ Signal Arrangements

Connector				
Name				Function
Power Supply Connector	1	R / L1		3 phase AC input / Single phase AC
	2	S		3 phase AC input
	3	T / L2		3 phase AC input / Single phase AC
	4	E		Protective Earth
Communication Connector	Host Connector	1	RXD0	RS-232C Receive Data from Host
		2	TXD0	RS-232C Transmit Data from Host
		3	GND	Communication GND
	Slave Connector	1	TXD1	RS-232C Transmit Data to Slave
		2	RXD1	RS-232C Receive Data to Slave
		3	GND	Signal GND
I/O Connector	1	+5V		+5V Output (0.2A max)
	2	INPUT1+		Digital Input1+ CW+ pulse+
	3	INPUT1-		Digital Input1- CW- pulse+
	4	INPUT2+		Digital Input2+ CCW+ Direction+
	5	INPUT2-		Digital Input2- CCW- Direction-
	6	INPUT3		Digital Input3
	7	INPUT4		Digital Input4
	8	INPUT5		Digital Input5
	9	INPUT6		Digital Input6
	10	INPUT COM		Common for Digital Input3,4,5,6
	11	OUTPUT1		Digital Output1
	12	OUTPUT2		Digital Output2
	13	OUTPUT3		Digital Output3
	14	OUTPUT4		Digital Output4
	15	OUTPUT COM		Common for Digital Output1,2,3,4
	16	ANALOG IN		Analog Input
	17	ANALOG OUT		Analog Output
	18	N.C.		-
	19	GND		Signal Ground
	20	GND		Signal Ground

■ Cable Option

- Serial Communications Cable
  CM2RS2-2000W: DB9, 2m, RS232

- I/O Cable
  CM2IO2-2000S: 20 wire, 2m, all I/O

- Power Cable
  CM2PW2-2000S: 1 or 3 phase power

- Daisy Chain Network Cable
  CM2DC2-2000W: motor to motor network

- USB Communications Cable
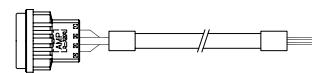 CM2US2-1800W: USB, 1.8m

■ Cable Part Description

CM2RS2 - 2000W

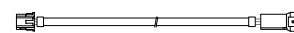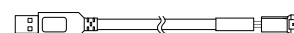| CM2 motor | RS232 | Length in mm | S Single ended W Double ended |
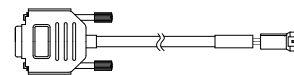
CM2IO2 - 2000S

| I/O |

CM2PW2 - 2000S

| Power |

CM2DC2 - 2000W

| Daisy Chain Network |

CM2US2 - 1800W

| CM2 motor | USB | Length in mm | W Double ended |

Cable	Interface	Max. Length	Connector	# of Conductors	AWG
CM2US2	USB	1.8m	JST XARR-03VF / USB	4	26
CM2IO2	I/O	5m	JST XADR-20V	20	26
CM2RS2	RS-232	5m	JST XARR-03VF / DB9 F	3	26
CM2PW2	Power	5m	AMP 1-179552-4	4	18
CM2DC2	Daisy Chain	5m	JST XAP-03V-1 / XARR-03VF	3	26

CM2 SPECIFICATIONS

■ Motor Side Connector Pin Configuration

Power Receptacle
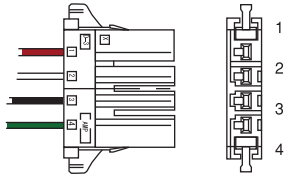
No	Wire Color		Function
1	Red	R / L1	3 phase AC input / Single phase AC
2	White	S	3 phase AC input
3	Black	T / L2	3 phase AC input / Single phase AC
4	Green	E	Protective Earth

Communications Connectors

Host Connector   XAP-03V-1 (JST)
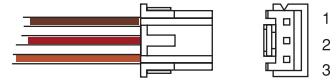
No	Wire Color		Function
1	Brown	RXD0	RS-232C Motor Receive Data
2	Red	TXD0	RS-232C Motor Transmit Data
3	Orange	GND	Communication GND

Secondary Connector   XARR-03VF (JST)
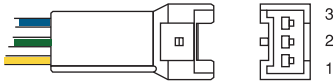
No	Wire Color		Function
3	Blue	GND	Communication GND
2	Green	RXD1	RS-232C Motor Receive Data
1	Yellow	TXD1	RS-232C Motor Transmit Data

I/O Receptacle XADRP-20V (JST)
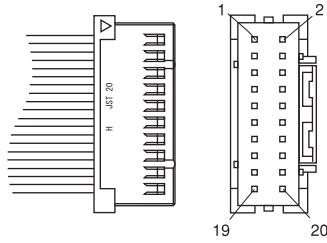
No	Wire Color	Function	No	Wire Color	Function
1 Brown	+5V	+5V Output (0.2A max)	2 Red	INPUT1+	Digital Input1+ / Step+
3 Orange	INPUT1-	Digital Input1- / Step-	4 Yellow	INPUT2+	Digital Input2+ / Direction+
5 Green	INPUT2-	Digital Input2- / Direction-	6 Blue	IINPUT3	Digital Input 3
7 Purple	IINPUT4	Digital Input 4	8 Gray	IINPUT5	Digital Input 5
9 White	INPUT6	Digital Input 6	10 Black	INPUT COM	Common for Input 3,4,5,6
11 Brown	OUTPUT1	Digital Output 1	12 Red	OUTPUT2	Digital Output 2
13 Orange	OUTPUT3	Digital Output 3	14 Yellow	OUTPUT4	Digital Output 4
15 Green	OUTPUT COM	Common for Output1,2,3,4	16 Blue	ANALOG IN	Analog Input
17 Purple	ANALOG OUT	Analog Output	18 Gray		
19 White	GND	Signal Ground	20 Black	GND	Signal Ground

■ Connection Example
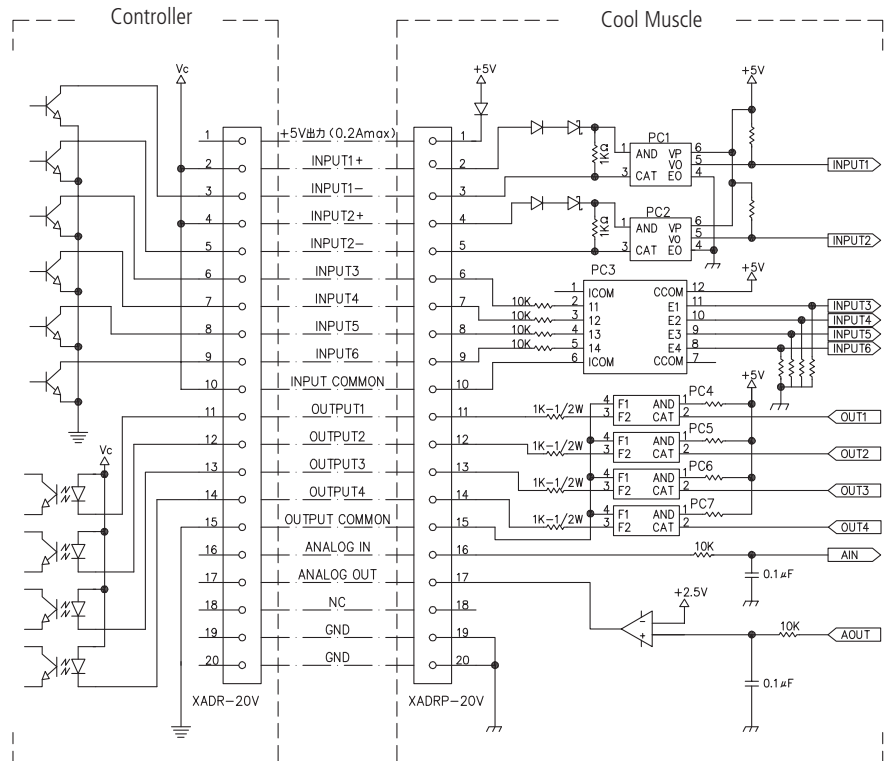
■ **CM2 -□ - 56B10C / CM2 -□ - 56B20C Dimensions   UNIT:mm (inch)**

■ **Torque Curves**

CM2-□-56B10C (100W)

Torque (N·m) / Speed (rpm)

AC200V / Peak / AC100V / Rated

CM2-□-56B20C (200W)

Torque (N·m) / Speed (rpm)

AC200V / Peak / AC100V / Rated
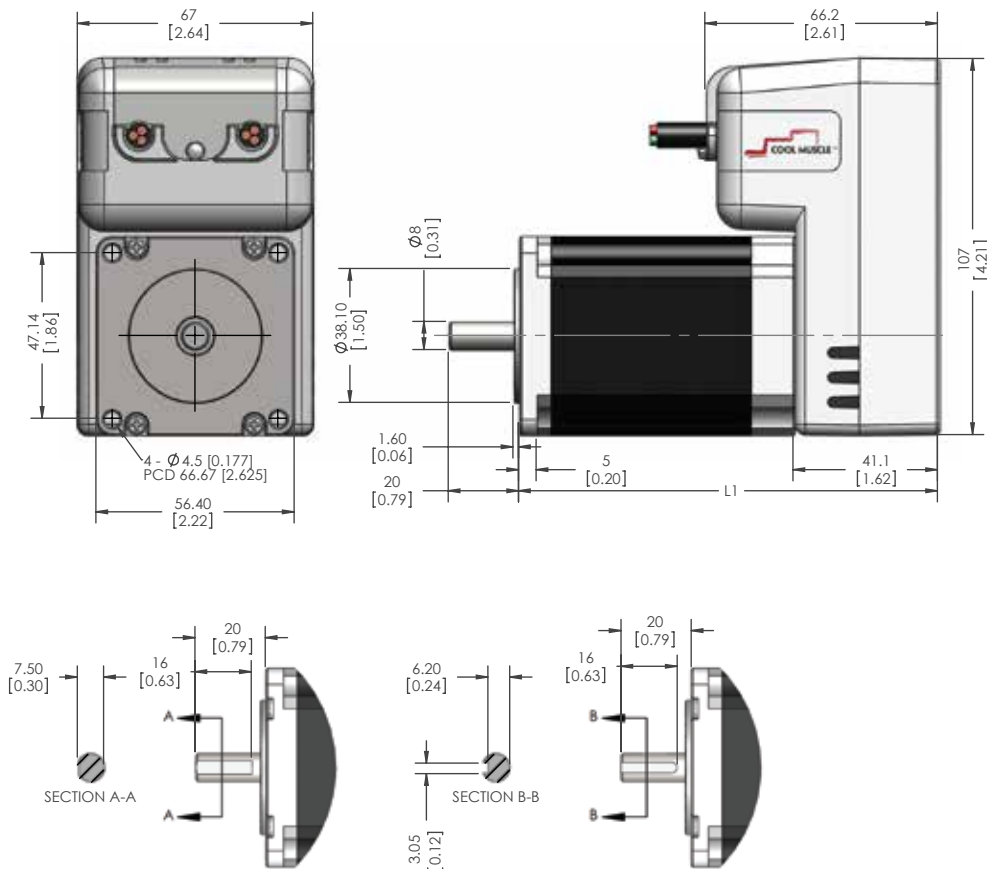
■ **Motor Lengths**

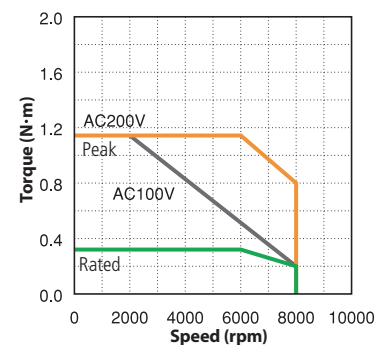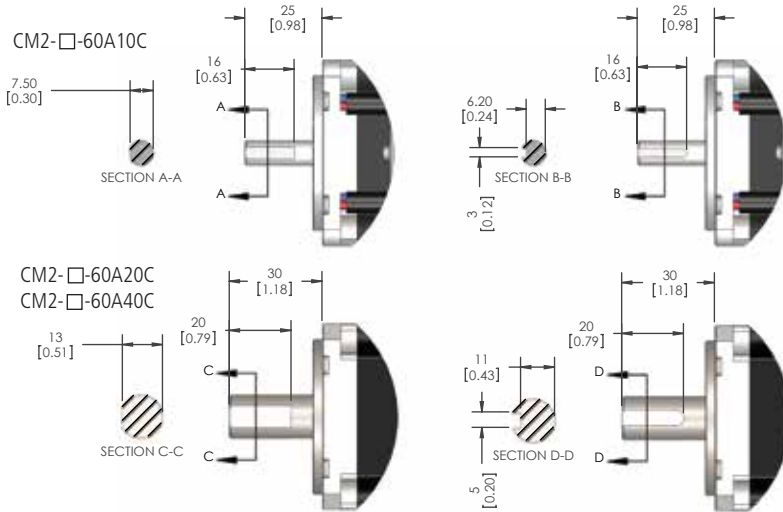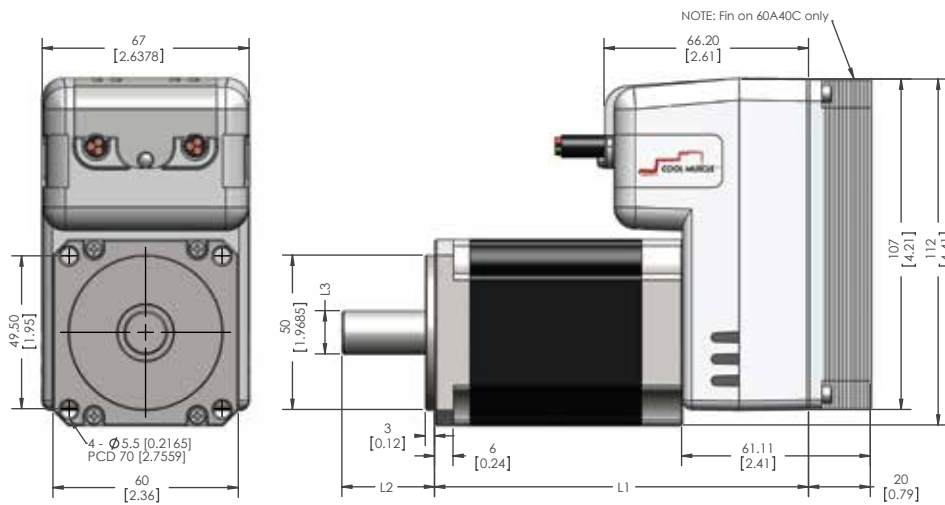| Model Name	L1
CM2-□-56B10C	93.2 (3.67)
CM2-□-56B20C	119.2 (4.69)

CM2-□-56B10C
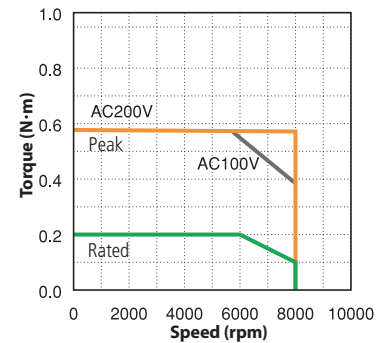
CM2-□-56B20C

The CM2 56 frame size servo system is designed for high speed applications such as rapid traverse systems in pick and place robots. The 56mm frame size is similar to the NEMA 23 standard, but has an 8mmOD shaft to accommodate the higher wattage capabilities of these AC servos. Myostat provides shaft couplings, linear actuators, and gearheads matched to this motor system.
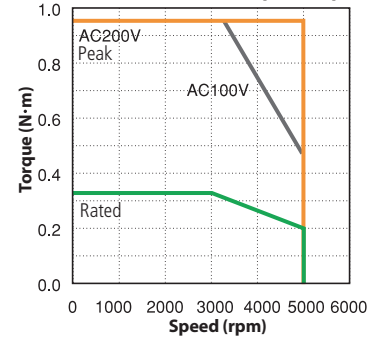
CM2 DIMENSIONS

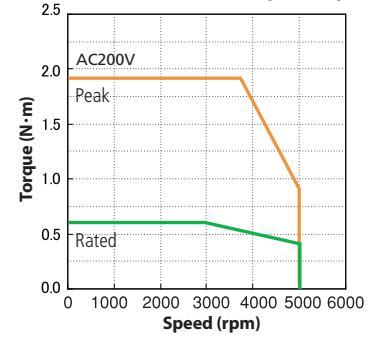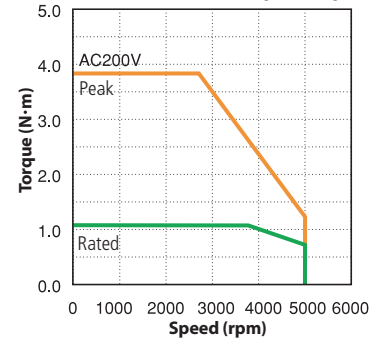## ■ CM2 - □ - 60A10C, 60A20C, 60A40C Dimensions   UNIT: mm (inch)

NOTE: Fin on 60A40C only

67 [2.6378]

49.50 [1.95]

4 - Ø 5.5 [0.2165]
PCD 70 [2.7559]

60 [2.36]

66.20 [2.61]

50 [1.9685]

L3

3 [0.12]

6 [0.24]

L2

L1

61.11 [2.41]

107 [4.21]

112 [4.41]

20 [0.79]

CM2-□-60A10C

7.50 [0.30]

SECTION A-A

25 [0.98]

16 [0.63]

A
A

6.20 [0.24]

3 [0.12]

SECTION B-B

25 [0.98]

16 [0.63]

B
B

CM2-□-60A20C
CM2-□-60A40C

13 [0.51]

SECTION C-C

30 [1.18]

20 [0.79]

C
C

11 [0.43]

5 [0.20]

SECTION D-D

30 [1.18]

20 [0.79]

D
D

■ Torque Curves

CM2-□-60A10C (100W)

AC200V
Peak

AC100V

Rated

Torque (N·m) — 0.0, 0.2, 0.4, 0.6, 0.8, 1.0
Speed (rpm) — 0, 1000, 2000, 3000, 4000, 5000, 6000

CM2-□-60A20C (200W)

AC200V

Peak

Rated

Torque (N·m) — 0.0, 0.5, 1.0, 1.5, 2.0, 2.5
Speed (rpm) — 0, 1000, 2000, 3000, 4000, 5000, 6000

CM2-□-60A40C (400W)

AC200V
Peak

Rated

Torque (N·m) — 0.0, 1.0, 2.0, 3.0, 4.0, 5.0
Speed (rpm) — 0, 1000, 2000, 3000, 4000, 5000, 6000

■ Motor Lengths

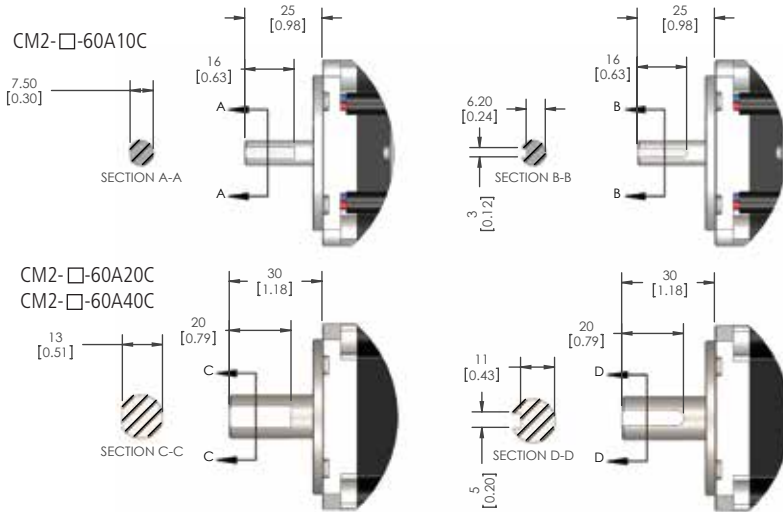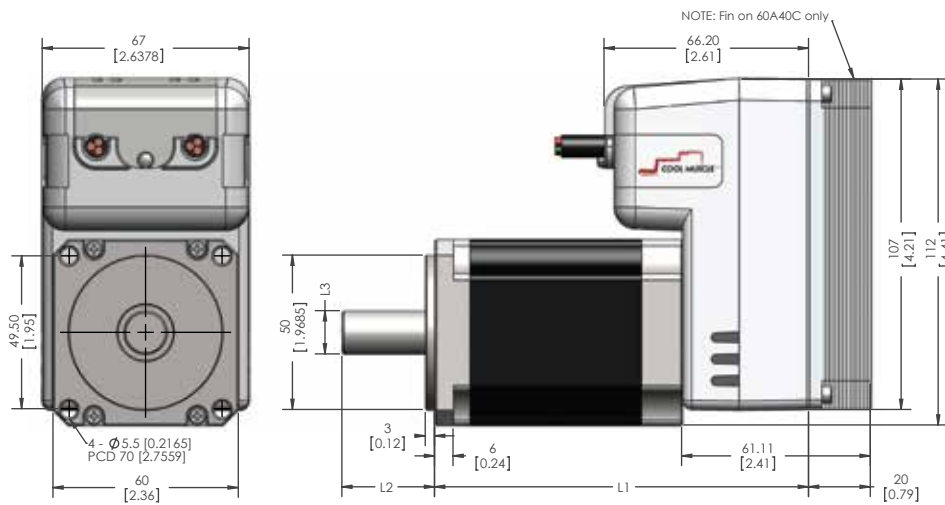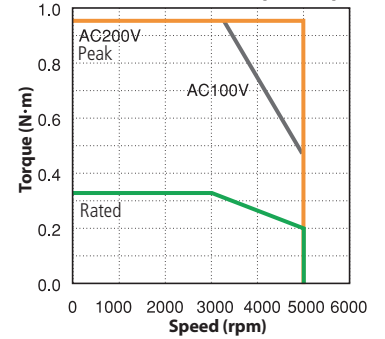| Model Name	L1	L2	L3
CM2-□-60A10C	88.1 (3.47)	25 (0.98)	Ø8
CM2-□-60A20C	99.1 (3.90)	30 (1.18)	Ø14
CM2-□-60A40C with heat radiation fin	141.1 (5.56)	30 (1.18)	Ø14

CM2-□-60A10C

CM2-□-60A20C

CM2-□-60A40C

CM2 DIMENSIONS

■ **CM2 - □ - 60A10C, 60A20C, 60A40C Dimensions   UNIT: mm (inch)**

67 [2.6378]
49.50 [1.95]
4 - Ø5.5 [0.2165] PCD 70 [2.7559]
60 [2.36]

NOTE: Fin on 60A40C only
66.20 [2.61]
50 [1.9685]
L3
3 [0.12]
6 [0.24]
L2
L1
61.11 [2.41]
107 [4.21]
112 [4.41]
20 [0.79]

CM2-□-60A10C
7.50 [0.30]
SECTION A-A
25 [0.98]
16 [0.63]
A
A
6.20 [0.24]
3 [0.12]
SECTION B-B
25 [0.98]
16 [0.63]
B
B

CM2-□-60A20C
CM2-□-60A40C
13 [0.51]
SECTION C-C
30 [1.18]
20 [0.79]
C
C
11 [0.43]
5 [0.20]
SECTION D-D
30 [1.18]
20 [0.79]
D
D

■ **Torque Curves**

CM2-□-60A10C (100W)

CM2-□-60A20C (200W)
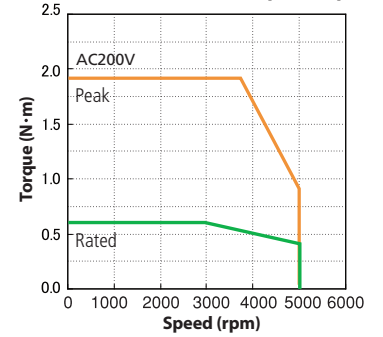
CM2-□-60A40C (400W)
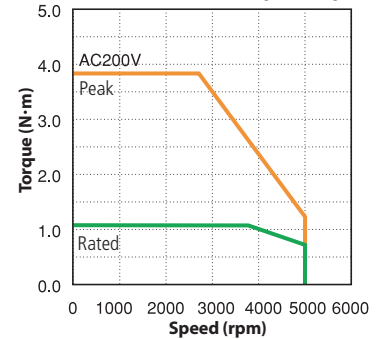
■ **Motor Lengths**

Model Name	L1	L2	L3
CM2-□-60A10C	88.1 (3.47)	25 (0.98)	Ø8
CM2-□-60A20C	99.1 (3.90)	30 (1.18)	Ø14
CM2-□-60A40C with heat radiation fin	141.1 (5.56)	30 (1.18)	Ø14

CM2-□-60A10C   CM2-□-60A20C   CM2-□-60A40C

LX Series In-Line Gearbox

■ **Model Name**

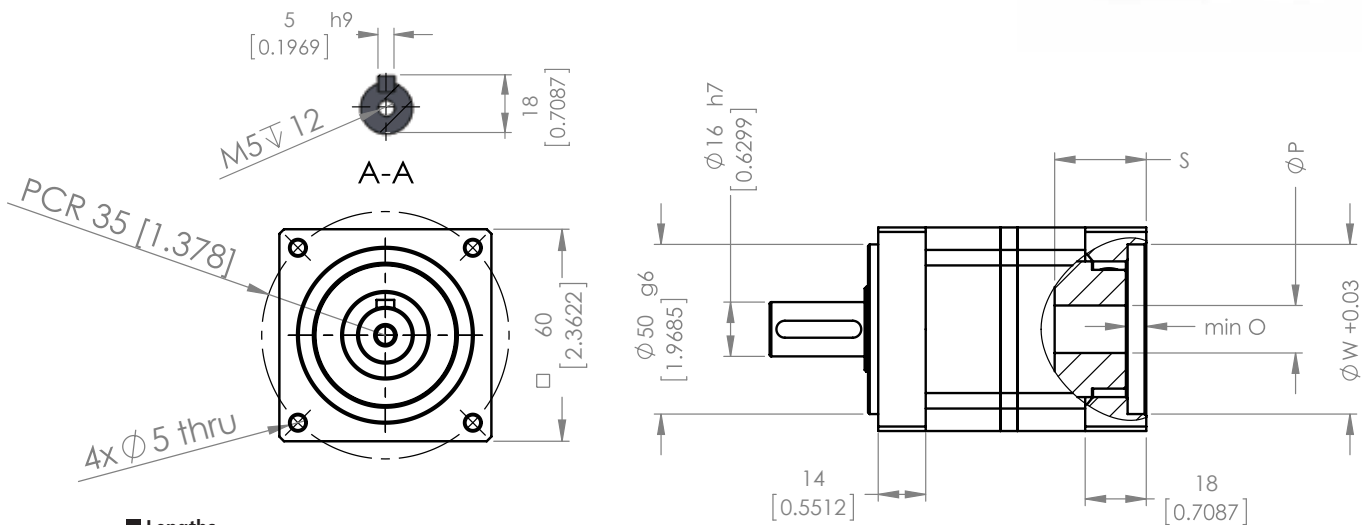# LX-060-010-17608

Series
LX

Body Size
042 ... 42mm
060 ... 60mm
090 ... 90mm

Ratio
003 ... 3:1
~
100 ... 100:1

Motor Mount
17608 ... CM1-X-23XXX
~
17610 ... CM2-X-56BXX

■ **LX-060-003-01917 in-line planetary gearbox Dimensions (UNIT:mm [inch])**

■ **Lengths**

Ratios	L
3:1 to 10:1	78 [3.07]
12:1 to 100:1	102.5 [4.35]

■ **Flange Options**

Cool Muscle Model	Input Flange
CM1-X-23XXX	-17608
CM2-X-56BXX	-17610
CM2-X-60A10A	-01910
CM2-X-60A40C	-01917
Right angle combinations available	

■ **Operational Specifications**

LX-060 Model	
Backlash	6arcmin
Radial Load	500N
Axial Load	600N
Torsional Stiffness	3Nm/arcmin
Service Life	10000hrs

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% efficiency rating for the single stage model and 90% for the double stage model. These values can used to calculate the final torque outout of the combined motor + gearbox combination.
Gearbox backlash is measured at 6arc/min for single stage units and 10 arc/min for double stage units. All gear boxes are sealed for use in any orientation and rated to IP65.
40mm, 60mm, and 90mm frame sizes are available to fit NEMA 17 to 34 or 40mm to 90mm motor frame sizes.
CAD files with full dimensions for each size are available at www.myostat.ca

With ratios of 20:1 or greater, please use the LX-090 size gearbox with the CM2-X-60A40C.
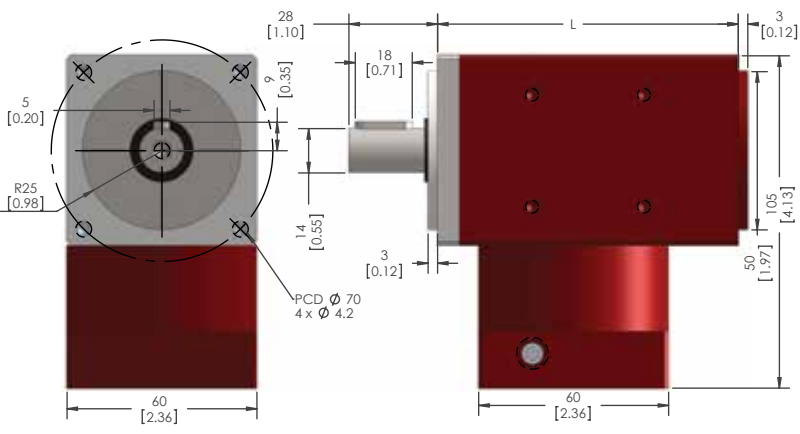
R Series Right Angle Gearbox
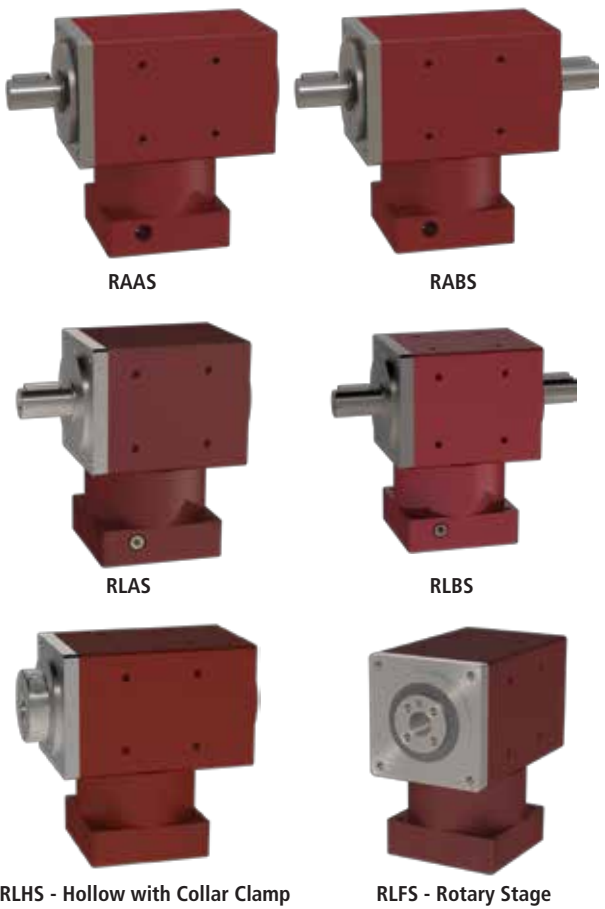
■ **Model Name**

RLAS-060-005-17608

Series	Body Size	Ratio	Motor Mount
RAAS RABS	042 ... 42mm	001 ... 1:1	17608 ... CM1-X-23XXX
~	060 ... 60mm	~	~
RAHS RLFS	090 ... 90mm	005... 5:1	17610 ... CM2-X-56BXX

■ **R-060 right angle gearbox Dimensions (UNIT:mm [inch])**

28 [1.10]
5 [0.20]
9 [0.35]
R25 [0.98]
L
18 [0.71]
3 [0.12]
3 [0.12]
14 [0.55]
105 [4.13]
50 [1.97]
PCD ∅ 70
4 x ∅ 4.2
60 [2.36]
60 [2.36]

■ **Model Variations**

RAAS   RABS

RLAS   RLBS

RLHS - Hollow with Collar Clamp   RLFS - Rotary Stage

■ **Flange Options**

Cool Muscle Model	Input Flange
CM1-X-23XXX	-17608
CM2-X-56BXX	-17610
CM2-X-60A10C	-01910
CM2-X-60A40C	-01917

Specific CAD files are avaliable from www.coolmuscle.com

■ **Lengths**

Model Single / Dual Output	Rations	L mm [inch]
RAAS / RABS	1:1~5:1	95 [3.74]
RLAS / RLBS	2:1~5:1	76 [2.99]
RAHS / RAPS	1:1~5:1	95 [3.74]
RLHS / RLPS	2:1~5:1	76 [2.99]
RLFS	2:1~5:1	76 [2.99]

Gearbox Performance

The R Series gearbox operates at a 95% efficiency rating, using helical bevel gears.
Gearbox backlash is measured at 6arc/min.
Each model is offered in both single and dual output variations.
Customizations to both the motor input flange and the gearbox output are available.

Please contact Myostat Motion Control Inc. for additional technical information.
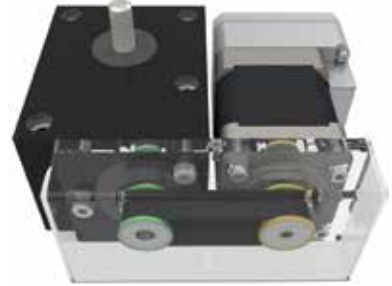
As an alternative, HY Hypoid right angle gearbox provides 5:1, 10:1, and 20:1 ratios in a small space envelope. The HY Gearbox can be supplied on its own, or with a matching motor.

Shaft Couplings

■ **PRODUCT NAME - RELI-A-FLEX®**

RCSA20C - 8 - 5
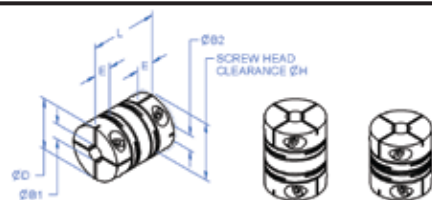
Basic Part #
Long
Short

Alminium

Outside
Diameter

C:Clamp
S:Set Screw
G:Reli-a-Grip®

Bore size
∅ B1-B2

(Reli-a-Grip® option shown)   **RCL (Long)**   **RCS (Short)**

■ **Bore sizes and dimentions (mm - Imperial sizes available) * Not all sizes shown, Diameters from 6mm to 40mm available.**

Basic Part #	Material	Size	Standard bore sizes B1 and B2 Bore tolerance +0.020/-0.00	O/D ∅D	∅ H	Length L	Hub Length E	Fitted Screw
RCS (Short)	A (Aluminium)	13C	3 4 5 6	13.0	14.5	16.8	5.0	M1.6
		16C	3 4 5 6 8	16.0	18.0	17.5	5.9	M2
		20C	4 5 6 8 10	20.0	21.8	21.5	6.6	M2.5
		25C	5 6 8 10 12	25.0	26.9	25.8	7.6	M3
RCL (Long)		13C	3 4 5 6	13.0	14.5	20.0	5.0	M1.6
		16C	3 4 5 6 8	16.0	18.0	23.5	5.9	M2
		20C	4 5 6 8 10	20.0	21.8	26.0	6.6	M2.5
		25C	5 6 8 10 12	25.0	25.0	34.0	7.6	M3

■ **Technical Specifications**

Basic Part #	Material	Size	Torsional Stiffness mNm/arc min	Radial Compliance microns/N	Misalignment			Max Mass g
					Parallel mm	Angular deg	Axial mm	
RCS (Short)	A (Aluminium)	13C	13C	29.2	0.08	2.5	±0.30	4.4
		16C	16C	28.9	0.10	2.5	±0.40	8.6
		20C	20C	23.4	0.12	3.0	±0.50	14.9
		25C	25C	20.0	0.16	3.0	±0.70	27.5
RCL (Long)		13C	13C	64.3	0.15	2.5	±0.30	5.5
		16C	16C	65.1	0.20	2.5	±0.40	10.6
		20C	20C	62.0	0.25	3.0	±0.50	18.7
		25C	25C	82.2	0.40	3.0	±0.70	38.5

■ **Torque and Speed Capacity**

Basic Part #	Material	Size	Typical Torque Capacity			Max Speed
			Reversing (Nm)	Non Rev (Nm)	Peak (Nm)	
RCS (Short)	A (Aluminium)	13C (13G)	0.35 (0.45)	0.55 (0.60)	0.50 (0.70)	12000
		16C (16G)	0.55 (0.75)	0.85 (1.15)	1.25 (1.65)	10000
RCL (Long)		20C (20G)	0.95 (1.30)	1.45 (1.95)	2.45 (3.25)	7500
		25C (25G)	1.55 (2.05)	2.35 (3.10)	3.90 (5.20)	5000

Specifications vary according to bore size. Please enquire. Reli-a-Flex is a registered trademark of Reliance Precision Limited
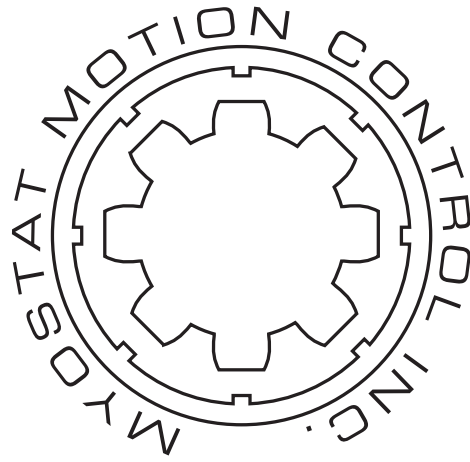
■ **Reli-a-Grip Clamp Option**

Unique Clamp Provides Stronger Shaft Grip And Higher Allowable Torque Transfer.

Aluminium alloy grade 7075-T6.

Alocrom 1000 surface finish.

Standard bore tolerance +0.020/0.000mm.

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MUSCLE CORPORATION

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