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TECHNOLOGY GROUP

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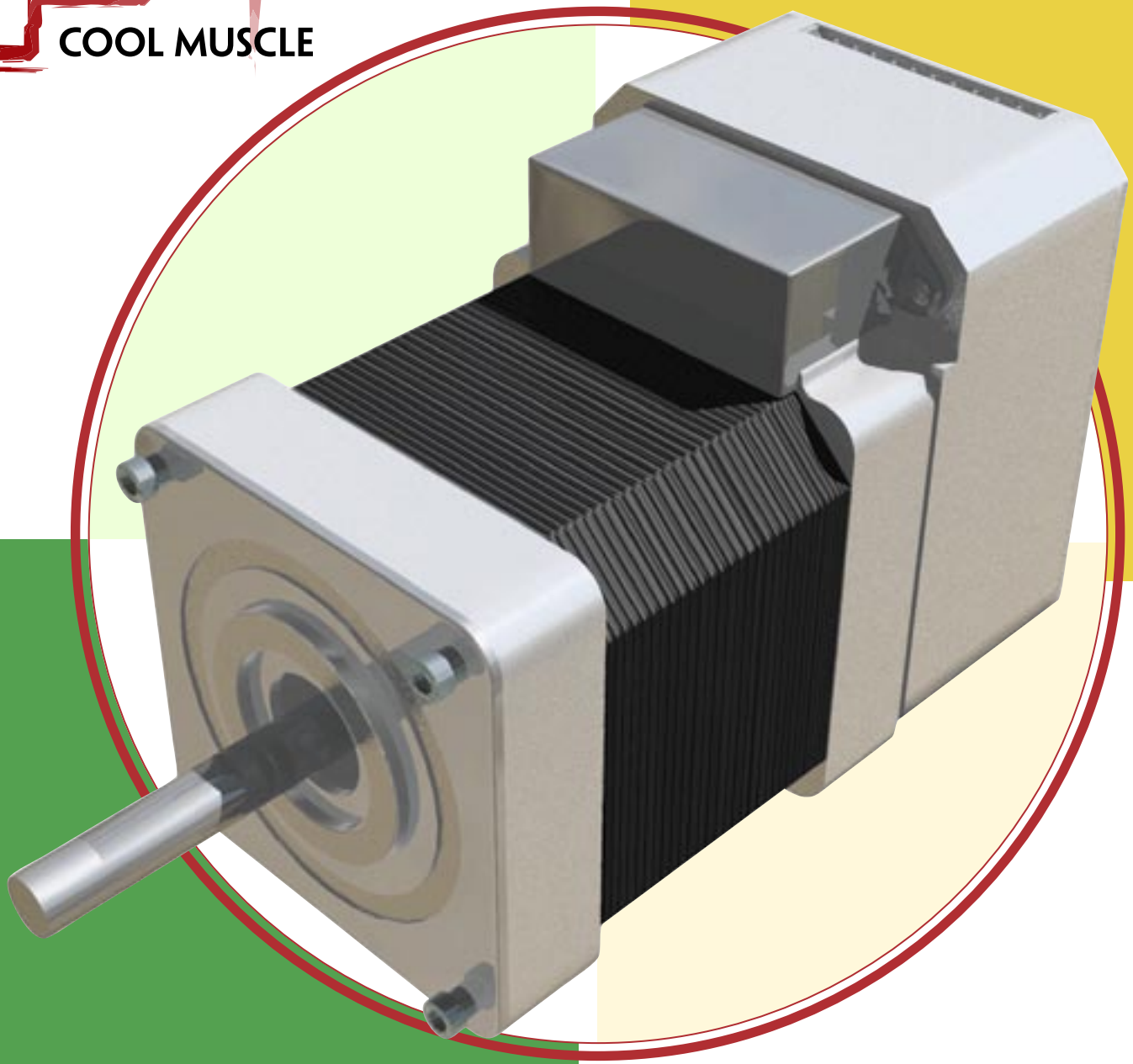
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Find the *Myostat Motion Control CM1-C-23L20A* at our website: *Click HERE*

COOL MUSCLE

Integrated Servo Systems

COOL MUSCLE



Creating Innovation with Motion Control

MUSCLE CORPORATION

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COOL MUSCLE

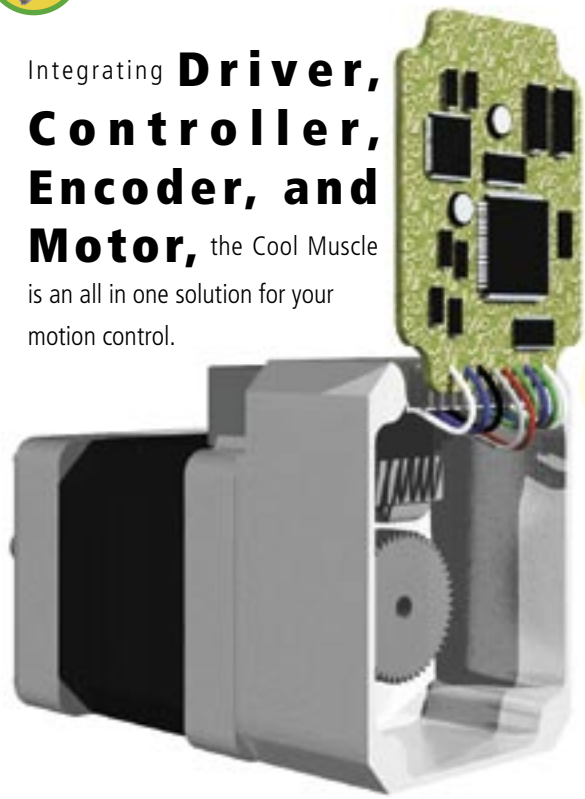
Integrated Vector Drive Servo System

The Cool Muscle is a closed loop vector drive servo system utilizing an H -infinity controller. An intelligent driver with a 32-bit RISC CPU, a magnetic encoder, and power management are built into the motor. The Cool Muscle excels in performance, size, and cost, offering new ways to design and develop with motion control.



ALL IN ONE SOLUTION

Integrating **Driver, Controller, Encoder, and Motor,** the Cool Muscle is an all in one solution for your motion control.



Integrated Controller

Based around a 32-bit RISC CPU, the integrated controller offers a wide range of hardware and software features. Motion programs can be stored with the motor, eliminating the need for driver and controller boxes. Networked motors can also communicate with each other.

Integrated Driver

A 24VDC sinusoidal driver with regenerative braking implements the Cool Muscle's Vector Driven motions at speeds up to 3000RPM. The closed loop architecture allows the driver to work extremely effectively, resulting in a cool long life servo system.

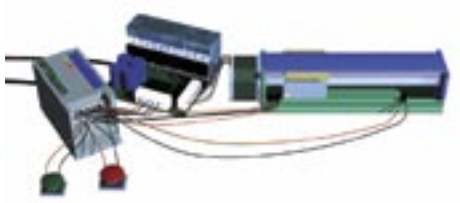
High Resolution Magnetic Encoder

Minimizing position error and reducing motion ripple can only be achieved with an advanced encoder. The Cool Muscle standard magnetic encoder feeds back position changes as small as 0.0072 degrees or 0.43 arc minutes.

THE POWER OF THE COOL MUSCLE

Conventional System

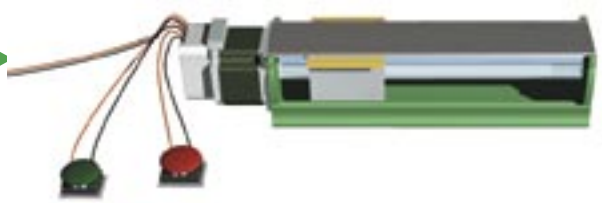
A typical conventional slider system requires a driver, controller, origin switch, limit switches and so on, making the whole system messy and bulky.q



Very hard to differentiate your product.

Cool Muscle System

The Cool Muscle eliminates the need for an external driver box, controller, and sensors, making your system compact, and simple.



Leave your competition behind with the Cool Muscle.

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Cool Muscle Types

The Cool Muscle supports different interfaces; Computer, I/O Driven and Pulse Input. Choose a type that will best suite your needs.

C type

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

Solution 1 Pre-Programmed

If your application only requires repetitive motion, you can preprogram the motor, eliminating the need for a controller. Preloaded programs can be executed by a switch, PC or PLC.



A slider system with a pre-programmed C type Cool Muscle.

Solution 2 Dynamic Command

If your application requires complicated motion or arbitrary motion, you can send commands dynamically to the Cool Muscle via PC or embedded computers.



A slider system with C type Cool Muscle

Solution 3 Networking

C type Cool Muscles can be daisy chained, providing you with a simple and low cost network solution. There are different ways to network C type Cool Muscles to suit your needs.



An X-Y system with C type Cool Muscles in a daisy chain network.

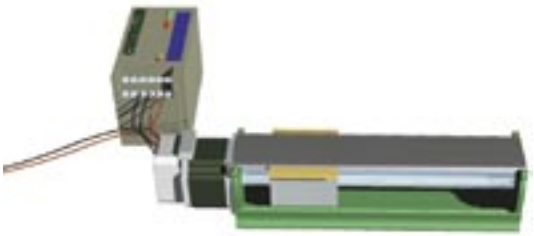
Solution 4 Analog Control



A slider system with C type Cool Muscle controlled by a joy-stick

P type

Replacing your current pulse driven system with the P type Cool Muscle will save space and remove problems associated with an open loop stepper. P type Cool Muscle supports both CW/CCW and Pulse/Direction.



A typical Slider system with P type Cool Muscle

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COOL MUSCLE

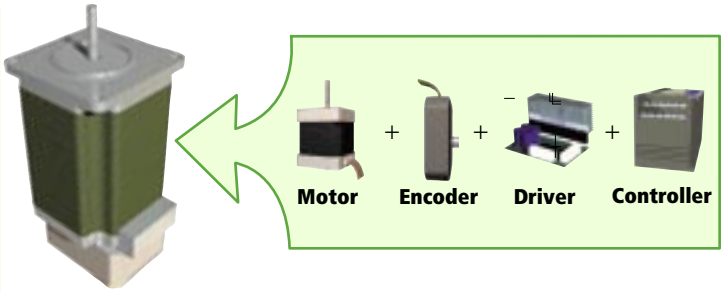
Cool Muscle Features

The Cool Muscle is packed with features that help you reduce the size and cost of your machines while also shortening development time.

Simple and Compact

An intelligent driver with a 32 bit RISC CPU, Magnetic encoder, and power management are all built in right on the motor.

No more driver/boxes. Reduced wiring. Smaller machines. Shortened development time.



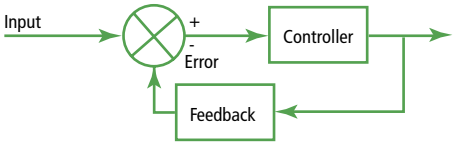
Full Closed Loop System

The Cool Muscle is a full closed loop system. With a high resolution magnetic encoder and the intelligent driver board mounted on the back, the Cool Muscle constantly monitors its position, eliminating any missed steps.

Higher repeatability, stability, and accuracy.

Closed Loop System

By receiving position input from the sensor the Cool Muscle knows its position and can correct itself.



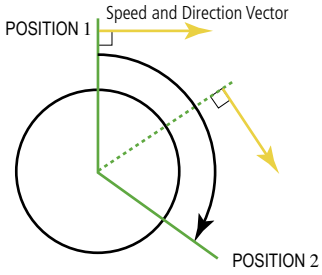
H∞

Using the newest control technology, the Cool Muscle goes beyond old fashioned 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 .

Smooth and Accurate Movements

The Cool Muscle's high resolution encoder gives you an exceptionally fine placement of 50,000 units per rotation. The Cool Muscle uses Vector Drive control, resulting in incredibly smooth motion even at low speeds not possible with micro stepping drivers.

Performance levels similar to AC servos at a fraction of the price.



Vector Drive Control

Vector Drive is a control technique used in servo systems. Vector Drive Control is a completely different technique from micro-stepping. Unlike micro-stepping Vector Drive Control is not subject to resonance problems and produces smooth movements.

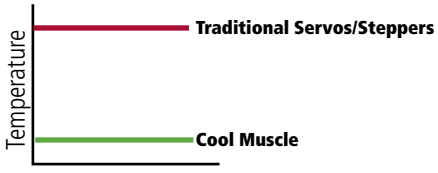
Cool Operation

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 Cool Muscle generates high torque at low speeds.

Longer motor life. Increased power efficiency. Great for enclosed spaces. Reduced need for gear boxes.

The Cool Muscle applies optimum current to produce motion whereas an open loop stepper always uses the maximum current.

The Cool Muscle has high torque even at low speeds.
The Cool Muscle excels at both smooth motion and slow speeds.



Various Interfaces

The Cool Muscle can be controlled by various methods, including Pulse, Analog, Computer and PLC. Choose the type that best suits your needs.

Minimum modification required to your system.
A wide range of solutions for your system.

	Control	Variations
P type	Pulses	CW/CCW Step/Direction
C type	PC Embedded Computer PLC Switch	Pre-Programmed Dynamic Command
	Analog Input	Position Speed

Programmable

Program the Cool Muscle to create the motion you need. Define motion profiles and create programs using easy-to-understand, ASCII based, Cool Muscle Language (CML). Motion programs you create can be downloaded to the Cool Muscle. The programs can be executed via PC, embedded computer or simply using I/Os.

Great solution for repetitive motion. Simple and compact machines.

CML

Cool Muscle Language is a set of ASCII commands that lets you easily create motion programs. Programs you create can be downloaded to the Cool Muscle via the free software package called Cool Works or via any standard terminal program.

```
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
B2
A2,S1,P3
```

Define motion programs using the motion profiles defined above.

User Definable Parameters

Define the character of your Cool Muscle to suit your needs. The Cool Muscle gives you access to over 50 parameters that can easily be set and adapted to fit your application.

Flexibly change your motor characteristics.

K46=1	Origin search set to automatic origin search using bumper.
K48=10000	Origin offset distance set to 10000 pulses.
K58=200000	Software limit + side set to 200000 pulses.
K37=3	Motor resolution set to 1000
K46=1	Automatic home routine using mechanical stopper
K38=0	Sets analog interface to speed control mode

USEFUL PARAMETER EXAMPLES

Unique Home Search Method

A home search parameter lets you select a home search method. Eliminate the need for home switches using our unique home search technique. Home can be determined using a hard-stop/bumper instead of using a home switch. The Cool Muscle hits a bumper at very low speed and keeps pushing until it reaches a specified current level, at which the motor determines that it has reached home. This method eliminates the need for home switch and wiring.

Software limit

You can set software limits using Cool Muscle parameters. Set limits on both CW and CCW sides to eliminate limit switches.

These two software features just saved you the cost of three sensors and the time needed to install wiring and calibrate them.

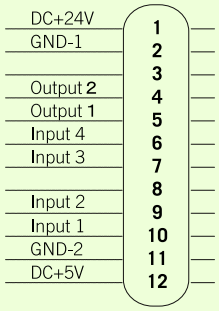
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COOL MUSCLE

Programmable I/O

Configure and assign multiple functions to I/O on the Cool Muscle. The Cool Muscle has 4 inputs and 2 outputs that can be used for digital, analog, serial or Step/Direction functions. The Cool Muscle lets you assign a function to each point of a signal.

Custom I/O. Flexible application of powerfully built in features.



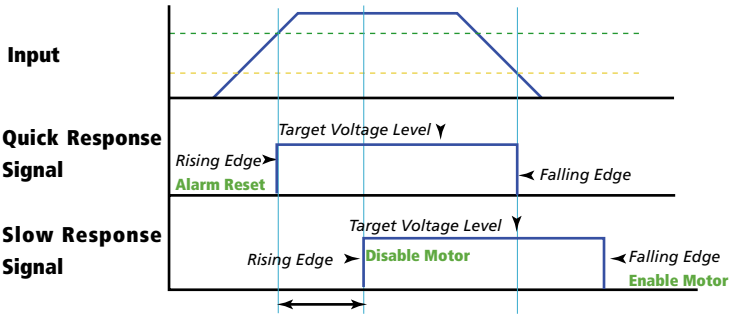
Input Functions examples:
Origin sensor/Homing Routine
Manual feed
Manual Jog
Execute Bank 1,2,3
Origin Search
Motor Free
Enable Motor
Execute Next Step
Execute Previous Step

Output Functions examples:
Alarm
In-position
Registration

Virtual Input Signal

Make the most of the I/O ports by taking advantage of Cool Muscle's unique virtual signal technique. The Cool Muscle creates two signals based on a single input signal by setting a time delay between the two signals, allowing you to assign multiple functions to a single input.

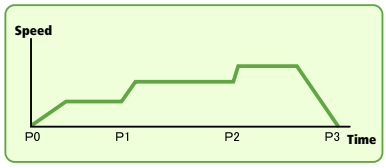
Eliminates the need for external I/O board.



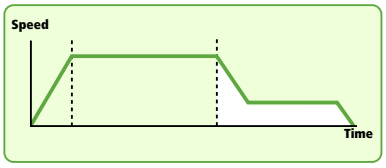
Quick and Slow response signals example: You can assign Alarm Reset, Motor Free and Enable Motor to the rising edge of Quick response, target voltage level and falling edge of Slow response signals respectively. Input functions are set by parameters.

Advanced Motion

Change speeds or accelerations while the motor is in operation. The Cool Muscle supports advanced motions such as continuous PTP and PTP motion with different accelerations and decelerations, Push mode and more.
The powerful push mode is also standard allowing for electric simulation of common pneumatic operations.



Continuous PTP: There is no stops in motion between origin and P3. Speed and acceleration are changed at each point.



Push Mode: Push mode mimics a typical pneumatic cylinder motion. It keeps pushing for a given time and at a set current level when a motor encounters a resistance such as bumper and stopper.

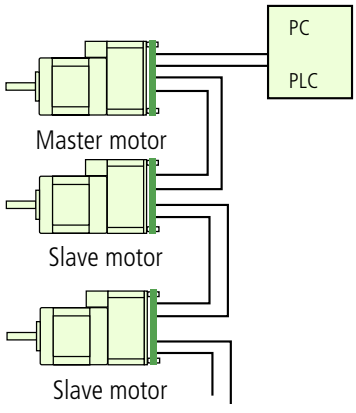
Network

The Cool Muscle provides you with different networking solutions that best suit your needs. 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.

Ethernet and MODBUS® options available.







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Accessories for the Cool Muscle

Accessories for the Cool Muscle work seamlessly with the Cool Muscle, enhancing its performance. Cool Muscle accessories include couplings, gears, cables, multiple-axis devices, power supplies, touch panel computer, and software.

Network Card



Daisy chain the Cool Muscles using the Network cards. Equipped with a voltage clipper, this Network board protects the motor from regenerated voltage. An additional daughter board is required for a master motor.



Gears

A wide range of high quality gears are available to suit your application needs. Combine a low backlash, zero maintenance, high durability gears with the Cool Muscle to maximize performance.

Available sizes:

Spur
3:1, 5:1,
10:1, 15:1, 20:1, 30:1, 50:1, 100:1



Planetary
3:1, 4:1, 5.5:1, 7:1
10:1, 16:1, 22:1, 28:1, 40:1, 49:1, 55:1,
70:1, 100:1,160:1,250:1,400:1,550:1,700:1

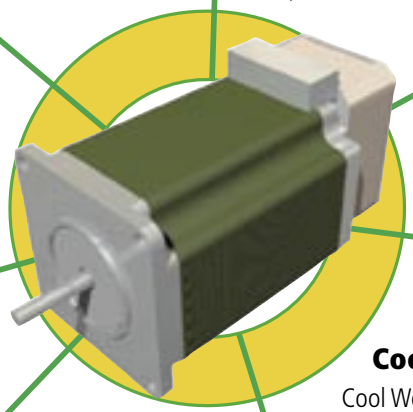
Couplings - Reli-a-Flex®



The Reli-a-Flex® range of one piece slit couplings has been specially designed to provide extremely accurate transfer of motion between two rotating shafts while, at the same time, catering to parallel and angular misalignment. A perfect match for the Cool Muscle. Strong, reliable and worry-free.

Available types

Clamp type
Short for where space is a consideration
Long for greater axial offset
Sizes range from 8mm - 25mm
(outside dimension)



Power Supply

Designed specifically for the Cool Muscle, this power supply is built to withstand the current spikes that the hard stops or starts often require.



Spec:
150W/300W
6A/10A

Cool Works

Cool Works Lite is a free application that gives you basic tools for setting parameters and creating motion profiles. An easy-to-use interface makes it easy to work with the Cool Muscle.

Intelligent Actuators

A wide range of intelligent actuators are available. Please refer to the Integrated Actuator Brochure.





Motor Cable



A standard motor cable (40cm) comes with every Cool Muscle. Longer motor cables are available as an option.

Y Cable



A Y cable is required to connect the Cool Muscle to a serial port. A Y cable is required for all types of the Cool Muscle.

Standard D Sub cable



A standard D Sub cable (9 pins) is required for daisy chain network using the Interface card.

CommManager

The CommManager is an ActiveX control that manages communications between the Microsoft Windows operating system and Cool Muscle devices connected via a serial port. The CommManager provides access to a library of over 40 API commands from any development environment that supports the Microsoft Component Object Model (COM).



Custom Software

Custom Software can be developed for your specific needs and applications. Please contact your Cool Muscle distributor.

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PRODUCT NAME

CM1-□-11L30-□

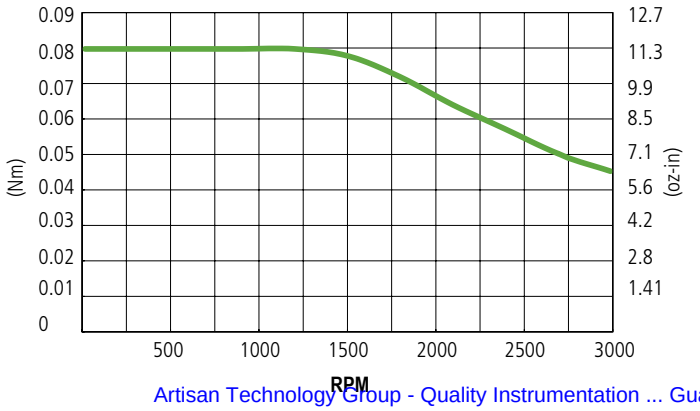
- **Generation**
- **Interface**: P Pulse; C Computer
- **Size**: 11; 17; 23
- **Length**: L Long; S Short
- **Max. Speed**: 30 3000rpm; 20 2000rpm
- **Custom**: Contact us

CM1-□-11 □30

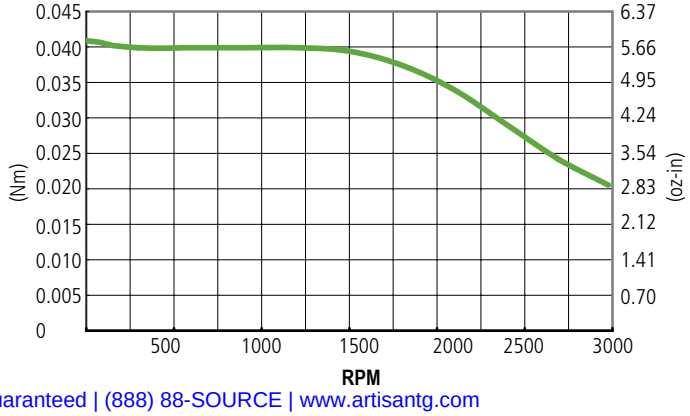
	CM1-□-11L30	CM1-□-11S30
Motor Output Power	18W	9W
Maximum Speed	3000rpm	3000rpm
Continuous Torque Nm(oz.in)	0.055 (7.78)	0.027(3.8)
Peak Torque Nm(oz.in)	0.078 (11.1)	0.039(5.5)
Load Inertia Allowance g-cm^2(oz-in-s^2)	180 (2.5 x 10^{-3})	80(1.1 x 10^{-3})
Motor Inertia g-cm^2(oz-in-s^2)	18 (2.5 x 10^{-4})	8(1.1 x 10^{-4})
	Depending on the load inertia, servo gain needs to be adjusted.	
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 Toque)	1.2A/1.5A	0.8A/1.0A
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%RH	
Shock/Vibration	Less than 10G /Less than 1G	

Torque Curve

CM1-□-11L30



CM1-□-11S30



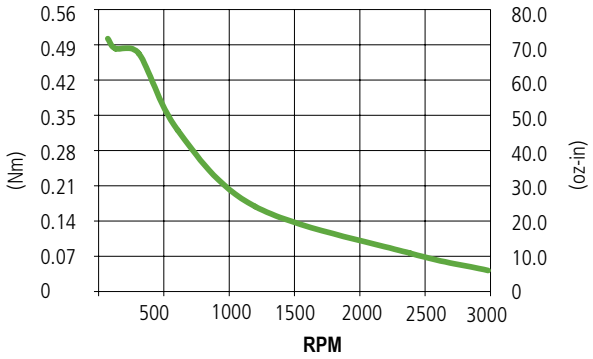
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CM1-□-17□30

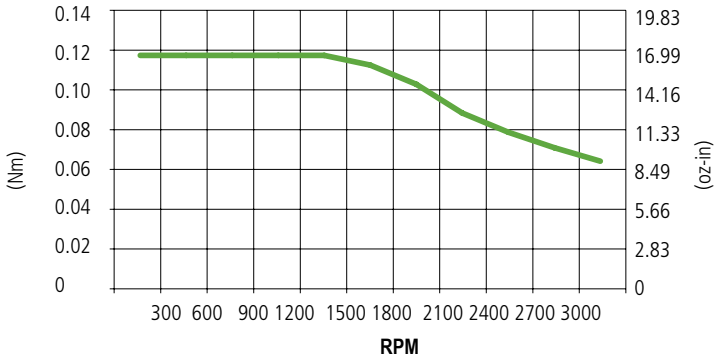
	CM1-□-17L30	CM1-□-17S30
Motor Output Power	18W	18W
Maximum Speed	3000rpm	3000rpm
Continuous Torque Nm(oz.in)	0.38 (53.8)	0.082(11.61)
Peak Torque Nm(oz.in)	0.54 (76.4)	0.117(16.56)
Load Inertia Allowance g-cm^2(oz-in-s^2)	760 (1.07 x 10^{-2})	380(5.38 x 10^{-3})
Motor Inertia g-cm^2(oz-in-s^2)	76 (1.07 x 10^{-3})	38(5.38 x 10^{-4})
	Depending on the load inertia, servo gain needs to be adjusted.	
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 Toque)	1.2A/2.5A	1.2A/1.4A
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%RH	
Shock/Vibration	Less than 10G /Less than 1G	

Torque Curve

CM1-□-17L30



CM1-□-17S30

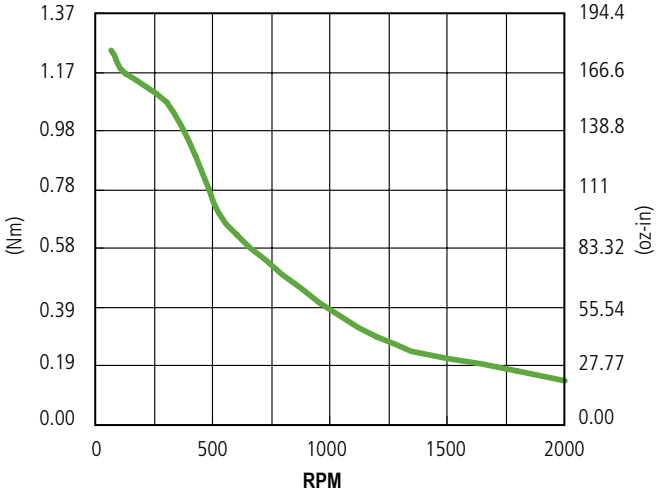


CM1-□ -23□20/30

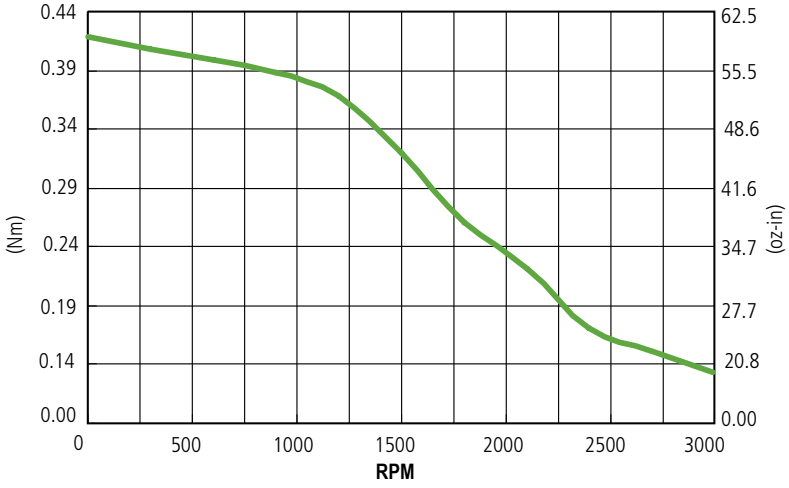
	CM1-□-23L20	CM1-□-23S30
Motor Output Power	30W	45W
Maximum Speed	2000rpm	3000rpm
Continuous Torque Nm(oz.in)	0.87 (123.2)	0.29(46.06)
Peak Torque Nm(oz.in)	1.24 (175.6)	0.46(65.14)
Load Inertia Allowance g-cm^2(oz-in-s^2)	4.6 x 10^3 (6.5 x 10^{-2})	1.4 x 10^3(1.9 x 10^{-2})
Motor Inertia g-cm^2(oz-in-s^2)	4.6 x 10^2 (6.5 x 10^{-3})	1.4 x 10^2(1.9 x 10^{-3})
	Depending on the load inertia, servo gain needs to be adjusted.	
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 Toque)	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%RH	
Shock/Vibration	Less than 10G /Less than 1G	

Torque Curve

CM1-□ -23L20



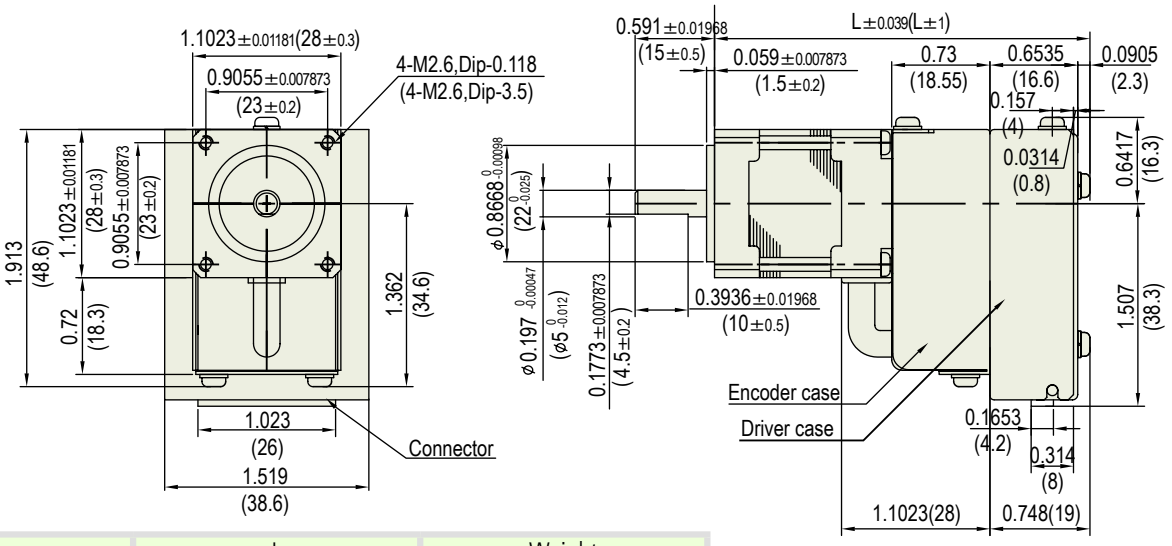
CM1-□ -23S30



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CM1-□-11□30

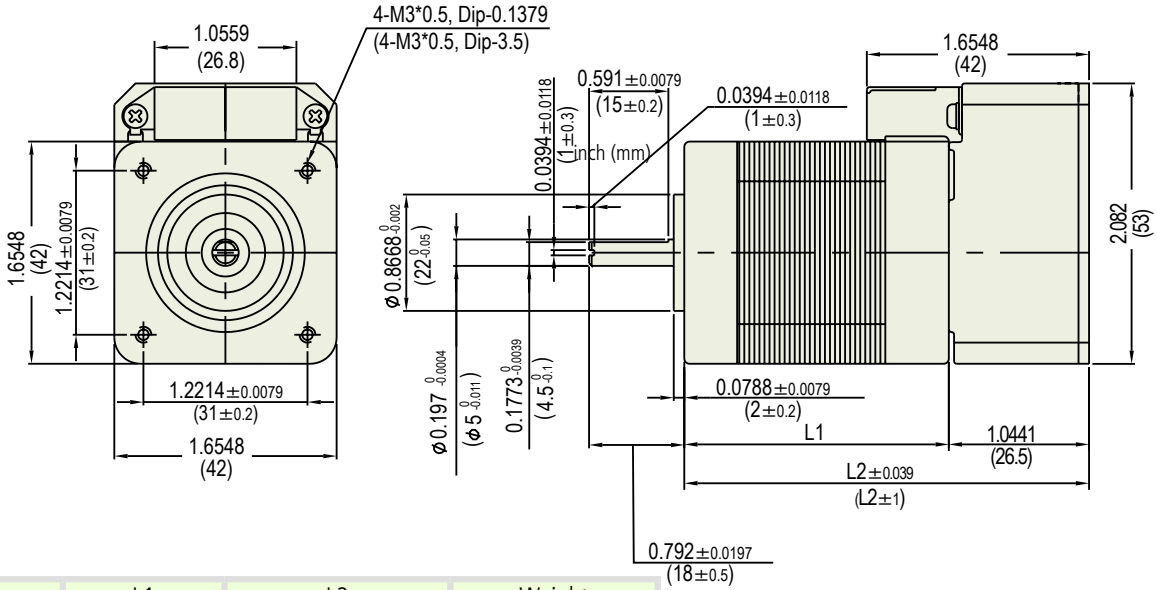
inch (mm)



	L	Weight
CM-□-11L30	3.346 (85)	300g
CM-□-11S30	2.795(71)	246g

CM1-□-17□30

inch (mm)

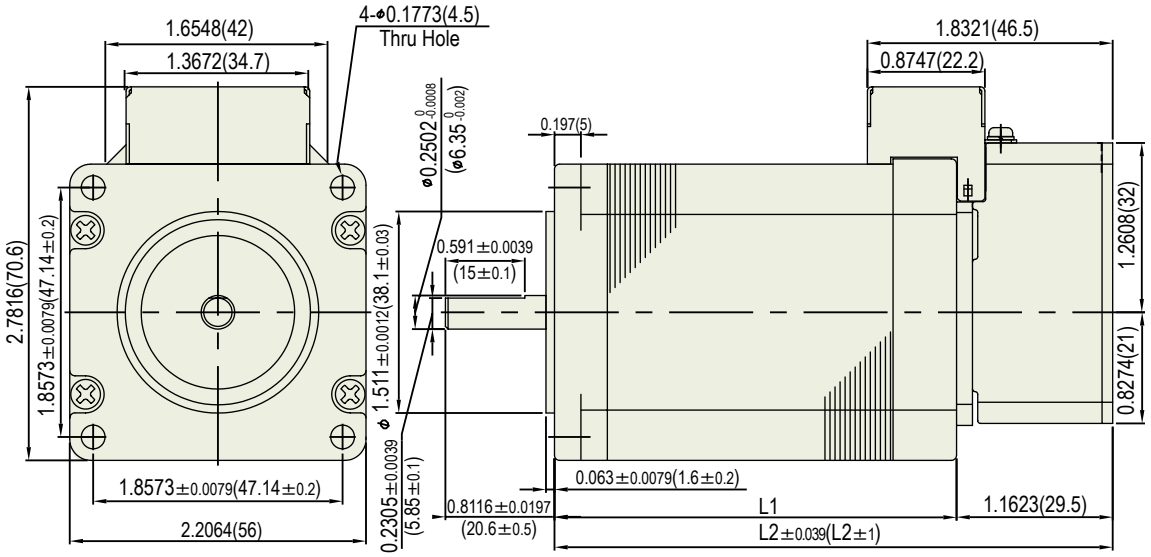


	L1	L2	Weight
CM-□-17L30	1.968(50)	3.01(76.5)	470g
CM-□-17S30	1.338(34)	2.38(60.5)	325g

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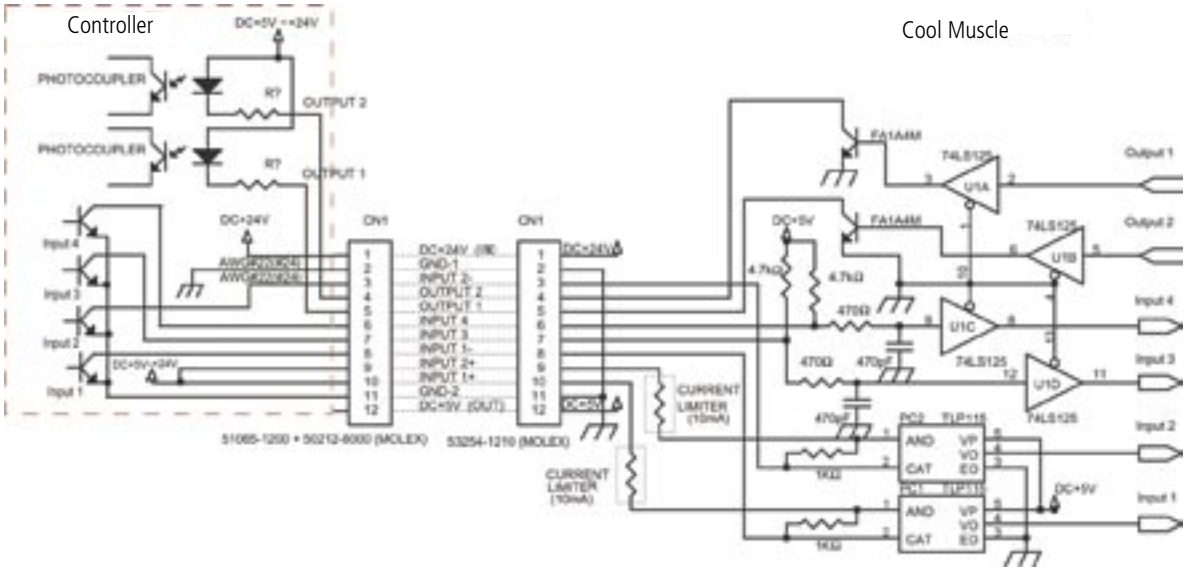
CM1-□-23□20/30

inch (mm)



	L1	L2	Weight
CM-□-23L20	2.99(76)	4.15(105.5)	1.1Kg
CM-□-23S30	1.65(42)	2.81(71.5)	580g

WIRING DIAGRAM



PIN LAYOUT

PIN #			CW/CCW	Step/Dir	Analog	C-Type
1	+24VDC IN	Motor Power				
2	GROUND 1					
3	INPUT 2-	Return For pin 9	CCW -	Direction -		
4	OUTPUT 2+	Digital Output, Serial TX				Serial 2
5	OUTPUT 1+	Digital Output, Serial TX				Serial 1
6	INPUT 4+	Digital Input, Analog Input			V +	
7	INPUT 3+	Digital Input				
8	INPUT 1-	Return For pin 10	CW-	Step -		
9	INPUT 2+	Digital Input, Pulse Counter, Serial RX	CCW +	Direction		Serial 2
10	INPUT 1+	Digital Input, Pulse Counter, Serial RX	CW +	Step +		Serial 1
11	GROUND 2				V -	
12	+5VDC OUT	Power out for LEDs, sensors, etc. 50mA max.				

INPUT/OUTPUT SIGNAL

PULSE INTERFACE	CW/CCW	STEP/DIRECTION
Input Signal **Pulse Input**	CW/CCW Pulse Maximum Frequency: 500 Kpps Minimum Pulse Width : 0.8 µsec Voltage Level High (with pulse) > +3.0V (+24VMAX) 7mA-15mA Voltage Level Low (no pulse) < +0.8V	Step Pulse Maximum Frequency: 500 Kpps Minimum Pulse Width : 0.8 µsec Voltage Level H (with pulse) > +3.0V (+24VMAX) 7mA-15mA Voltage Level L (no pulse) < +0.8V

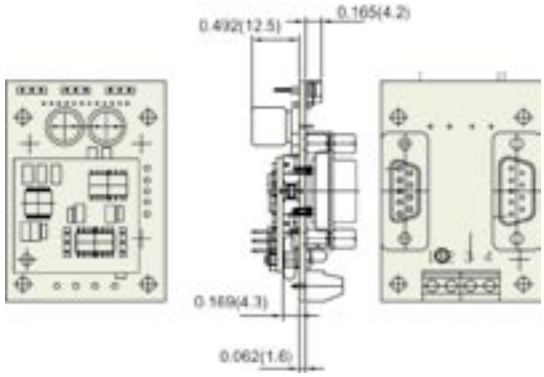
VARIABLE VOLTAGE FUNCTIONS	
Input Signal **Analog Input**	Speed Control Setting Increase from 2.6V to 4.8VDC to increase speed in the CW direction. Decrease voltage from 2.4V to 0VDC to increase speed in the CCW direction. Use an OP AMP for max resolution. Position Control Setting Travel Distance is proportionate to voltage input(Between 0V and 4.8VDC) Max. Travel distance is set by a parameter or in program bank

COMPUTER CONTROL INTERFACE	
Input Signal **Control**	Via supplied cabling - motor interface is TTL. Please specify RS-232 or RS-485 interface cable option
Input signal level	Voltage Level High> 3V (min. 7mA) Voltage Level Low< 0.8V

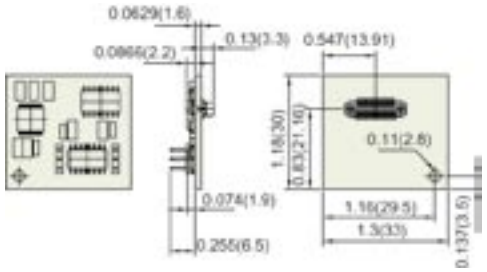
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NETWORK CARD DIMENSIONS

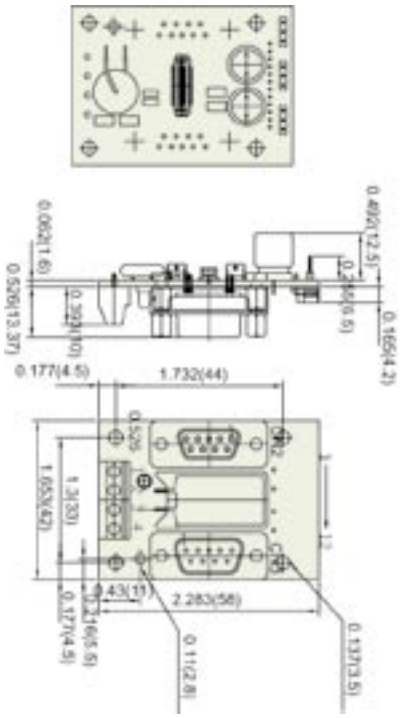
Master Card inch(mm)



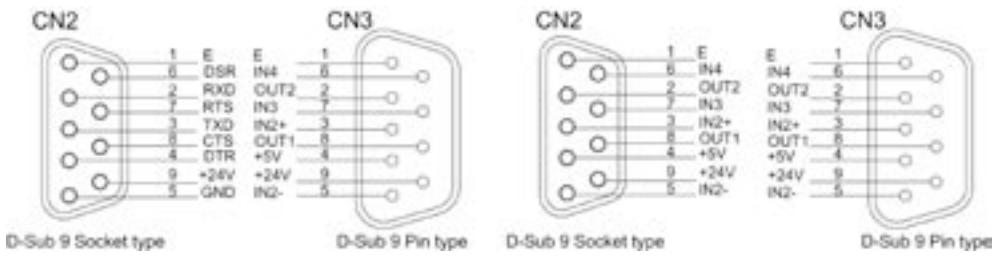
RS232/485 Interface Card inch(mm)



Slave Card inch(mm)



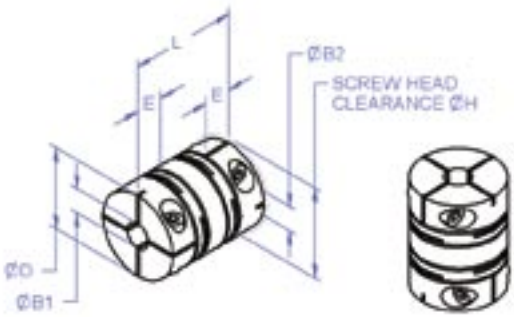
DB-9



PRODUCT NAME - RELI-A-FLEX®

RCSA20C-8-5

- **Basic Part#**
- **Size**
- **C:Clamp S:Set**
- **Bore size ∅ B1–B2**



RCL (Long)



RCS (Short)

BORE SIZES AND DIMENSIONS

Basic part#	Material	Size	Standard bore sizes ∅B1and∅B2 (Bore tolerance：+0.020/-0.00)	0/D ∅D	∅H	Length H	Hub Length E	Fitted Screw
RCS (Short)	A (Aluminum)	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

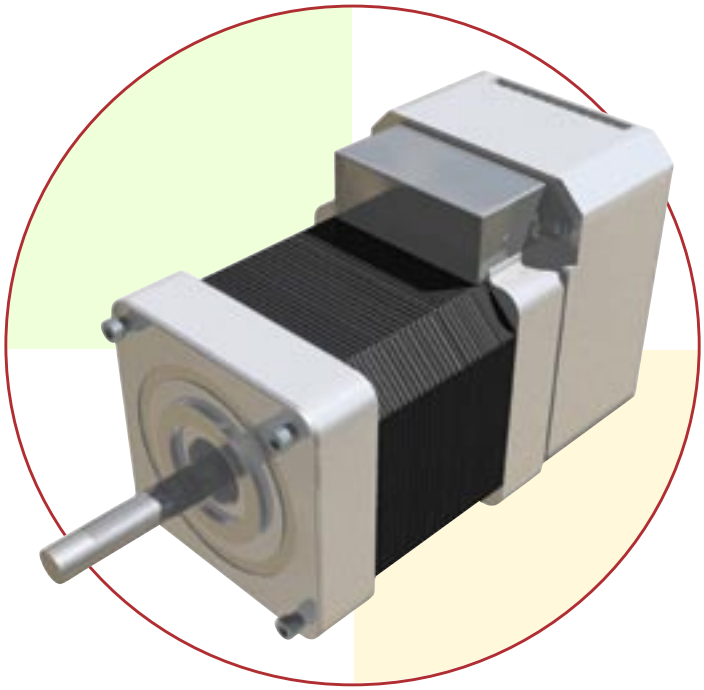
Basic part#	Material	Size	Torsional Stiffness mNm/arc min	Radial Compliance microns/N	Misalignment			Max Mass g
					Parallel mm	Angular deg	Axial mm	
RCS (Short)	A (Aluminum)	13C	13.09	29.2	0.08	2.5	±0.30	4.4
		16C	20.36	28.9	0.10	2.5	±0.40	8.6
		20C	33.45	23.4	0.12	3.0	±0.50	14.9
		25C	52.94	20.0	0.16	3.0	±0.70	27.5
RCL (Long)		13C	15.56	64.3	0.15	2.5	±0.30	5.5
		16C	24.43	65.1	0.20	2.5	±0.40	10.6
		20C	40.43	62.0	0.25	3.0	±0.50	18.7
		25C	66.03	82.2	0.40	3.0	±0.70	38.5

TORQUE AND SPEED CAPACITY

Basic part#	Size	Typical Torque Capacity			Max Speed
		Reversing (Nm)	Non Rev (Nm)	Peak (Nm)	
RCS (Short)	13C	0.35	0.45	0.50	12000
	16C	0.55	0.85	1.25	10000
RCL (Long)	20C	0.95	1.45	2.45	7500
	25C	1.55	2.35	3.90	5000



COOL MUSCLE



MYOSTAT MOTION CONTROL INC

Myostat Motion Control

17817 Leslie Street, Unit 43

Newmarket Ontario Canada L3Y 8C6

Tel: 905-836-4441 Fax: 905-836-1214

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