The future.
ServoClass® Coupling

Patent Pending

ZERO-MAX

ACP&D Limited

Zero-Max ServoClass Couplings

- For high performance servo motor and demanding motion control applications
- High torsional stiffness for precision positioning
- Eco-Friendly, Adapted to RoHS Directive with no banned substances
- Low inertia for high speed applications
- Zero backlash and low hysteresis ensures repeatable precise positioning
- Clean Room Applications

Today's servo motor applications are more demanding than ever. The precision positioning requirements and high reverse load characteristics of AC and DC servomotor applications necessitate a coupling design that specifically addresses the needs of these sophisticated systems.

Inertia and torsional stiffness are critical features of a superior servo coupling. The inertia should be low so as not to add significantly to overall inertia of the servo system. The lower the inertia, the less energy required by the motor to move the system and therefore, higher acceleration is possible. The torsional stiffness should be high enough to prevent the coupling from winding up during acceleration, deceleration or reversing conditions. The torsional stiffness of the Zero-Max ServoClass coupling leads to a higher system resonant frequency, which in most cases, is far above the operating range.

Zero backlash is another key requirement of a high performance servo coupling. A coupling may be considered zero backlash and still have a large amount of windup. Zero backlash is the ability of the coupling to maintain the same relative relationship between the input and output shaft without lost motion. The windup of the coupling can be detrimental to the servo system. A coupling with a high amount of windup will cause positioning errors to the servo system. The Zero-Max ServoClass coupling is a zero backlash coupling and it exhibits a very low amount of windup.

Misalignment capability of a coupling is also important in a motion control system. Usually, the alignment of a well manufactured servo system will be very good. Over time and under high load conditions, this alignment may deteriorate. The coupling should be capable of handling this change. Also, the coupling should accommodate any lack of concentricity in the connected shafts as well as the stack up of tolerances in the motion assembly. Another important benefit of a high misalignment capability is the dispersion of reaction loads on the bearings and bushings in the system. The Zero-Max ServoClass coupling utilizes a design that provides adequate amounts of flexibility but does not sacrifice any of the torque capability or the torsional stiffness capability and therefore minimizes the reaction loads to the servo motor bearings.

Operating Temperature Range
–22° to +212°F
–30° to +100°C

ServoClass Couplings For Every Servo System Requirement

ServoClass couplings are available in single and double disc models. A total of 16 sizes are available.

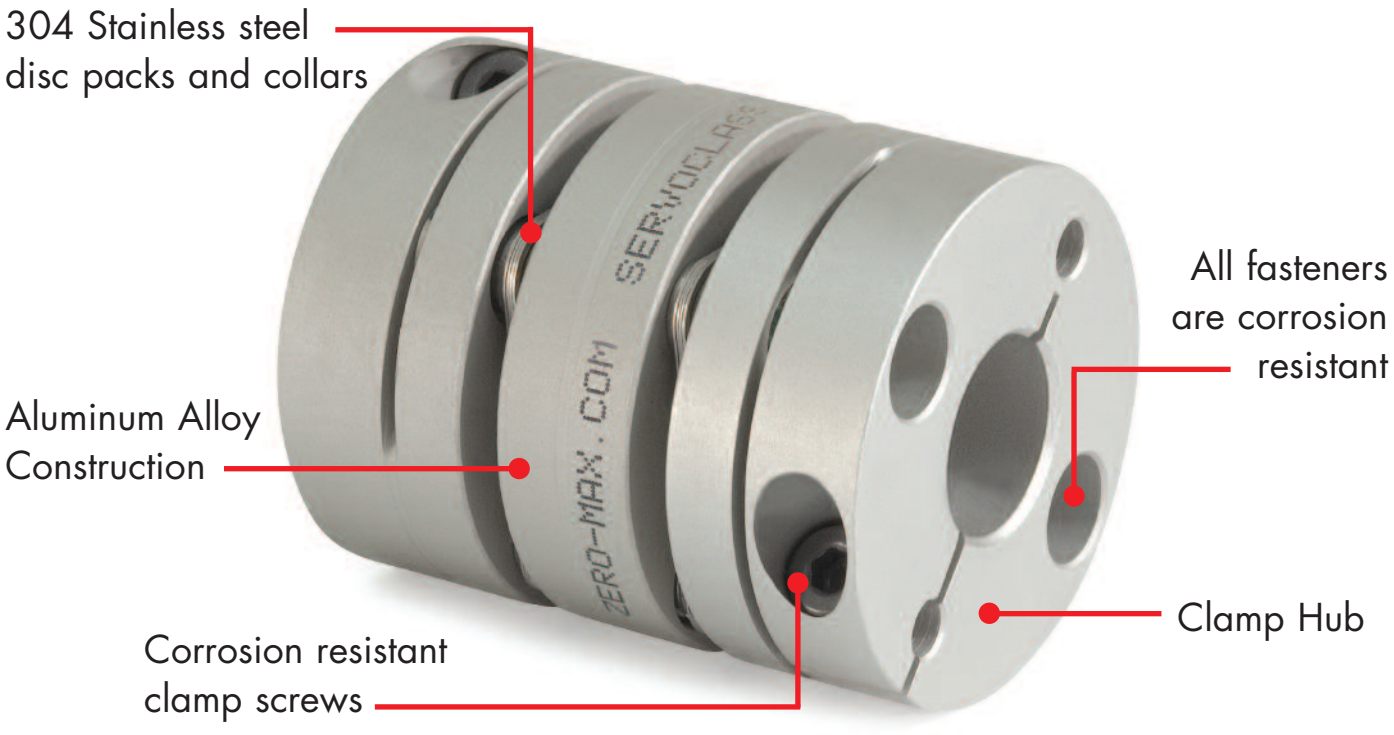
Double disc ServoClass models provide highest misalignment capability. Single disc ServoClass models provide a smaller package coupling with more torsional and axial stiffness than the Double disc model.

Torque ratings for ServoClass couplings range from 4.43 to 530 lb-in (.5 to 60 Nm). These ratings are based on the minimum bore of the coupling. These couplings can accommodate bores sizes from 4.0 mm to a maximum of 30 mm. Contact Zero-Max for larger or smaller bore sizes.

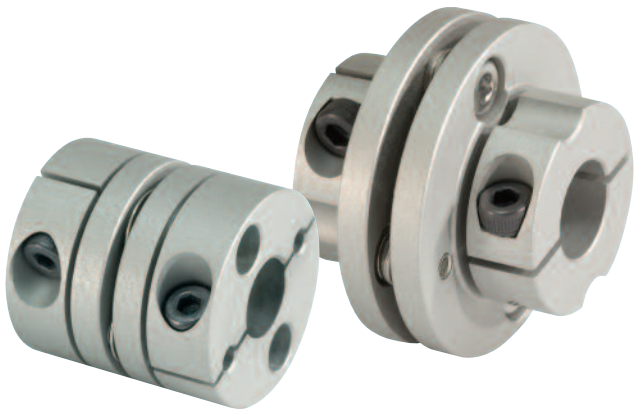
Hubs and center members of ServoClass couplings are manufactured of aluminum alloy for high strength and durability. They are treated to prevent oxidation and to preserve appearance. Disc members are made of 304 stainless steel providing torsional stiffness and some misalignment capability.

Coupling assembly/hub design. ServoClass couplings are precisely assembled using highest strength, corrosion resistant fasteners. The couplings also have integral clamp style hubs for fast and easy mounting. The design allows for specifying combinations of inch and mm hub bore sizes and styles.

RoHS Compliant. ServoClass couplings are manufactured of RoHS compliant materials and contain no banned substances.



SD Series



SD Series ServoClass Single Disc Specifications

Model	Operating Torque in.lb. (Nm)	Maximum RPM r/min	Torsional Stiffness in.lb./deg. (Nm/rad)	Axial Stiffness lb./in. (N/mm)	Misalignment Capacity Parallel inch (mm)	Misalignment Capacity Angular degree	Misalignment Capacity Axial inch (mm)	Moment of Inertia lb.in.^{2} kgm^2(x10^{-5})	Weight Oz. (gm)	Style
SD005R	4.4 (0.5)	10,000	77 (500)	799 (140)	0.001 (0.02)	0.5	0.002 (0.05)	0.0009 (0.26)	0.25 (7)	C
SD010R	7 (0.8)	10,000	216 (1400)	799 (140)	0.001 (0.02)	1	0.004 (0.10)	0.0019 (0.57)	0.39 (11)	C
SD020R	13 (1.5)	10,000	572 (3700)	365 (64)	0.001 (0.02)	1	0.006 (0.15)	0.008 (2.39)	0.9 (25)	C
SD030R	35 (4.0)	10,000	1236 (8000)	365 (64)	0.001 (0.02)	1	0.008 (0.2)	0.028 (8.13)	1.7 (49)	A B C
SD035R	53 (6.0)	10,000	2780 (18000)	640 (112)	0.001 (0.02)	1	0.010 (0.3)	0.063 (18.4)	3.0 (84)	C
SD040R	89 (10)	10,000	3089 (20000)	457 (80)	0.001 (0.02)	1	0.012 (0.3)	0.101 (29.5)	3.7 (105)	A B C
SD050R	221 (25)	10,000	4943 (32000)	274 (48)	0.001 (0.02)	1	0.016 (0.4)	0.34 (99.3)	7.5 (214)	A B C
SD060R	531 (60)	10,000	10812 (70000)	436 (76.4)	0.001 (0.02)	1	0.018 (0.5)	0.92 (268.5)	14.0 (396)	A B C

- Moment of Inertia and Weight are measured with the maximum bore diameters
- Tolerance of mounted shaft should be h7

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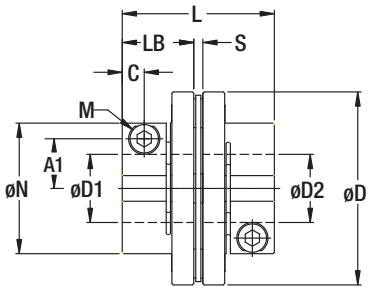

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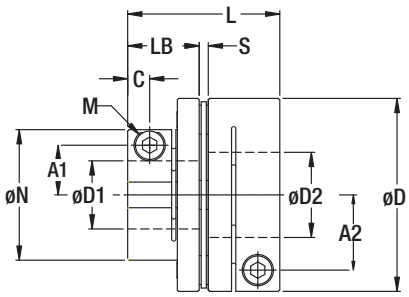

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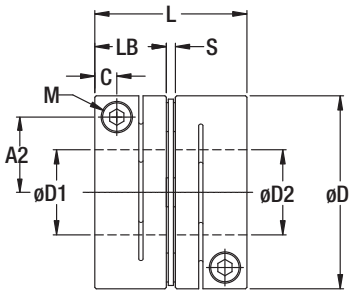
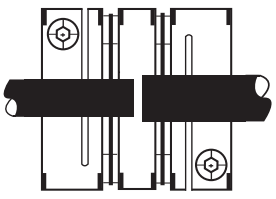


SD Series ServoClass Single Disc Dimensions

Model	Bore D1*1 Min Inch (mm)	Bore D1*1 Max Inch (mm)	Bore D2*1 Min Inch (mm)	Bore D2*1 Max Inch (mm)	Outside Diameter D Inch (mm)	N Inch (mm)	Overall Length L Inch (mm)	Hub Length LB Inch (mm)	Spacer Gap S Inch (mm)	A1 Inch (mm)	A2 Inch (mm)	C Inch (mm)	Clamp Screw Size M	Tightening Torque in. lb. (Nm)	Style
SD005R	0.157 (4)	0.236 (6)	0.157 (4)	0.236 (6)	0.630 (16.0)	–	0.657 (16.7)	0.309 (7.85)	0.039 (1.0)	–	0.189 (4.8)	0.098 (2.5)	2-M2.0	3.5 (0.4)	C
SD010R	0.157 (4)	0.3125 (8)	0.157 (4)	0.3125 (8)	0.748 (19.0)	–	0.762 (19.35)	0.360 (9.15)	0.041 (1.05)	–	0.228 (5.8)*2	0.124 (3.15)	2-M2.0*4 2-M2.5*3	3.5 (0.4)*4 9 (1)*3	C
SD020R	0.1875 (5)	0.375 (10)	0.1875 (5)	0.375 (10)	1.024 (26.0)	–	0.911 (23.15)	0.423 (10.75)	0.065 (1.65)	–	0.374 (9.5)	0.130 (3.3)	2-M2.5	9 (1)	C
SD030R	0.1875 (5)	0.375 (10)	0.1875 (5)	0.375 (10)	1.339 (34.0)	0.850 (21.6)	1.075 (27.3)	0.488 (12.4)	0.098 (2.5)	0.315 (8)	–	0.148 (3.75)	2-M3	13 (1.5)	A
	0.1875 (5)	0.375 (10)	Over 0.375 (Over 10)	0.5625 (14)						0.315 (8)	0.492 (12.5)				B
	Over 0.375 (Over 10)	0.5625 (14)	Over 0.375 (Over 10)	0.5625 (14)		–				–	0.492 (12.5)				C
SD035R	0.3125 (8)	0.625 (16)	0.3125 (8)	0.625 (16)	1.535 (39.0)	–	1.339 (34.0)	0.610 (15.5)	0.118 (3.0)	–	0.551 (14)	0.177 (4.5)	2-M4	30 (3.4)	C
SD040R	0.3125 (8)	0.5625 (15)	0.3125 (8)	0.5625 (15)	1.732 (44.0)	1.165 (29.6)	1.399 (34.0)	0.610 (15.5)	0.118 (3.0)	0.433 (11)	–	0.177 (4.5)	2-M4	30 (3.4)	A
	0.3125 (8)	0.5625 (15)	Over 0.5625 (Over 15)	0.750 (19)						0.433 (11)	0.669 (17)				B
	Over 0.5625 (Over 15)	0.750 (19)	Over 0.5625 (Over 15)	0.750 (19)		–				–	0.669 (17)				C
SD050R	0.375 (10)	0.750 (19)	0.375 (10)	0.750 (19)	2.205 (56.0)	1.496 (38)	1.709 (43.4)	0.807 (20.5)	0.094 (2.4)	0.571 (14.5)	–	0.236 (6)	2-M5	62 (7)	A
	0.375 (10)	0.750 (19)	Over 0.750 (Over 19)	1.000 (25)						0.571 (14.5)	0.866 (22)				B
	Over 0.750 (Over 19)	1.000 (25)	Over 0.750 (Over 19)	1.000 (25)		–				–	0.866 (22)				C
SD060R	0.500 (12)	0.9375 (24)	0.500 (12)	0.9375 (24)	2.677 (68.0)	1.811 (46)	2.110 (53.6)	0.992 (25.2)	0.126 (3.2)	0.689 (17.5)	–	0.305 (7.75)	2-M6	121 (14)	A
	0.500 (12)	0.9375 (24)	Over 0.9375 (Over 24)	1.1875 (30)						0.689 (17.5)	1.043 (26.5)				B
	Over 0.9375 (Over 24)	1.1875 (30)	Over 0.9375 (Over 24)	1.1875 (30)		–				–	1.043 (26.5)				C

*1: Bore size affects and limits the operating torque of the coupling.
See the table "Bore Size and Operating Torque Term" on Page 6.
*2: The Dimension for 4mm-7mm bores. For 8mm bore, the dimension is 0.236 inch or 6mm.
*3: The screw size and tightening torque for 4mm-7mm bores.
*4: The screw size and tightening torque for 8mm bore.



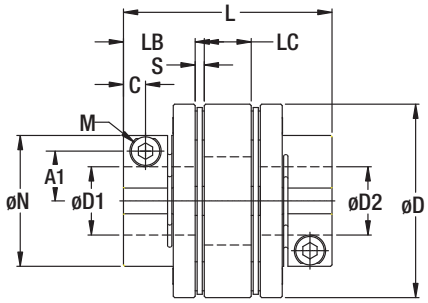
The shafts of the equi
may be extended into the
ServoClass coupling. Hov

SC Series ServoClass Double Disc Specifications

Model	Operating Torque	Maximum RPM	Torsional Stiffness	Axial Stiffness	Misalignment Capacity			Moment of Inertia	Weight	Style
					Parallel	Angular	Axial			
	in.lb. (Nm)	r/min	in.lb./deg. (Nm/rad)	lb./in. (N/mm)	inch (mm)	degree	inch (mm)	lb.in.^{2} kgm^2(x10^{-6})	Oz. (gm)	
SC005R	4.4 (0.5)	10,000	39 (250)	400 (70)	0.002 (0.05)	0.5	0.004 (0.10)	0.0012 (0.36)	0.35 (10)	C
SC010R	7 (0.8)	10,000	108 (700)	400 (70)	0.004 (0.11)	1	0.008 (0.20)	0.0027 (0.78)	0.53 (15)	C
SC020R	13 (1.5)	10,000	286 (1850)	183 (32)	0.006 (0.15)	1	0.013 (0.33)	0.012 (3.43)	1.3 (36)	C
SC030R	35 (4.0)	10,000	618 (4000)	183 (32)	0.007 (0.18)	1	0.016 (0.4)	0.039 (11.5)	2.4 (69)	A B C
SC035R	53 (6.0)	10,000	1390 (9000)	320 (56)	0.009 (0.24)	1	0.020 (0.5)	0.092 (26.8)	4.3 (123)	C
SC040R	89 (10)	10,000	1545 (10000)	228 (40)	0.009 (0.24)	1	0.024 (0.6)	0.146 (42.6)	5.3 (151)	A B C
SC050R	221 (25)	10,000	2471 (16000)	137 (24)	0.011 (0.28)	1	0.031 (0.8)	0.48 (141.4)	10.7 (304)	A B C
SC060R	531 (60)	10,000	5406 (35000)	218 (38)	0.013 (0.34)	1	0.035 (0.9)	1.29 (377.3)	19.6 (556)	A B C

- Moment of Inertia and Weight are measured with the maximum bore diameters
- Tolerance of mounted shaft should be h7

Style A



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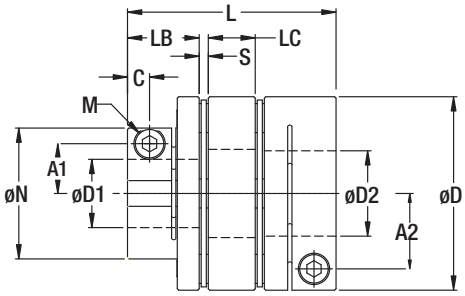

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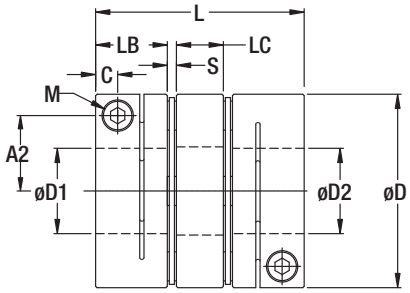


SC Series ServoClass Double Disc Dimensions

Model	Bore D1*1		Bore D2*1		Outside Diameter D	N	Overall Length L	Hub Length LB	Center Member LC	Spacer Gap S	A1	A2	C	Clamp Screw Size	Tightening Torque	Style
	Min	Max	Min	Max												
	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	M	in. lb. (Nm)	
SC005R	0.157 (4)	0.236 (6)	0.157 (4)	0.236 (6)	0.630 (16.0)	–	0.913 (23.2)	0.309 (7.85)	0.217 (5.5)	0.039 (1.0)	–	0.189 (4.8)	0.098 (2.5)	2-M2.0	3.5 (0.4)	C
SC010R	0.157 (4)	0.3125 (8)	0.157 (4)	0.3125 (8)	0.748 (19.0)	–	1.020 (25.9)	0.360 (9.15)	0.217 (5.5)	0.041 (1.05)	–	0.228 (5.8)*2	0.124 (3.15)	2-M2.0*4 2-M2.5*3	3.5 (0.4)*4 9 (1)*3	C
SC020R	0.1875 (5)	0.375 (10)	0.1875 (5)	0.375 (10)	1.024 (26.0)	–	1.272 (32.3)	0.423 (10.75)	0.295 (7.5)	0.065 (1.65)	–	0.374 (9.5)	0.130 (3.3)	2-M2.5	9 (1)	C
SC030R	0.1875 (5)	0.375 (10)	0.1875 (5)	0.375 (10)	1.339 (34.0)	0.850 (21.6)	1.488 (37.8)	0.488 (12.4)	0.315 (8.0)	0.098 (2.5)	0.315 (8)	–	0.148 (3.75)	2-M3	13 (1.5)	A
	0.1875 (5)	0.375 (10)	Over 0.375 (Over 10)	0.5625 (14)							0.315 (8)	0.492 (12.5)				B
	Over 0.375 (Over 10)	0.5625 (14)	Over 0.375 (Over 10)	0.5625 (14)		–					–	0.492 (12.5)				C
SC035R	0.3125 (8)	0.625 (16)	0.3125 (8)	0.625 (16)	1.535 (39.0)	–	1.890 (48)	0.610 (15.5)	0.433 (11.0)	0.118 (3.0)	–	0.551 (14)	0.177 (4.5)	2-M4	30 (3.4)	C
SC040R	0.3125 (8)	0.5625 (15)	0.3125 (8)	0.5625 (15)	1.732 (44.0)	1.165 (29.6)	1.890 (48)	0.610 (15.5)	0.433 (11.0)	0.118 (3.0)	0.433 (11)	–	0.177 (4.5)	2-M4	30 (3.4)	A
	0.3125 (8)	0.5625 (15)	Over 0.5625 (Over 15)	0.750 (19)							0.433 (11)	0.669 (17)				B
	Over 0.5625 (Over 15)	0.750 (19)	Over 0.5625 (Over 15)	0.750 (19)		–					–	0.669 (17)				C
SC050R	0.375 (10)	0.750 (19)	0.375 (10)	0.750 (19)	2.205 (56.0)	1.496 (38)	2.354 (59.8)	0.807 (20.5)	0.551 (14.0)	0.094 (2.4)	0.571 (14.5)	–	0.236 (6)	2-M5	62 (7)	A
	0.375 (10)	0.750 (19)	Over 0.750 (Over 19)	1.000 (25)							0.571 (14.5)	0.866 (22)				B
	Over 0.750 (Over 19)	1.000 (25)	Over 0.750 (Over 19)	1.000 (25)		–					–	0.866 (22)				C
SC060R	0.500 (12)	0.9375 (24)	0.500 (12)	0.9375 (24)	2.677 (68.0)	1.811 (46)	2.886 (73.3)	0.992 (25.2)	0.650 (16.5)	0.126 (3.2)	0.689 (17.5)	–	0.305 (7.75)	2-M6	121 (14)	A
	0.500 (12)	0.9375 (24)	Over 0.9375 (Over 24)	1.1875 (30)							0.689 (17.5)	1.043 (26.5)				B
	Over 0.9375 (Over 24)	1.1875 (30)	Over 0.9375 (Over 24)	1.1875 (30)		–					–	1.043 (26.5)				C

*1: Bore size affects and limits the operating torque of the coupling.
See the table "Bore Size and Operating Torque Term" on Page 6.
*2: The Dimension for 4mm-7mm bores. For 8mm bore, the dimension is 0.236 inch or 6mm.
*3: The screw size and tightening torque for 4mm-7mm bores.
*4: The screw size and tightening torque for 8mm bore.

pment (up to the maximum bore size of the coupling)
e interior of the coupling without any modification to the
vever, the ends of the shafts must never touch each other.

Bore Size

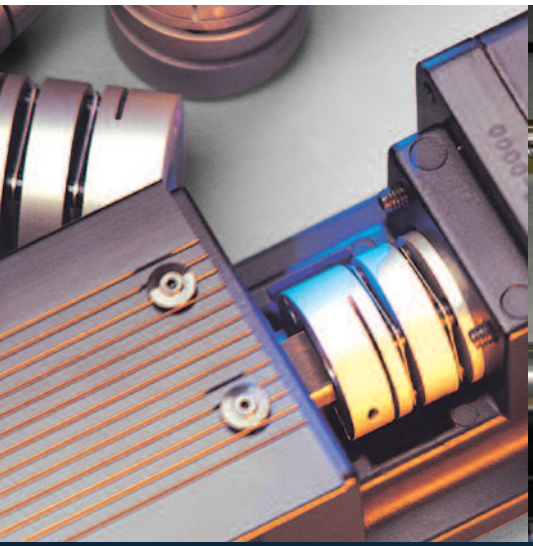
Model		Bore Size D1 D2 mm																				
	Inch	0.157	0.1875	0.236	0.250	0.275	0.3125	0.354	0.375	0.375	0.433	0.500	0.563	0.563	0.625	0.708	0.750	0.813	0.875	0.938	1.00	1.10	1.188
	mm	4	5	6	6.35	7	8	9	9.525	10	11	12	14	15	16	18	19	20	22	24	25	28	30
SD/SC005R		●	●	●																			
SD/SC010R		●	●	●	●	●	●																
SD/SC020R			❍	●	●	●	●	●	●	●													
SD/SC030R			❍	❍	●	●	●	●	●	●	●	●	●										
SD/SC035R							●	●	●	●	●	●	●	●	●								
SD/SC040R							❍	●	●	●	●	●	●	●	●	●	●						
SD/SC050R										❍	●	●	●	●	●	●	●	●	●	●	●		
SD/SC060R												❍	●	●	●	●	●	●	●	●	●	●	●

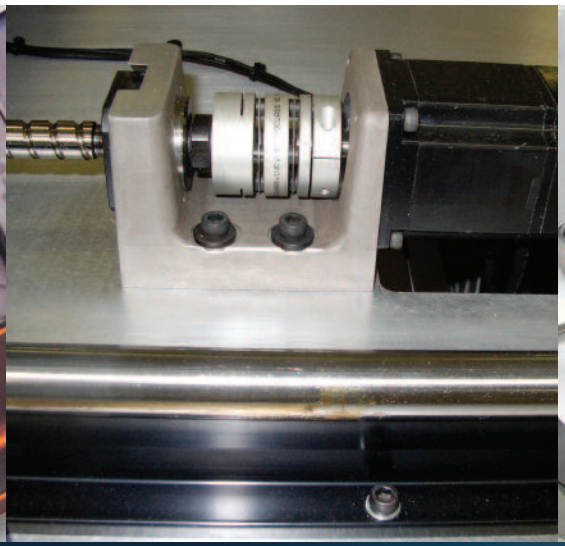
●: Standard Bore Size ❍: Standard Bore, See the operating torque in the table below

Bore Size and Operating Torque

Bore size affects and limits the operating torque of the coupling

Model	Bore		Coupling Operating Torque	
	Inch	mm	Inch Lb's	Nm
SD/SC020R	0.1875	5	11	1.2
SD/SC030R	0.1875	5	25	2.8
	0.236	6	30	3.4
SD/SC040R	0.3125	8	80	9
SD/SC050R	0.375	10	195	22
SD/SC060R	0.500	12	451	51





Selecting A ServoClass Coupling

Standard Motor Application

1. Determine the speed-revolutions per minute (RPM) and horsepower (HP). Then calculate the torque (T), in inch-pounds, to be transmitted:

$$T = \frac{HP \times 63{,}025}{RPM}$$

2. Select the service factor (K) according to the characteristics of the load or application. See chart below for load characteristics and service factor. Calculate the coupling selection torque (TD) based on the appropriate service factor:

$$TD = T \times K$$

3. Select a coupling with a torque rating equal or greater than TD.

4. Check the dimensions and bore range of the coupling selected with the application requirements.

Servomotor Application

Although servomotors have different torque values relative to RPM, and torque values change relative to continuous or intermittent duty, it is suggested to use the peak torque rating of the servomotor multiplied by a service factor in determining the coupling selection:

$$TS = TM \times KS$$

TS is the torque used to select the coupling; TM is the peak torque of the servomotor; KS is the servo service factor of the application. Generally, KS is a value within the range of 1.3 to 1.5 for ServoClass coupling applications. 1.3 is a factor applied to typical reverse-load, continuous-duty applications. 1.5 is a factor applied to the most demanding high reverse-load, rapid-acceleration applications. Example:

Servomotor Peak Torque:	7.59 inch-pounds
Rated Torque:	2.53 inch-pounds
Shaft Diameter:	.375 inch

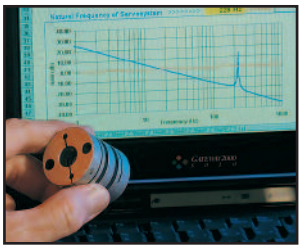
TS = 7.59 x 1.5
TS = 11.39 inch-pounds of torque

Coupling selection: SC 020, rated at 13 inch-pounds of torque. .375 bore is OK.

Additional ServoClass Coupling Applications

The ServoClass coupling was designed specifically for the servo motor market. Other applications include stepper motors and encoders. Typically these motors are used in applications that involve positioning devices such as linear ball screws, actuators, and positioning systems (X, Y and Z-axis). The ServoClass is ideal for use in machine tools, printing machines, pick and place machines and many other high precision applications. If there's is a servomotor in the system, a ServoClass coupling should be used!

Natural Frequency & Resonance



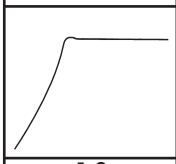
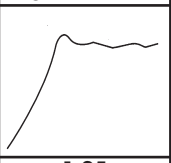
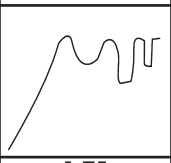
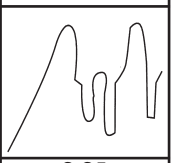
In servomotor systems, torsional vibration can be caused by acceleration, deceleration, driver characteristics and other factors. While torsional vibration is inherent in power transmission systems, it is important that its frequency and amplitude be minimized. Torsional vibration can cause component failure or poor system performance. By selecting the proper coupling that places the natural frequency outside the range of 150-400 Hz, the effects of torsional vibration or resonance can be reduced. The calculated natural frequency of the system should be 1.3 to 1.5 times greater than this range.

The natural torsional frequency can be calculated from a 2 mass system approximation using the following equation.

$$F = 1/2\pi \times \sqrt{\frac{K \times (J_1 + J_2)}{J_1 \times J_2}}$$

Where:
F = Natural Frequency in Hz
J_1 = Inertia of the Motor
J_2 = Inertia of the load
K = Torsional Stiffness of the Coupling

Other factors such as system gain, elasticity of the system and dampening can also be included in the equation. Please call us for a natural frequency analysis of your servo system.

Load Characteristics			
Constant	Slight fluctuation	Medium fluctuation	Great fluctuation
			
1.0	1.25	1.75	2.25

Sizing software for ServoClass Couplings

Zero-Max provides free software on a CD ROM to help select and size the correct ServoClass Coupling. This CD ROM contains all Zero-Max product catalogs in a PDF format, a comprehensive sizing and selection program and CAD drawings for most of the Zero-Max products.

ServoClass® Couplings
www.zero-max.com/servo

ETP® Bushings
www.zero-max.com/etp

CD® Couplings
www.zero-max.com/cd

Roh'lix® Linear Actuators
www.zero-max.com/rohlix

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www.zero-max.com/offset

Zero-Max® Adjustable Speed Drives
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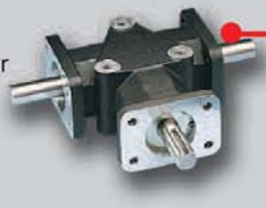
Torq-Tender®
www.zero-max.com/torqtender



Crown Right Angle Gear Drives
www.zero-max.com/crown

Control-Flex® Couplings
www.zero-max.com/controlflex

OHLA® Overhung Load Adapters
www.zero-max.com/ohla

ZERO-MAX

ACP&D Limited
Units 6 & 9A,
Charlestown Industrial Estate,
Robinson Street,
Ashton-under-Lyne,
Lancashire, OL6 8NS.

Tel: +44 (0)161 343 1884
Fax: +44 (0)161 339 0650
e-mail: sales@acpd.co.uk
Websites: www.acpd.com &
www.acpd.co.uk