

Housed Direct Drive Rotary (DDR) Motors Selection Guide



with AKD[®] Servo Drive Systems

KOLLMORGEN[®]

Because Motion Matters™

Kollmorgen: Your partner. In Motion.

Every solution comes from a real understanding of the challenges facing machine designers and users.

Innovators consistently rate Kollmorgen as one of their best motion systems manufacturing partners. Whether you are looking for classic servo motors, direct-drive servo motors, stepper motors, drives & amplifiers, gearing, actuation, or CNC & multi-axis motion controllers, Kollmorgen is one of the few companies in the world who actually designs and manufactures all of these products.

Our customers are leaders in many industries such as Aerospace & Defense, Printing, Packaging & Converting, Food & Beverage Processing, Medical Imaging, In Vitro Diagnostics & Laboratory Automation, Pharmaceutical Manufacturing, Material Forming and Cutting, Oil & Gas, and Robotics. Kollmorgen is also a leader in Warehouse Automation, including complete AGV systems, software, awareness and autonomy.

Our Automation Solutions can be found on Mars and in space, ships and submarines, O&G drilling and metrology, surgical robots and laser eye surgery, even inside artificial hearts. These are just a few applications that demand high-performance and high-quality while satisfying their specific needs.

Because motion matters, it's our focus: Motion can distinctly differentiate a machine and deliver a marketplace advantage by increasing its performance and dramatically improving overall equipment effectiveness (OEE).

High-performance motion can make your customer's machine more reliable and energy-efficient, enhance accuracy and improve operator safety. Motion also represents endless possibilities for innovation.

We've always understood this potential, and thus have kept motion at our core and in our Vision, Mission & Values, relentlessly developing products that offer precise control of torque, velocity and position accuracy in machines that rely on complex motion.

Removing the Barriers of Design, Sourcing, and Time

At Kollmorgen, we know that OEM engineers can achieve a lot more when obstacles aren't in the way. So, we clear obstacles in three important ways:

Integrating Standard and Custom Products

The optimal solution is often not clear-cut. Our application expertise allows us to modify standard products or develop totally custom solutions across our whole product portfolio so that designs can take flight.

Providing Motion Solutions, Not Just Components

As companies reduce their supplier base and have less engineering manpower, they need a total system supplier with a wide range of integrated solutions. Kollmorgen offers complete solutions as well as motion subsystems that combine programming software, engineering services and best-in-class motion components.

Global Footprint

With direct sales, engineering support, manufacturing facilities, and distributors spanning the Americas, Europe, Middle East, and Asia, we're close to OEMs worldwide. Our proximity helps speed delivery and lend support where and when they're needed.

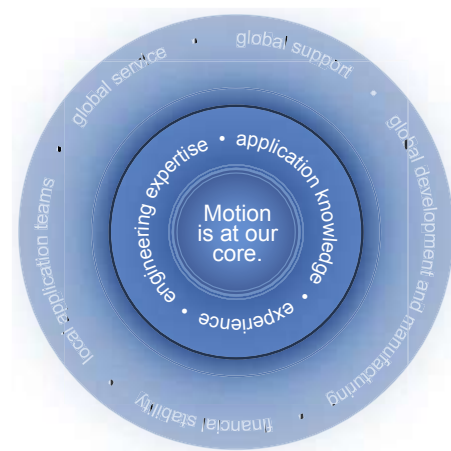
Financial and Operational Stability

Kollmorgen is part of Fortive. A key driver in the growth of all Fortive divisions is the Fortive Business System, which relies on the principle of "kaizen" – or continuous improvement. Using world-class tools, cross-disciplinary teams of exceptional people evaluate processes and develop plans that result in superior performance.

Kollmorgen: Your partner. In Motion.

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Direct Drive Rotary Motors

Conventional servo systems commonly have a mechanical transmission which can consist of gears, gearboxes, belts/pulleys or cams connected between the motor and the load. With Direct Drive Rotary Motors, the mechanical transmission is eliminated and the motor is coupled directly to the load.

Why Use Direct Drive Rotary Motors?

Increased Accuracy and Repeatability

A “precision” planetary gearbox could have a backlash of 1 arc-minute. This can result in the load moving by 1 arc-minute with an absolutely stationary drive motor. Kollmorgen’s standard direct drive rotary (DDR) servo motors have repeatability better than 1 arc-second. Therefore, a direct drive motor can hold a position 60 times better than a conventional motor/gearbox.

The increased accuracy of direct drive rotary motors results in a higher quality product out of the machine:

- Print registration is more accurate
- Cut or feed lengths can be held more precisely
- Coordination with other machine axes is more accurate
- Indexing location is more exact
- Tuning issues due to backlash are eliminated

Higher Bandwidth

Mechanical transmission components impose a limit on how fast a machine can start and stop and also extend the required settling time. These factors limit the possible throughput of a machine.

Direct drive rotary motors remove these limitations and allows for much faster start/stop cycles and also provide greatly reduced settling time. Users of direct drive systems have reported up to a 2X increase in throughput.

Improved Reliability and Zero Maintenance

Gears, belts, and other mechanical transmission parts break. By eliminating these parts and using DDR motors, the reliability of the machine is improved. Gearboxes require periodic lubrication and/or replacement in aggressive start/stop applications. Belts require periodic tightening. There are no time-wear components in a direct drive motor and consequently they require zero maintenance.

Fewer Parts

With direct drive motors, all you need is the motor and the mounting bolts. This often replaces many parts including brackets, guards, belts, pulleys, tensioners, couplings, and bolts, resulting in:

- Fewer parts on the BOM. Less parts to purchase, schedule, inventory and control, and less parts to assemble.
- Assembly time of the servo drops from several hours with the mechanical transmission to several minutes with the DDR.
- Reduced cost. Although a direct drive motor may carry a small price-premium compared to a motor/gearbox with the same torque, consider that there is an overall cost reduction when eliminating the parts and labor of all the extra components required in a servo system with mechanical transmission.

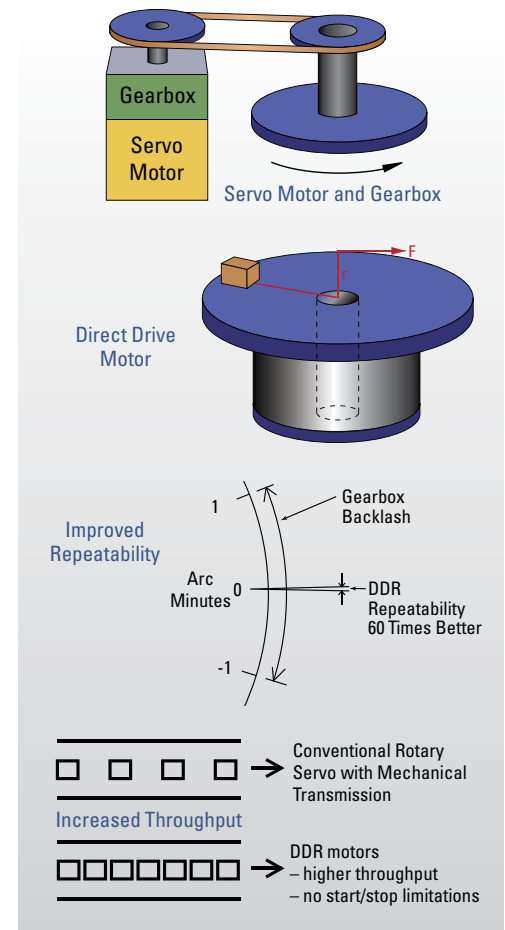
No Inertia Matching

Servo systems with mechanical transmissions require inertia matching that limits the reflected load inertia at 5 to 10 times the motor inertia. If this limitation is not met, the system becomes difficult to control due to instability issues. Inertia matching limitations of mechanical transmission systems often force machine designers to use a larger motor than would otherwise be required just to satisfy the inertia matching requirement.

Such sizing conventions are not required with direct drive rotary motors. Since the motor is directly connected to the load, the inertia of the motor and the load become a common inertia. Therefore, no inertia matching is required when using DDR. DDR applications have run with inertia ratios greater than 11,000:1.

Reduced Audible Noise

Machines with DDR motors have audible noise levels as low as 20 dB less than the same machine with a mechanical transmission.



Which DDR Product is Right for Your Application?

Kollmorgen's 70 years of electromagnetic and electromechanical design experience combined with our quality and service, allowed us to refine and expand DDR motors into three product categories for easy installation, use, and short lead times: Frameless DDR, Housed DDR, and the Cartridge DDR™. This allows you to select the right DDR solution for your application.

Applications where the load rides on the motor's bearings such as indexing or rate tables



Cartridge DDR Motor

This motor is the first in the industry to combine the space-saving and performance advantages of Frameless DDR motors with the ease of installation of a full-frame motor. Consisting of a rotor, stator, and factory-aligned high-resolution feedback device, the motor uses the machine's bearings to support the rotor. An innovative compression coupling engages the rotor to the load and the frame of the motor mounts to the machine with a bolt circle and pilot diameter just like a conventional servo motor, saving space and design time and simplifying the overall system.

Any application with existing bearings

Housed DDR Motor

The Housed DDR is a housed motor assembly featuring a factory aligned high-resolution feedback device and precision bearings, allowing it to function as the core of rotary indexing and rate table applications. The system can also be used as a flexible indexer, providing programmable, rapid indexing far exceeding the throughput and accuracy of conventional mechanical or variable reluctance indexers.



Applications where size and weight must be absolutely minimized



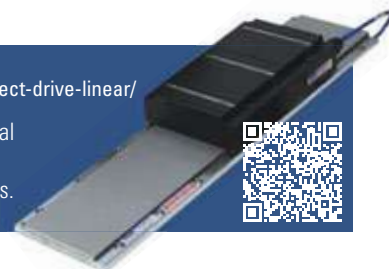
Frameless DDR Motors

Frameless motors include a rotor and stator as separate components which are integrated into, ride on the bearings of, and become a part of the driven load. Frameless motors offer the most compact and lightweight DDR solution available. The KBM™ and TBM series are Kollmorgen's Frameless DDR products. The KBM provides excellent torque/volume with the use of a proprietary neodymium-iron magnet rotor structure and skewed armature assembly. The KBM series is the first UL recognized parts set available on the market. This provides OEMs with the benefits of UL component ratings for easier agency approval on their machines. The TBM frameless motor is a series of direct drive torque motors designed for applications that require high power in a small, compact form factor with minimized weight and inertia.

Need a Solution for Linear Motion Applications?

Direct Drive Linear (DDL) Motor <http://www.kollmorgen.com/en-us/products/motors/direct-drive/direct-drive-linear/>

Directly coupling a linear motor to the driven load offers many advantages, including eliminating all mechanical transmissions, such as ball/lead screws, rack & pinions, belts/pulleys, and eliminating gearboxes. This in turn also eliminates backlash and compliance, and other problems associated with these mechanical transmissions.



Housed Direct Drive Rotary (DDR) Motor

Our Housed Direct Drive Rotary (DDR) motor series offer a high performance, zero maintenance servo solution. They achieve very high torque density through the combination of large diameter, short length, and a high number of magnetic poles.

By pairing the Housed DDR motor series with our wide range of plug-and-play Ethernet-based AKD[®] servo drives, you can optimize performance and increase the machine's overall effectiveness. The DDR motor can be used as a flexible indexer, providing programmable, rapid, indexing far exceeding the throughput of conventional mechanical or variable reluctance technology indexers. It can also be used for replacing mechanical transmissions such as gearboxes, timing belts, and rack and pinion reducers.

The Benefits of Housed DDR Motor

-
- Zero Maintenance with Greater Accuracy and Higher Bandwidth
 - Smoother velocity and reduced, audible noise
 - Power transmission without backlash
 - Transmission elements such as couplings, toothed belts, spindles, and other fitted components can be eliminated
 - No gearboxes, no lubrication required
-
- Wide Range of Sizes and Torque to Cover any Direct Drive Rotary (DDR) Application
 - Increased performance for the entire system
 - Flat, compact drive solution
 - Easily mix / match motors and drives (without serial numbers)
 - Speeds up to 800 rpm for continuous velocity applications
-
- Simplified, High Torque Density Permanent Magnet Design
 - Provides more speed and torque vs. variable reluctance motors
 - Rapid indexing of large inertia loads with peak torque up to 990 lb-ft
 - Carry heavy loads for indexing with axial loading up to 12,700 lbs
 - Operate motor with significant offset loads up to 472 lb-ft
 - Large through bore providing run process fluids, pneumatic, and electrical through center of motor
 - Reduced audible noise, fewer parts and lower cost of ownership
 - More compact machine and reduced design time

Housed Direct Drive Rotary (DDR) Motor



Housed DDR Features

- 4 frame sizes
- Robust cross-roller bearing
- Dual bearing option
- IP67 option
- Continuous torque range: 5.8 Nm (4.3 lb-ft) to 339 Nm (250 lb-ft)
- Optimized torque output with high-pole count efficient electromagnetic design
- Integrated high-resolution sine-encoder
- 134,217,728 counts per rev resolution, 27 bits
- Feedback accuracy: +/- 26 arc-sec
- Repeatability better than 1 arc second

Housed DDR Motor Advantage

Consider how a Housed DDR motor improved a medical manufacturing machine.

Product is located at the steel pins on the outside of the machine's turret as shown. The 115 kg load wheel has an inertia of 20 kg-m². There are 96 steel pins for an index angle of 3.5 degrees to move.

The move is accomplished in less than 100 ms.

Housed DDR Benefits

- Transmission elements such as couplings, toothed belts, spindles, and other fitted components can be eliminated
- Mechanical design is made much simpler
- Power transmission without backlash
- More compact machinery assemblies
- Increased performance for the entire system

Housed DDR motors are multi-pole (16 to 32) hollow shaft motors with their own bearings and high-resolution encoder system. They are coupled directly to the load and enable very precise and repeatable systems. Housed DDR motors are maintenance free and run more quietly and with better dynamics than systems that use gears, belts, cams or other mechanical transmission components.

Realized Housed DDR Motor Benefits

The Direct Drive Advantage

The following improvements were observed compared to the previous design that used a mechanical indexer:



Improved Repeatability

The Housed DDR motor demonstrated a repeatability better than 1 arc-second which was substantially better than the mechanical indexer.

No Degradation

Direct drive system performance, accuracy and repeatability do not degrade over time as they do with a mechanical indexer. With a mechanical indexer, as parts wear over time, the accuracy and repeatability degrade.

Immediate Stop

The direct drive system can immediately stop if there is a process error. The mechanical indexer required several cycles to stop which could cause tooling and machine damage.

Greatly Reduced Audible Noise

With the mechanical indexer, the noise was at a level such that two people would have to yell to hear each other. By contrast, if you turned your back to the Housed DDR motor, you could barely detect that it was running.

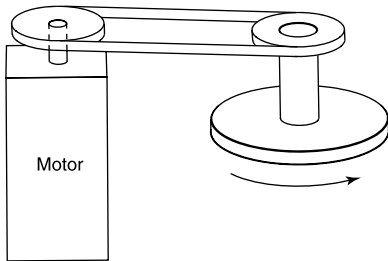
Easy Profile Change

Motion parameters such as index angle, speed, acceleration, and dwell are very simple to change with the Housed DDR motor. The mechanical indexer does not support flexible motion profiles.

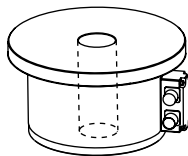
Better Value

The Housed DDR motor is attractively priced compared to the mechanical indexer it replaced. When the other advantages listed above are also considered, the Housed DDR motor was the obvious choice.

Application Problem



Solution

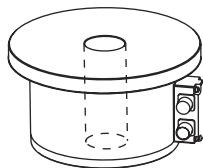
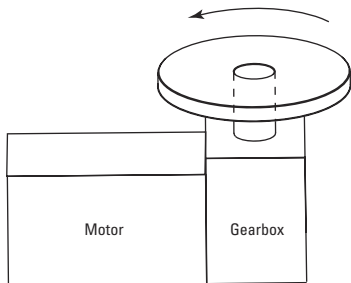


DDR

Benefits

Belt/pulley

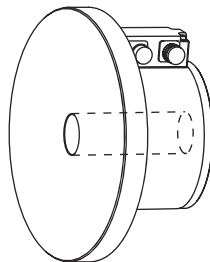
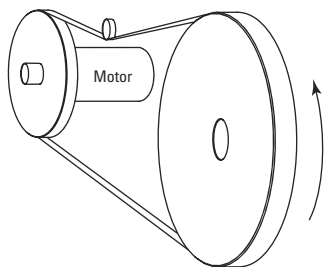
- Zero maintenance
- No belt adjustment/replacement
- No belt compliance
- Better servo performance
- Clean mechanical assembly
- Flat profile
- Quiet
- Reduced number of parts
- Hollow shaft



DDR

Gearmotors/right angle/in-line

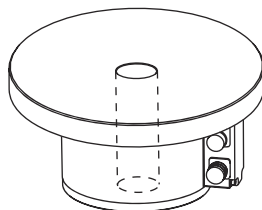
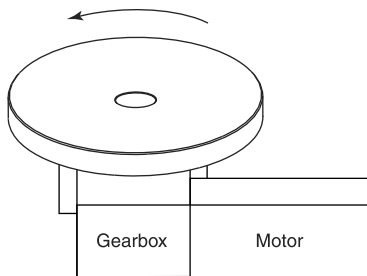
- Zero maintenance
- No gearbox lubrication
- No gearbox backlash
- Better servo performance
- Flat profile
- Quiet
- Hollow shaft



DDR

Large Vertical Wheel

- Zero maintenance
- No belt adjustment/replacement
- No belt compliance
- Better servo performance
- Faster index times
- Clean mechanical assembly
- Quiet
- Reduced number of parts
- Hollow shaft



DDR

Rotary Indexer

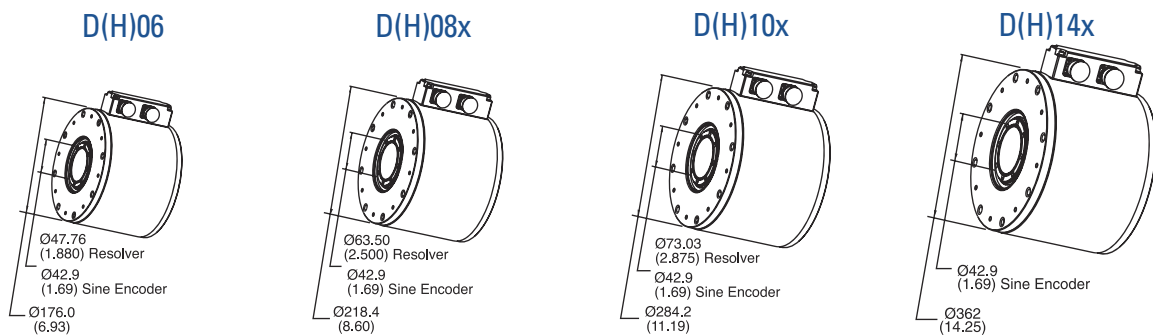
- Zero maintenance
- No gearbox lubrication
- No gearbox backlash
- Better servo performance
- Quiet
- Reduced number of parts
- Hollow shaft

Housed DDR Motor System Summary

		AKD Servo Drive			Performance					
		AKD-■0060X	AKD-■0120X	AKD-■0240X	Continuous Torque ¹		Peak Torque		Maximum Speed	
					Nm	lb-ft	Nm	lb-ft	RPM	
Housed DDR Motors	240 Volt Systems	D061	x		5.3	3.9	16.9	12.5	500	
		D062	x		9.8	7.2	33.5	24.7	500	
		D063	x		17.7	13.1	64.4	47.5	500	
		D081	x		15.9	11.7	45.0	33.2	500	
		D082	x		25.9	19.1	92.2	68.0	300	
		D083	x		50.4	37.2	160	118	250	
		D101	x		34.6	25.5	129	95.0	300	
		D102	x		63.4	46.7	227	167	200	
		D103		x	115	85.0	501	370	120	
		D141		x	108	80.0	367	271	200	
		D142		x	183	135	519	383	120	
		D143			x	339	250	1341	989	60
		Housed DDR Motors	400 / 480 Volt Systems	DH061	x		5.3	3.9	16.9	12.5
DH062	x				9.8	7.2	33.5	24.7	800	
DH063	x				17.7	13.1	64.4	47.5	800	
DH081	x				15.9	11.7	45.0	33.2	500	
DH082	x				25.9	19.1	92.2	68.0	500	
DH083	x				50.4	37.2	160	118	500	
DH101	x				34.6	25.5	129	95.0	300	
DH102	x				63.4	46.7	227	167	300	
DH103				x	115	85.0	501	370	250	
DH141				x	108	80.0	367	271	300	
DH142				x	183	135	519	383	300	
DH143					x	339	250	1341	989	120

Note 1: Continuous torque with sine encoder feedback. For continuous torque with resolver feedback, see the Performance Data Table.

Motor Outside / Inside Diameters by Model

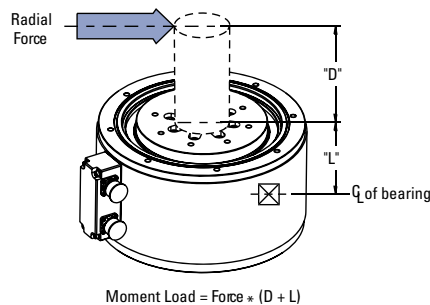
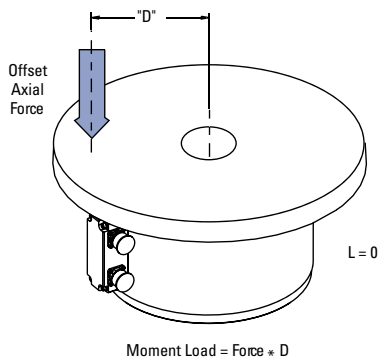
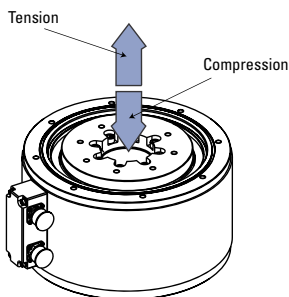


Model	Maximum Moment Load				Maximum Axial Load Ratings		
	Single Bearing		Dual Bearing		lbs	kg	
	lb-ft	N-m	lb-ft	N-m			
D061	53.3	72.3	71.7	97.2	Compression Tension	4500 932	2040 423
D062	47.5	64.4	79.5	108			
D063	43.4	58.9	87.2	118			
D081	62.6	84.9	114	154	Compression Tension	7400 819	3360 371
D082	52.3	70.9	131	177			
D083	39.3	53.3	174	236			
D101	142	192	322	437	Compression Tension	11700 1405	5300 637
D102	108	146	279	378			
D103	72.6	98.4	305	413			
D141	234	317	472	640	Compression Tension	11700 1405	5300 637
D142	134	182	409	555			
D143	N/A	N/A	391	530			

Application Notes:

1. Axial load rating dynamic values based on an L_{10} life rating when motor is mounted on a rigid base and running under normal operation conditions. L_{10} life ratings for applications where high rotational accuracy is desired or operation during vibration or shock, please contact customer support at (540) 633-3545, or through email at support@kollmorgen.com.
2. Standard motor is not designed for repetitive small angle oscillations less than $\pm 13^\circ$. Please contact customer support for additional options.
3. Motor is not intended to be directly coupled to a load which has its own two bearing system.
4. Motor may be mounted in any orientation provided the axial (both tension and compression) limits are observed. All applications having moment loads in tension should be reviewed by Customer Support.
5. All bolts for mounting load and base should be used to ensure stiff coupling.

Model	Dim. "L" (in)
D(H)06x	(1.05)
D(H)08x	(1.21)
D(H)10x	(1.58)
D(H)14x	(1.44)

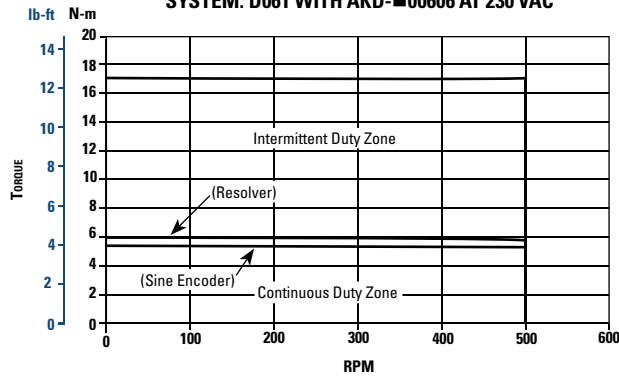


Housed DDR D06X Performance Data

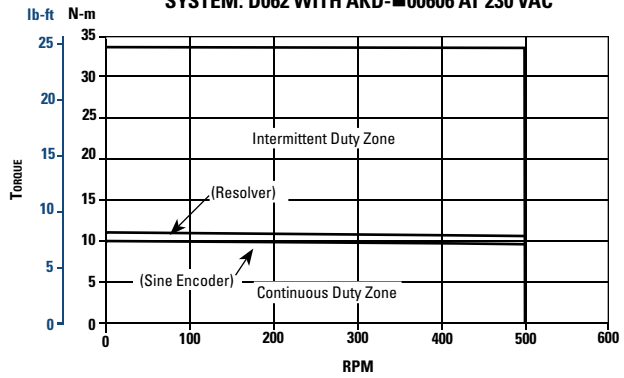
230 VAC

System Performance:		Symbols	Units	D061A/D061M	D062A/D062M	D063A/D063M
Peak Torque		T _p	lb-ft (N-m)	12.5 (16.9)	24.7 (33.5)	47.5 (64.4)
Continuous ¹ Torque 40°C	Sine Encoder	T _c	lb-ft (N-m)	3.9 (5.3)	7.2 (9.8)	13.1 (17.7)
	Resolver	T _c	lb-ft (N-m)	4.3 (5.8)	8.0 (10.8)	14.5 (19.7)
Max. Operating Speed		N max	rpm (rps)	500 (8.3)	500 (8.3)	500 (8.3)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±2.4	±2.4	±2.4
	Accuracy	-	arc/sec	±270	±270	±270
Mechanical:						
Weight		W _t	lb kg	20.8 (9.4)	25.0 (11.3)	30.5 (13.8)
Rotor Inertia		J _m	lb-ft-sec ² (kg-m ²)	0.0045 (0.0061)	0.0052 (0.0071)	0.0064 (0.0086)
Static Friction Adder for Sealed Units		T _f	lb-ft (N-m)	1.8 (2.4)	1.8 (2.4)	1.8 (2.4)
Max. Dynamic Axle Compression Load (See page 11 for Details)		-	lbf (kg)	4,500 (2,040)	4,500 (2,040)	4,500 (2,040)

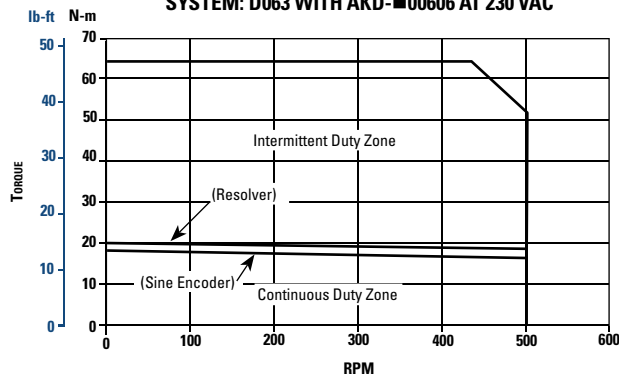
SYSTEM: D061 WITH AKD-00606 AT 230 VAC



SYSTEM: D062 WITH AKD-00606 AT 230 VAC



SYSTEM: D063 WITH AKD-00606 AT 230 VAC

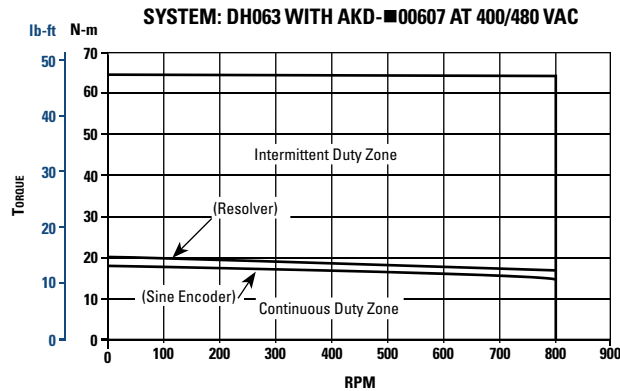
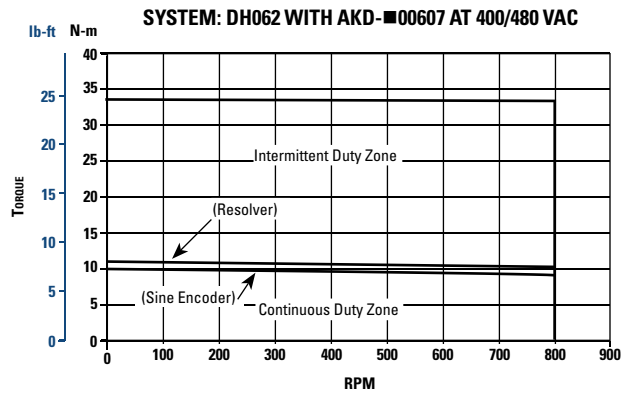
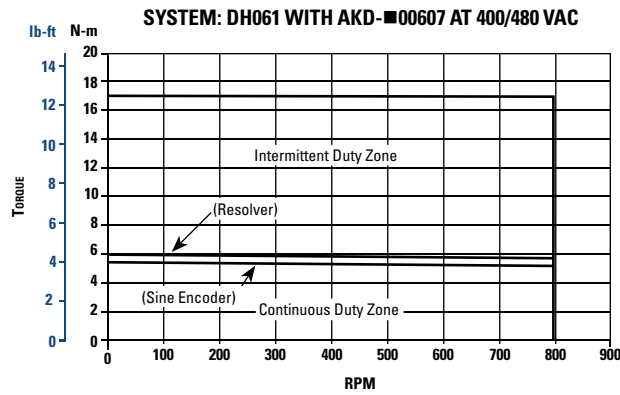


Notes:

- For 25°C ambient, multiply T_c by 1.06.
- Curves for 230 V applicable to single or three phase input power.

400/480 VAC

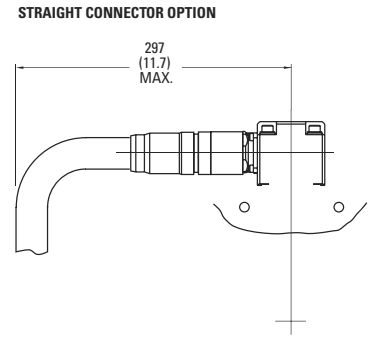
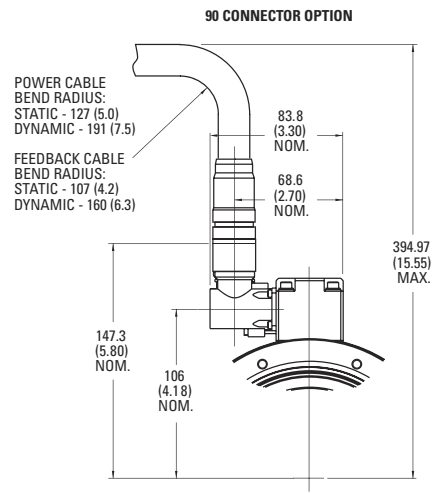
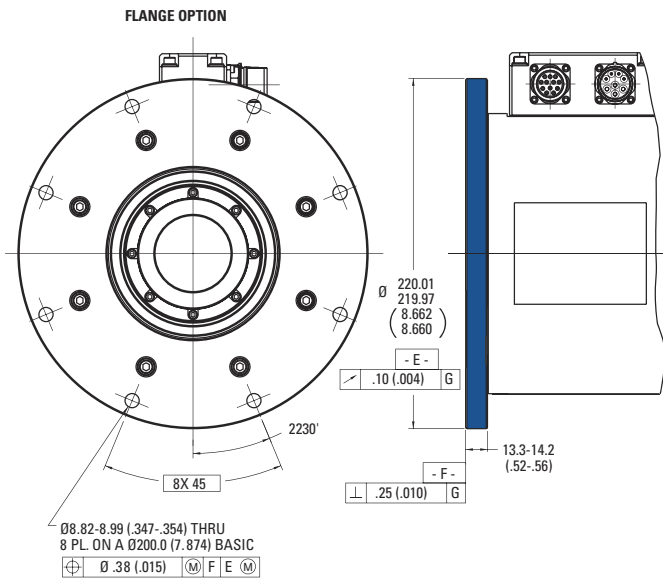
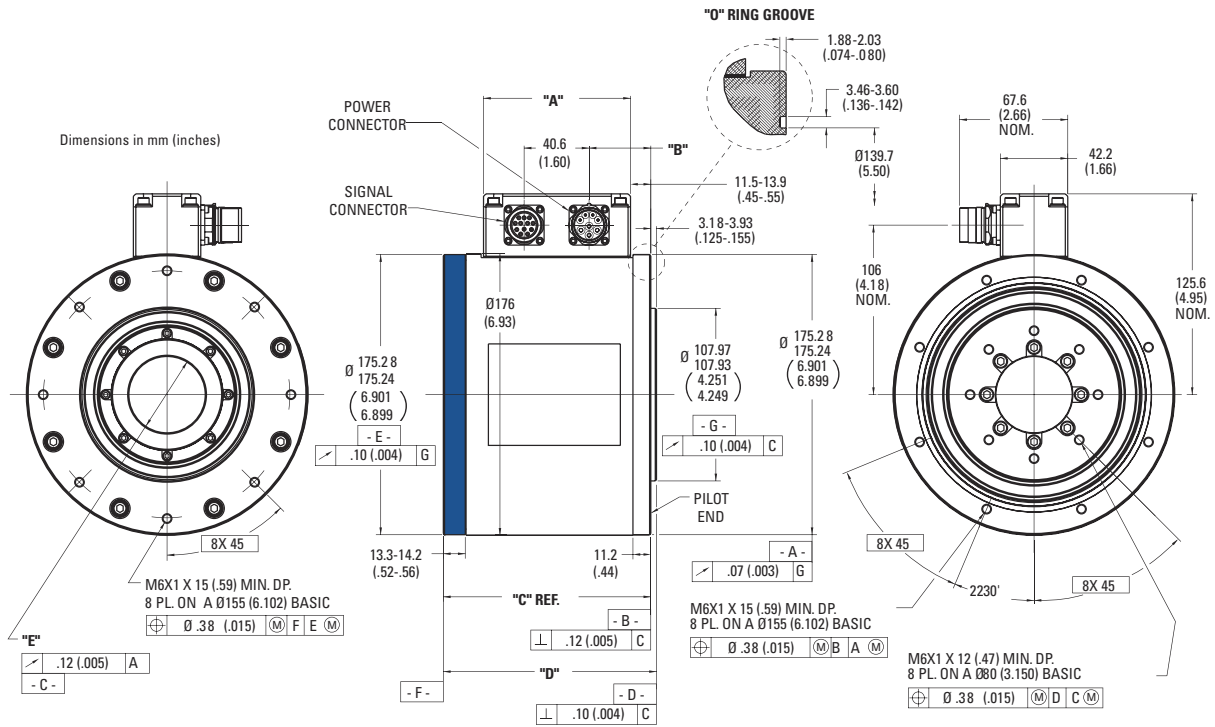
System Performance:		Symbols	Units	DH061A/DH061M	DH062A/DH062M	DH063A/DH063M
Peak Torque		Tp	lb-ft (N-m)	12.5 (16.9)	24.7 (32.8)	47.5 (64.4)
Continuous ¹ Torque 40°C	Sine Encoder	Tc	lb-ft (N-m)	3.9 (5.3)	7.2 (9.8)	13.1 (17.7)
	Resolver	Tc	lb-ft (N-m)	4.3 (5.8)	8.0 (10.8)	14.5 (19.7)
Max. Operating Speed 400/480 V 3 Phase		N max	rpm (rps)	800 (13.3)	800 (13.3)	800 (13.3)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±10	±10	±10
	Accuracy	-	arc/sec	±270	±270	±270
Mechanical:						
Weight		Wt	lb (kg)	20.8 (9.4)	25.0 (11.3)	30.5 (13.8)
Rotor Inertia		Jm	lb-ft-sec ² (kg-m ²)	0.0045 (0.0061)	0.0052 (0.0071)	0.0064 (0.0086)
Static Friction Adder for Sealed Units		Tf	lb-ft (N-m)	1.8 (2.4)	1.8 (2.4)	1.8 (2.4)
Max. Dynamic Axel Compression Load (See Page 11 For Details)		-	lbf (kg)	4,500 (2,040)	4,500 (2,040)	4,500 (2,040)



Notes:
1. For 25°C ambient, multiply by 1.06.

Housed DDR D06X Outline Drawings

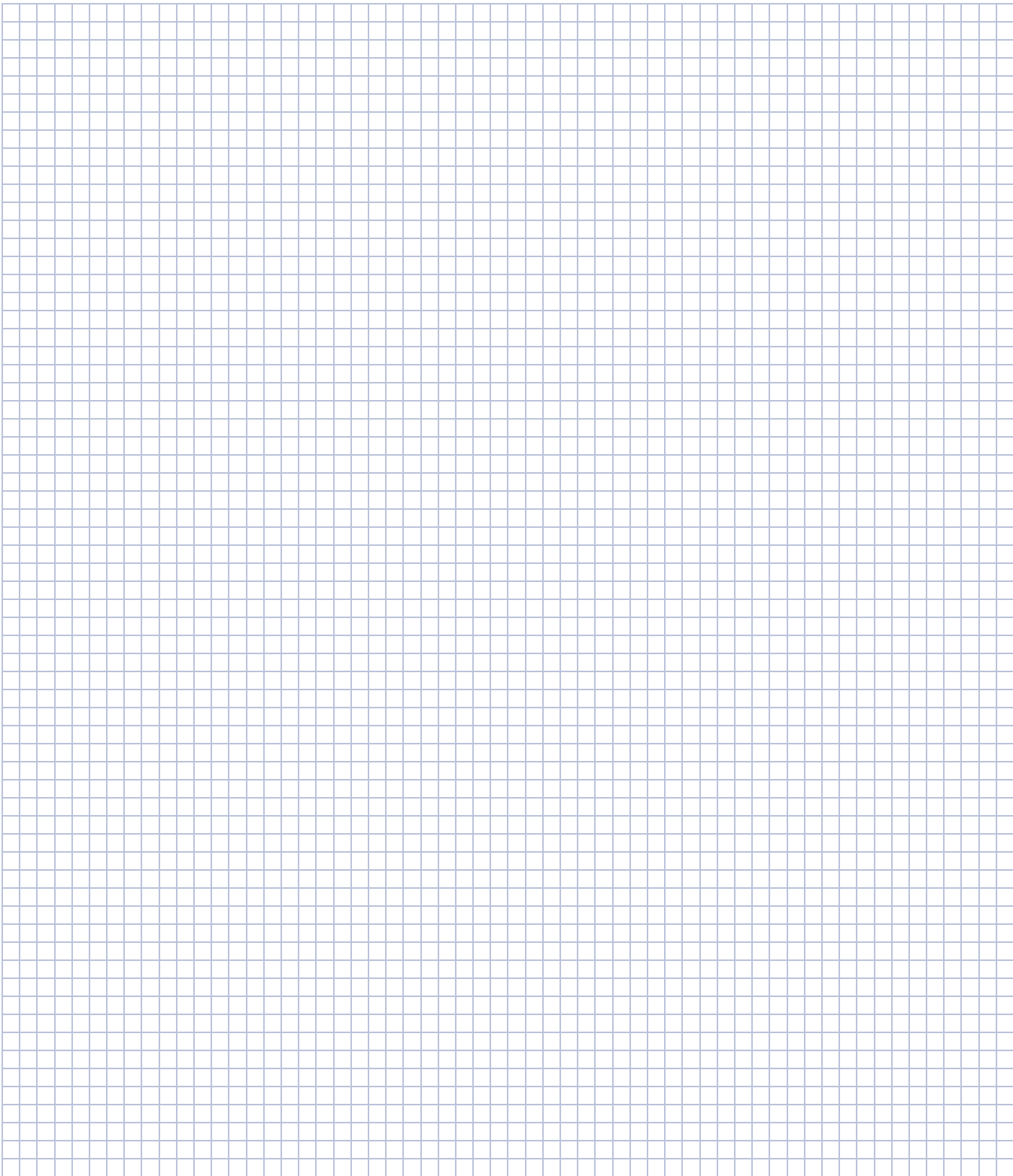
HOUSED DDR 06X OUTLINE DRAWINGS



Model	"A"	"B"	"C"	"D"	"E"	
D061	91.9 (3.62)	37.1-40.1 (1.46-1.58)	129.42-130.171 (5.095-5.125)	132.59-134.11 (5.220-5.280)	Resolver	Sine Encoder
D062	103.4 (4.07)	48.6-51.5 (1.91-2.03)	140.85-141.601 (5.545-5.575)	144.02-145.54 (5.660-5.730)	Ø47.71-47.80 (1.878-1.882)	Ø42.88-42.98 (1.688-1.692)
D063	126.2 (4.97)	71.4-74.4 (2.81-2.93)	163.71-164.46 (6.445-6.475)	166.88-168.40 (6.570-6.630)		

Note: Dimensions "C" and "D" increase by 7.90mm (0.311") on sine encoder models with IP65 or IP67 seals.

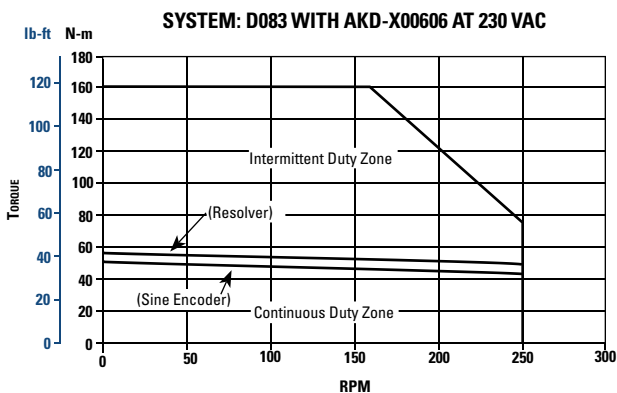
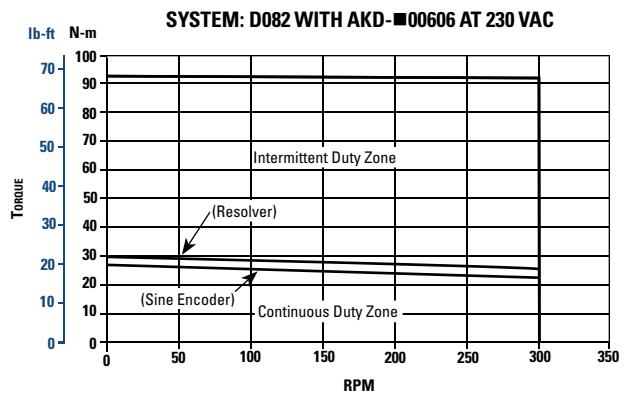
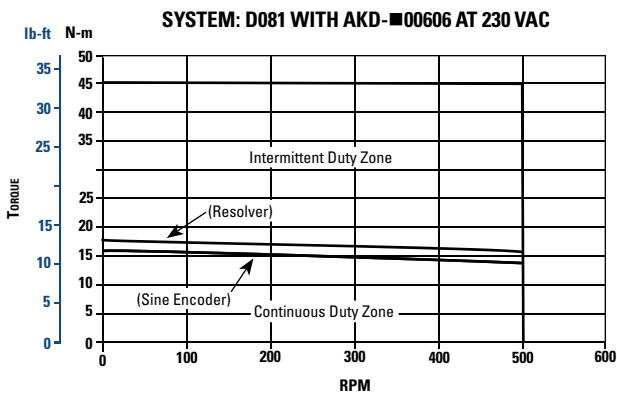
Notes



Housed DDR D08X Performance Data

230 VAC

System Performance:		Symbols	Units	D081A/D081M	D082A/D082M	D083A/D083M
Peak Torque		T _p	lb-ft (N-m)	33.2 (45.0)	68.0 (92.2)	118 (160)
Continuous ¹ Torque 40°C	Sine Encoder	T _c	lb-ft (N-m)	11.7 (15.9)	19.1 (25.9)	37.2 (50.4)
	Resolver	T _c	lb-ft (N-m)	13.0 (17.6)	21.2 (28.7)	41.3 (56.0)
Max. Operating Speed		N max	rpm (rps)	500 (8.3)	300 (5.0)	250 (4.2)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±2.4	±2.4	±2.4
	Accuracy	-	arc/sec	±140	±140	±140
Mechanical:						
Weight		Wt	lb (kg)	39.5 (17.9)	47.5 (21.5)	63.6 (28.8)
Rotor Inertia		J _m	lb-ft-sec ² (kg-m ²)	0.0106 (0.0144)	0.0143 (0.0194)	0.0222 (0.0301)
Static Friction Adder for Sealed Units		T _f	lb-ft (N-m)	2.0 (2.7)	2.0 (2.7)	2.0 (2.7)
Max. Dynamic Axle Compression Load (See page 11 for details)		-	lbf (kg)	7,400 (3,360)	7,400 (3,360)	7,400 (3,360)

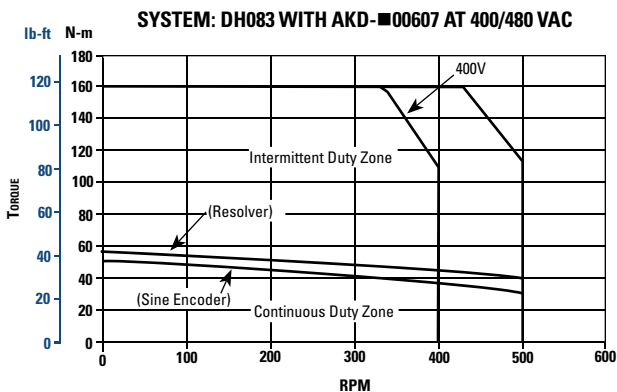
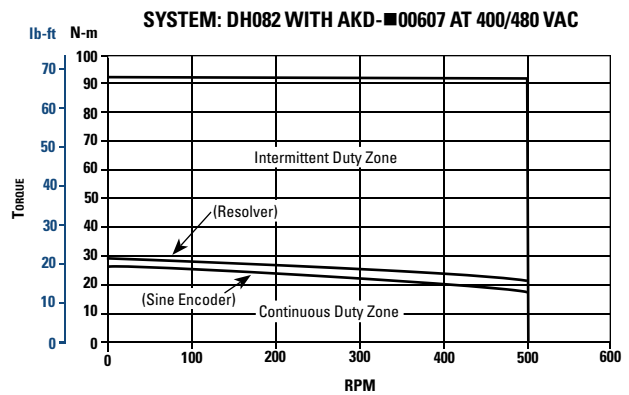
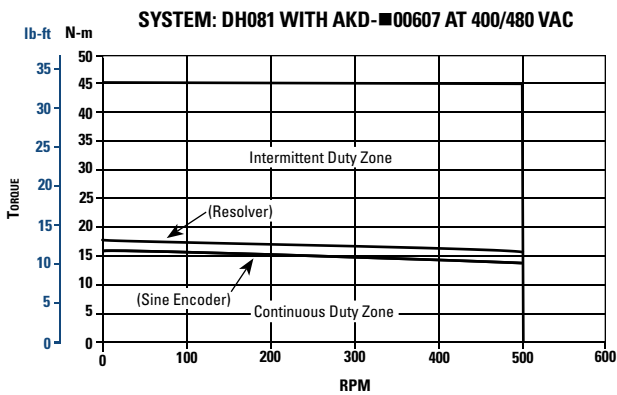


Notes:

1. For 25°C ambient, multiply T_c by 1.06.
2. Curves for 230 V applicable to single or three phase input power.

400/480 VAC

System Performance:		Symbols	Units	DH081A/DH081M	DH082A/DH082M	DH083A/DH083M
Peak Torque		Tp	lb-ft (N-m)	33.2 (45.0)	68.0 (92.2)	118 (160)
Continuous ¹ Torque 40°C	Sine Encoder	Tc	lb-ft (N-m)	11.7 (15.9)	19.1 (25.9)	37.2 (50.4)
	Resolver	Tc	lb-ft (N-m)	13.0 (17.6)	21.2 (28.7)	41.3 (56.0)
Max. Operating Speed 400/480 V 3 Phase		N max	rpm (rps)	500 (8.3)	500 (8.3)	400/500 (6.7/8.3)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±2.4	±2.4	±2.4
	Accuracy	-	arc/sec	±140	±140	±140
Mechanical:						
Weight		Wt	lb (kg)	39.5 (17.9)	47.5 (21.5)	63.6 (28.8)
Rotor Inertia		Jm	lb-ft-sec ² (kg-m ²)	0.0106 (0.0144)	0.0143 (0.0194)	0.0222 (0.0301)
Static Friction Adder for Sealed Units		Tf	lb-ft (N-m)	2.0 (2.7)	2.0 (2.7)	2.0 (2.7)
Max. Dynamic Axle Compression Load (See Page 11 for Details)		-	lbf (kg)	7,400 (3,360)	7,400 (3,360)	7,400 (3,360)

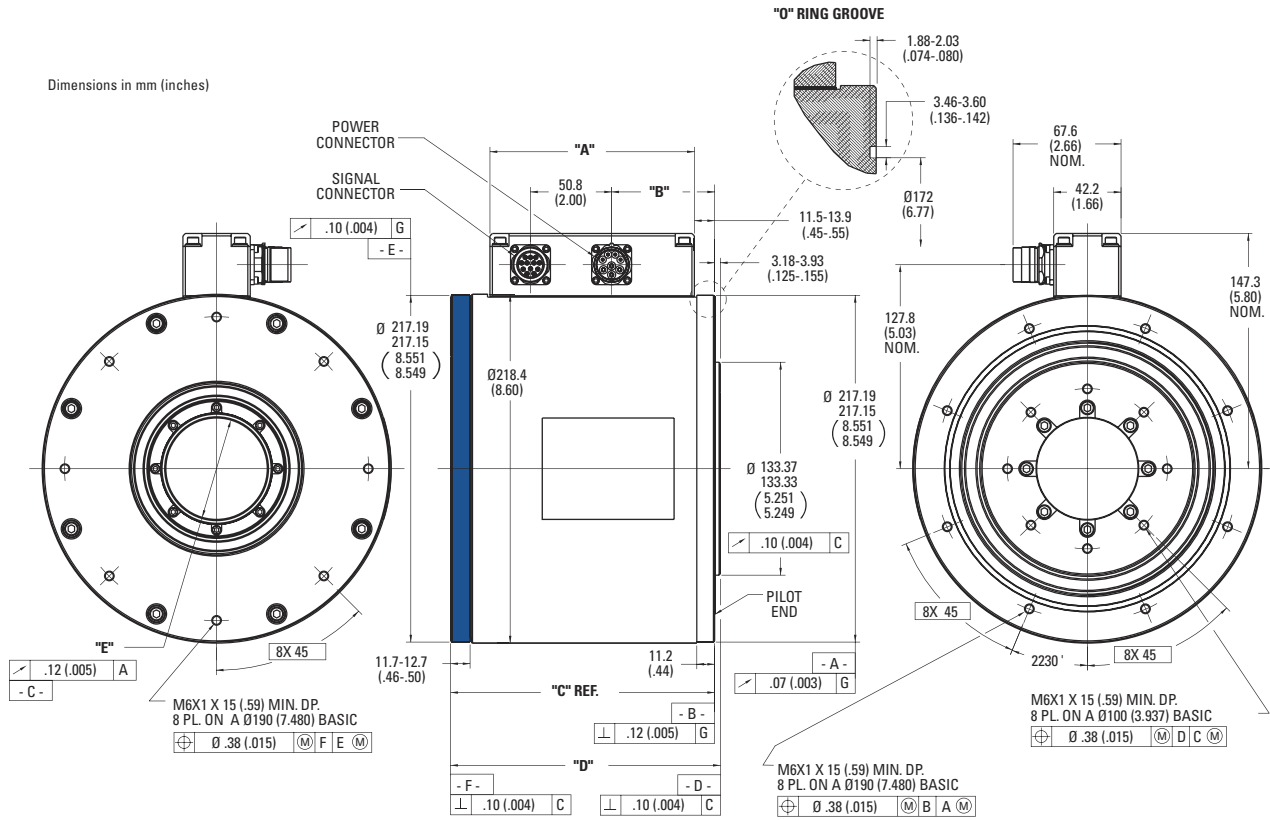


Notes:
1. For 25°C ambient, multiply by 1.06.

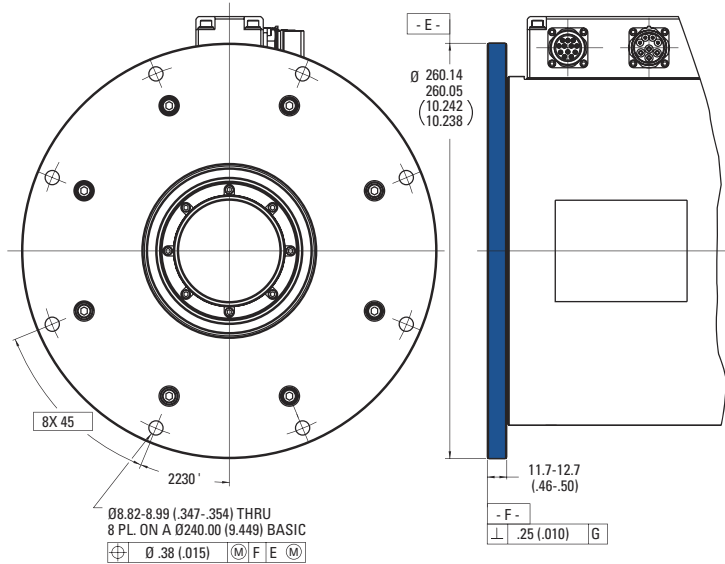
Housed DDR D08X Outline Drawings

HOUSED DDR D08X OUTLINE DRAWINGS

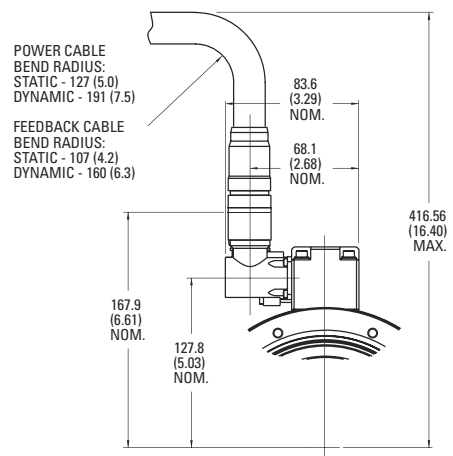
Dimensions in mm (inches)



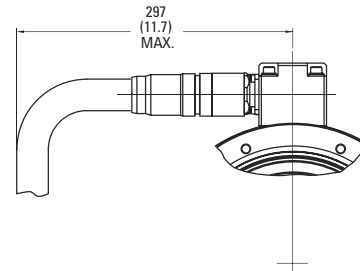
FLANGE OPTION



90 CONNECTOR OPTION



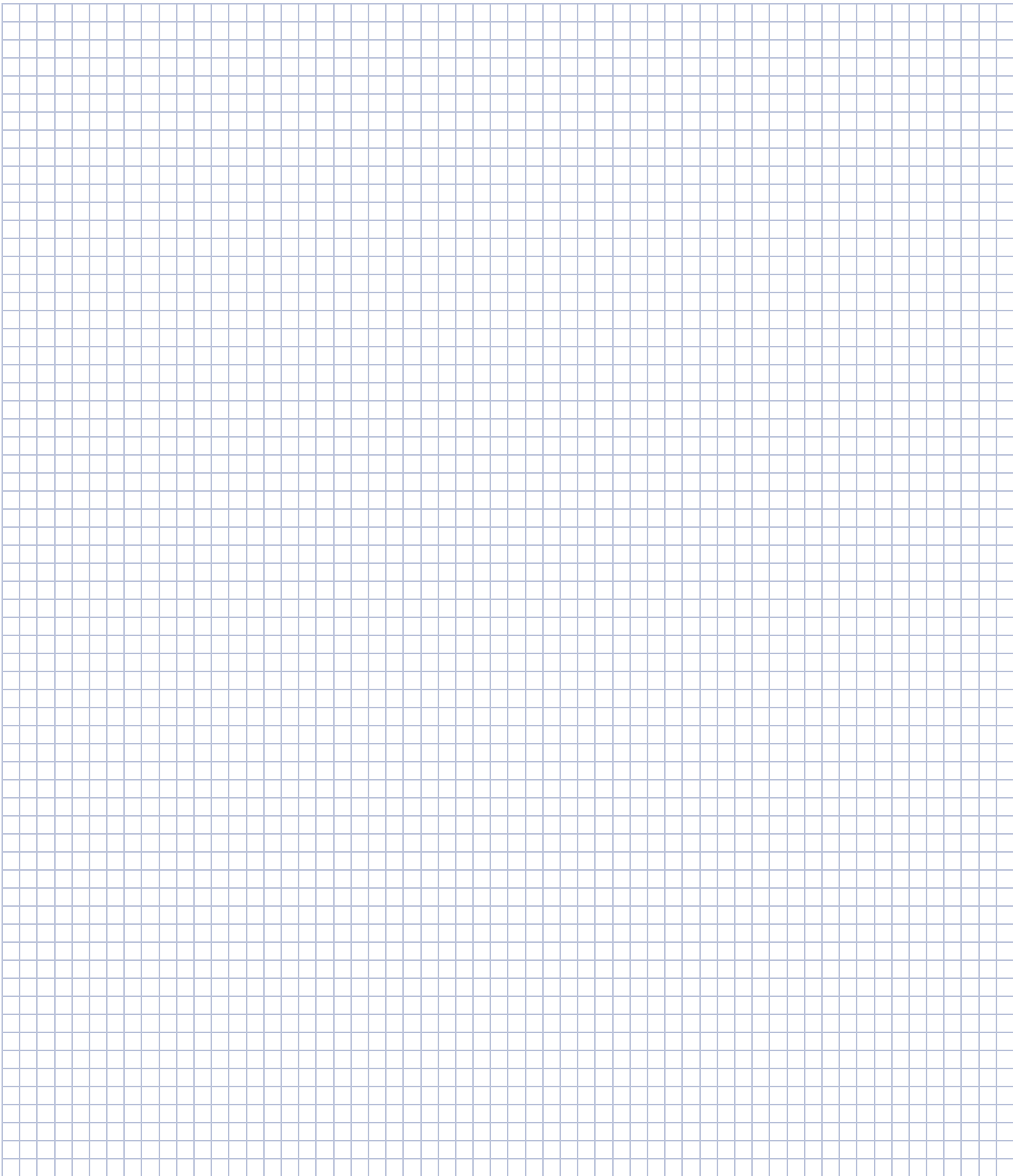
STRAIGHT CONNECTOR OPTION



Model	"A"	"B"	"C"	"D"	"E"	
D081	107.7 (4.24)	42.7-45.7 (1.68-1.80)	144.66-145.41 (5.695-5.725)	147.83-149.35 (5.820-5.880)	Resolver	Sine Encoder
D082	128.0 (5.04)	63.0-66.0 (2.48-2.60)	164.98-165.73 (6.495-6.525)	168.15-169.67 (6.620-6.680)	Ø63.45-63.55 (2.498-2.502)	Ø42.88-42.98 (1.688-1.692)
D083	168.7 (6.64)	71.4-74.4 (4.08-4.20)	163.71-164.46 (8.095-8.125)	166.88-168.40 (8.220-8.280)		

Dimensions "C" and "D" increase by 8.64mm (0.340") on sine encoder models with IP65 or IP67 seals.

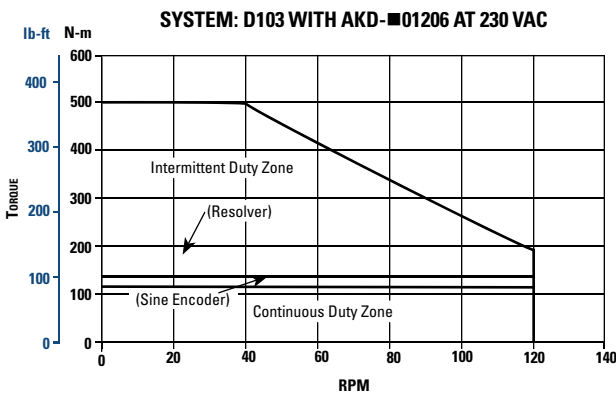
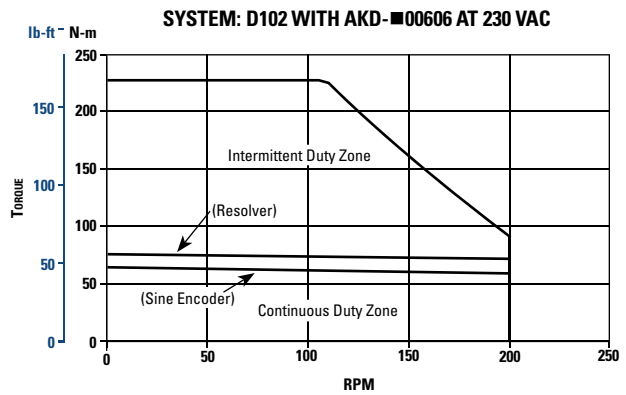
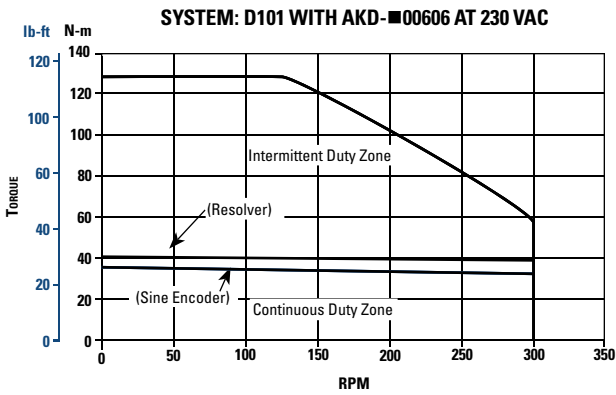
Notes



Housed DDR D10X Performance Data

230 VAC

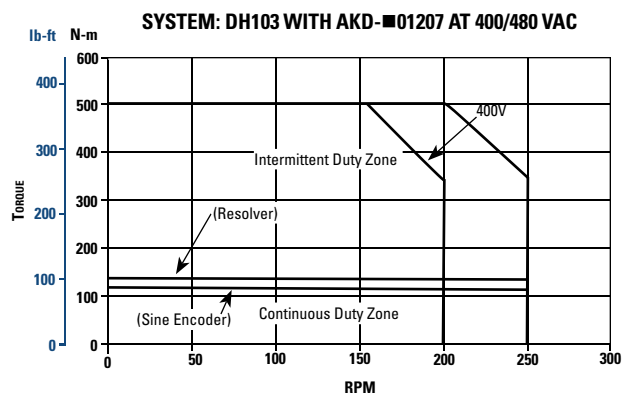
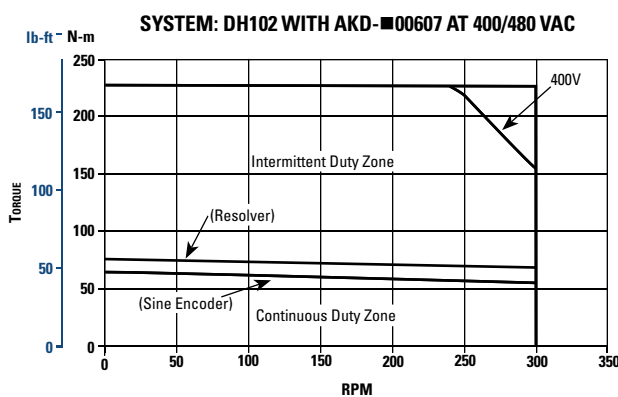
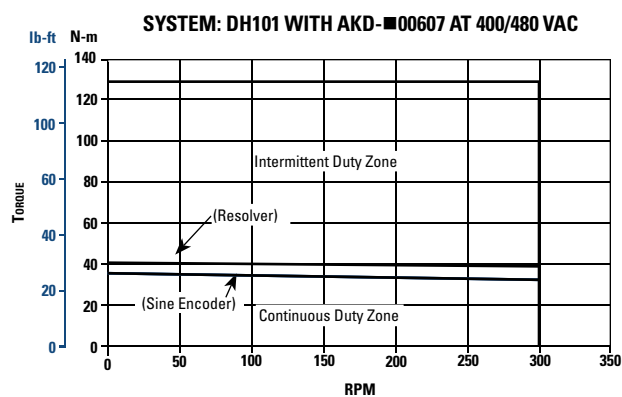
System Performance:		Symbols	Units	D101A/D101M	D102A/D102M	D103A/D103M
Peak Torque		Tp	lb-ft (N-m)	95.0 (129)	167 (227)	370 (501)
Continuous ¹ Torque 40°C	Sine Encoder	Tc	lb-ft (N-m)	25.5 (34.6)	46.8 (63.4)	85.0 (115)
	Resolver	Tc	lb-ft (N-m)	30.0 (40.7)	55.0 (74.6)	100 (136)
Max. Operating Speed		N max	rpm (rps)	300 (5.0)	200 (3.3)	120 (2.0)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±2.4	±2.4	±2.4
	Accuracy	-	arc/sec	±135	±135	±135
Mechanical:						
Weight		Wt	lb (kg)	69.5 (31.5)	96.5 (43.8)	134 (60.8)
Rotor Inertia		Jm	lb-ft-sec ² (kg-m ²)	0.0511 (0.0693)	0.0732 (0.0992)	0.129 (0.175)
Static Friction Adder for Sealed Units		Tf	lb-ft (N-m)	2.6 (3.5)	2.6 (3.5)	2.6 (3.5)
Max. Dynamic Axle Compression Load (See Page 11 for Details)		-	lbf (kg)	11,700 (5,300)	11,700 (5,300)	11,700 (5,300)



- Notes:
- For 25°C ambient, multiply Tc by 1.06.
 - Curves for 230 V applicable to single or three phase input power.

400/480 VAC

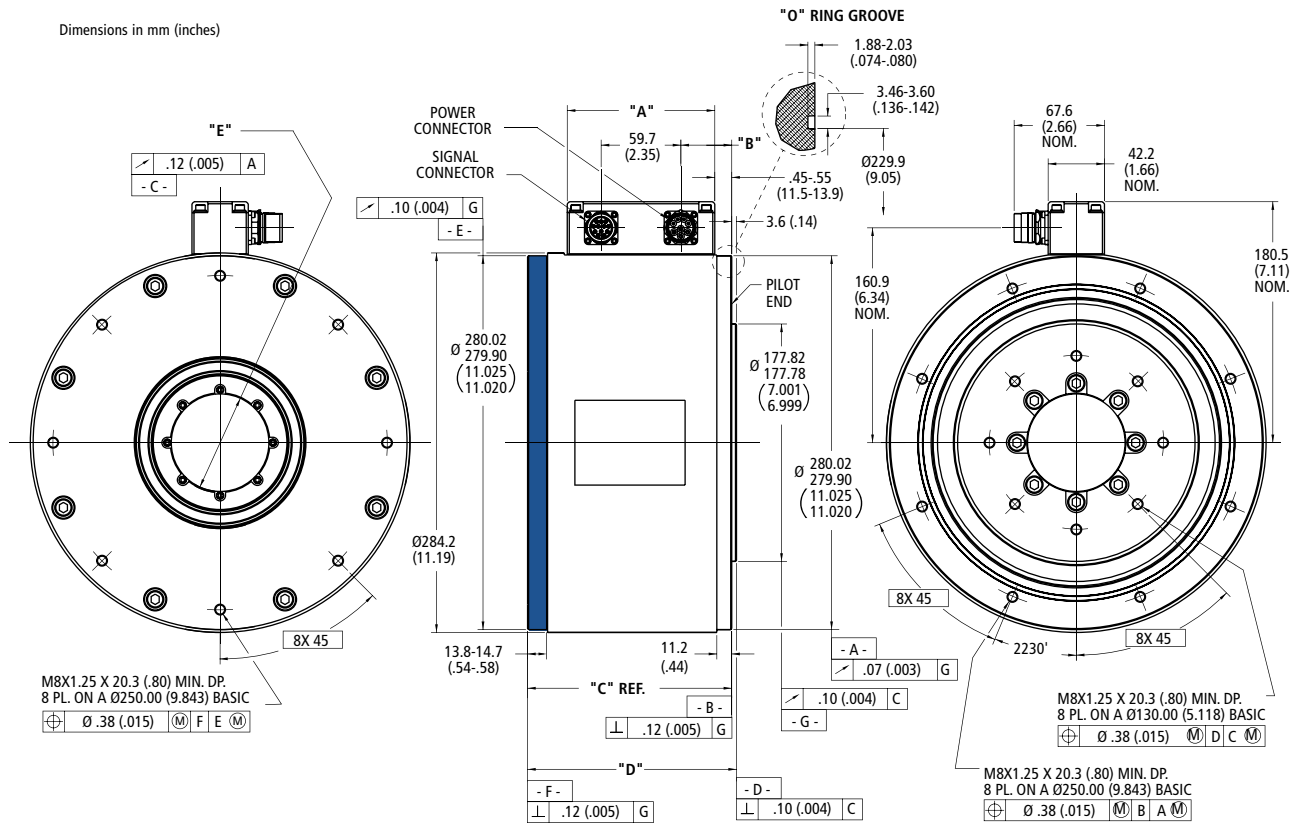
System Performance:		Symbols	Units	DH101A/DH101M	DH102A/DH102M	DH103A/DH103M
Peak Torque		T _p	lb-ft (N-m)	95.0 (129)	167 (227)	370 (501)
Continuous ¹ Torque 40°C	Sine Encoder	T _c	lb-ft (N-m)	25.5 (34.6)	46.8 (63.4)	85.0 (115)
	Resolver	T _c	lb-ft (N-m)	30.0 (40.7)	55.0 (74.6)	100 (136)
Max. Operating Speed 400/480 V 3 Phase		N max	rpm (rps)	300 (5.0/5.0)	300 (5.0/5.0)	200/250 (3.3/4.3)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
Resolver System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	±2.4	±2.4	±2.4
	Accuracy	-	arc/sec	±135	±135	±135
Mechanical:						
Weight		W _t	lb (kg)	69.5 (31.5)	96.5 (43.8)	134 (60.8)
Rotor Inertia		J _m	lb-ft-sec ² (kg-m ²)	0.0511 (0.0693)	0.0732 (0.0992)	0.129 (0.175)
Static Friction Adder For Sealed Units		T _f	lb-ft (N-m)	2.6 (3.5)	2.6 (3.5)	2.6 (3.5)
Max. Dynamic Axle Compression Load (See Page 11 For Details)		-	lbf (kg)	11,700 (5,300)	11,700 (5,300)	11,700 (5,300)



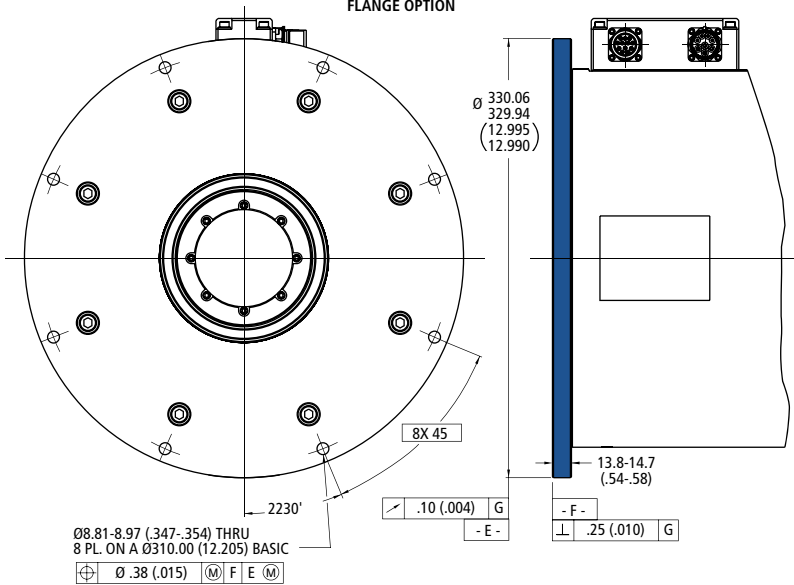
Notes:
1. For 25°C ambient, multiply by 1.06.

Housed DDR D10X Outline Drawings

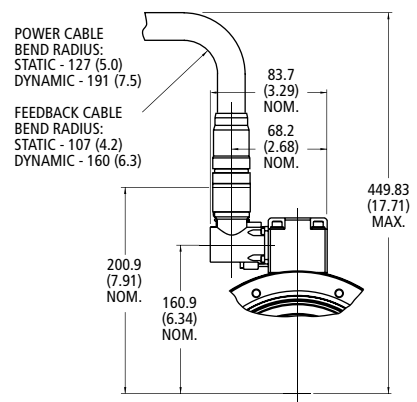
Dimensions in mm (inches)



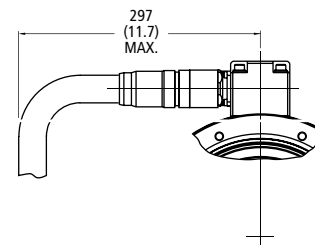
FLANGE OPTION



90° CONNECTOR OPTION



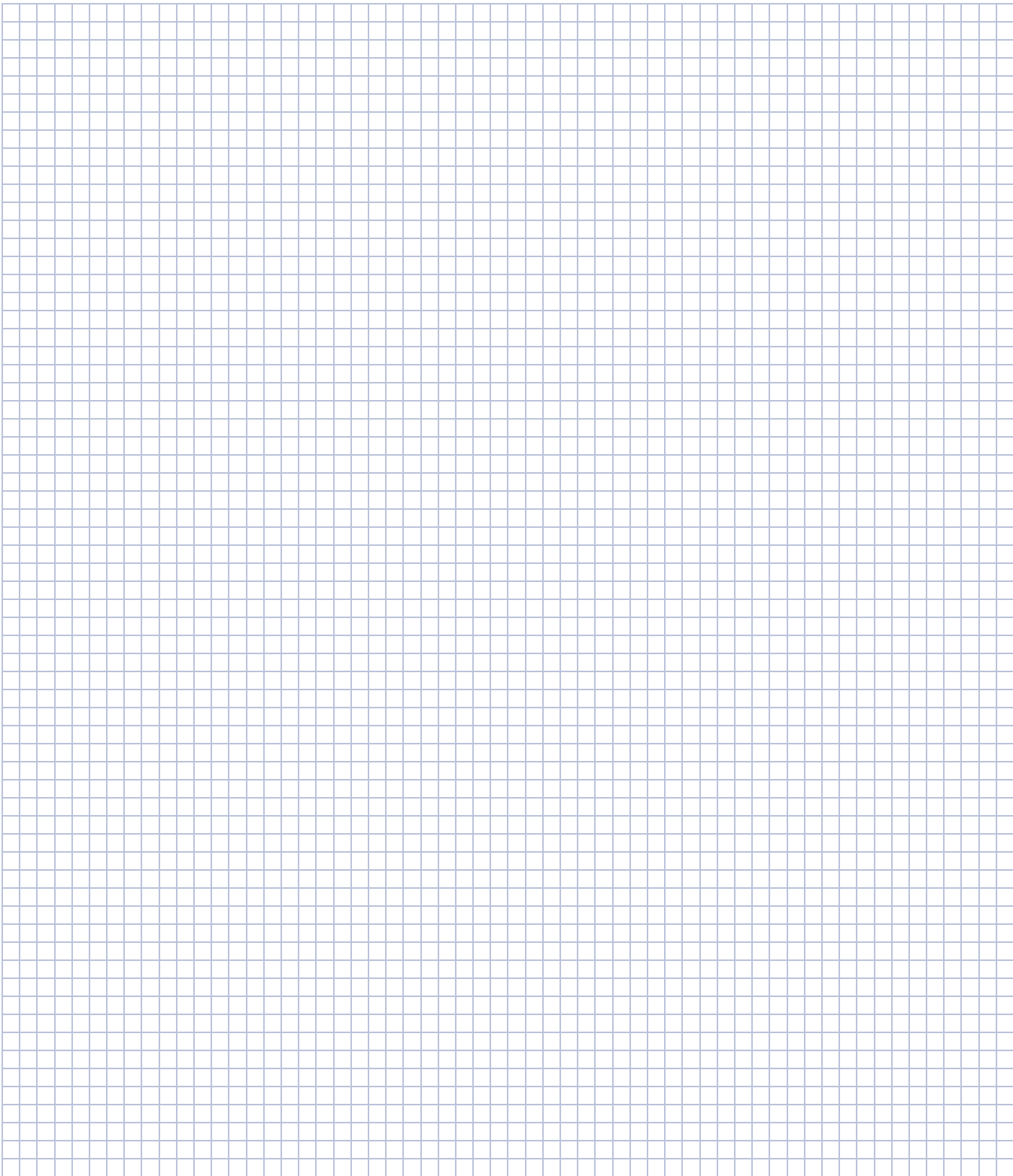
STRAIGHT CONNECTOR OPTION



Model	"A"	"B"	"C"	"D"	"E"	
D101	110.5 (4.35)	36.6-39.6 (1.44-1.56)	152.53-153.28 (6.005-6.035)	155.71-157.22 (6.130-6.190)	Resolver	Sine Encoder
D102	142.2 (5.60)	68.4-71.3 (2.69-2.81)	184.28-185.03 (7.255-7.285)	187.46-188.97 (7.380-7.440)	Ø73.07-72.98 (2.877-2.873)	Ø42.88-42.98 (1.688-1.692)
D103	205.7 (8.10)	131.9-134.8 (5.19-5.31)	247.78-248.53 (9.755-9.785)	250.96-252.47 (9.880-9.940)		

Note: Dimensions "C" and "D" increase by 7.57mm (0.298") on sine encoder models with IP65 or IP67 seals.

Notes

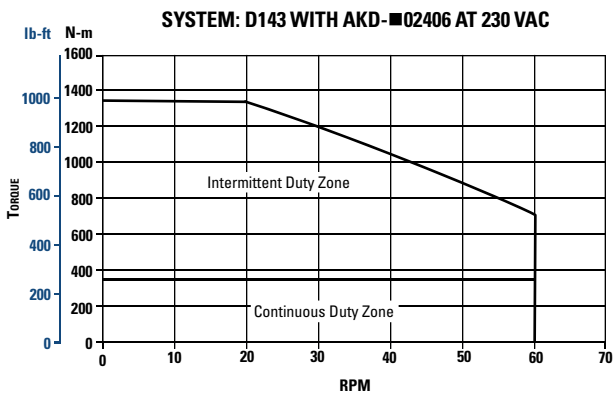
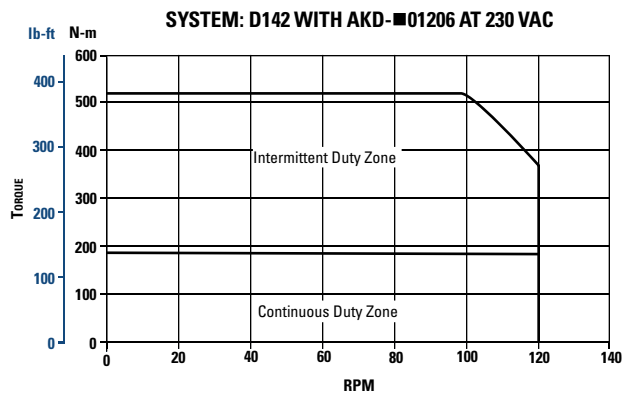
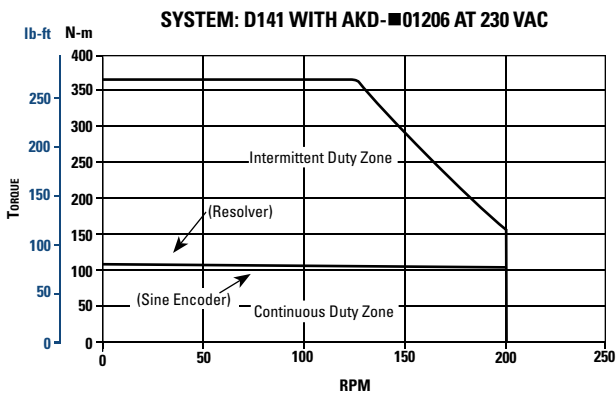


Housed DDR D14X Performance Data

230 VAC

System Performance:		Symbols	Units	D141M	D142M	D143M
Peak Torque		T _p	lb-ft (N-m)	271 (367)	383 (519)	989 (1341)
Continuous ¹ Torque 40°C	Sine Encoder	T _c	lb-ft (N-m)	80.0 (108)	135 (183)	250 (339)
Max. Operating Speed		N max	rpm (rps)	200 (3.3)	120 (2.0)	60 (1.0)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
System Performance:		Symbols	Units	D141M	D142M	D143M
Mechanical:						
Weight		Wt	lb kg	131 (59.4)	191 (86.6)	323 (146)
Rotor Inertia		J _m	lb-ft-sec ² (kg-m ²)	0.120 (0.163)	0.202 (0.274)	0.400 (0.542)
Static Friction Adder for Sealed Units		T _f	lb-ft (N-m)	2.6 (3.5)	2.6 (3.5)	2.6 (3.5)
Max. Dynamic Axle Compression Load (See Page 11 for Details)		-	lbf (kg)	12,700 (5,760)	12,700 (5,760)	12,700 (5,760)

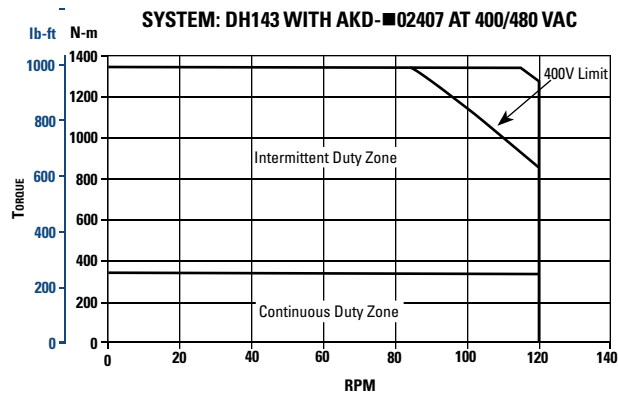
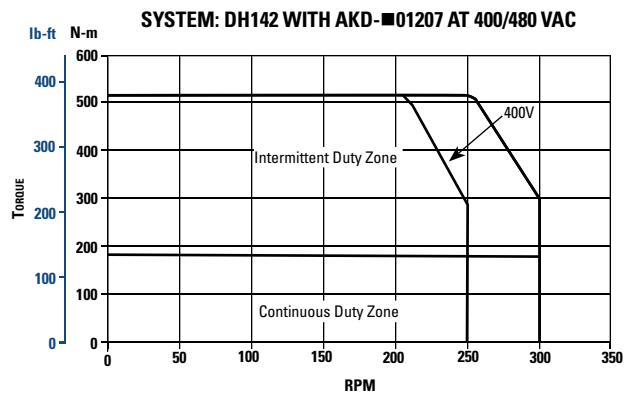
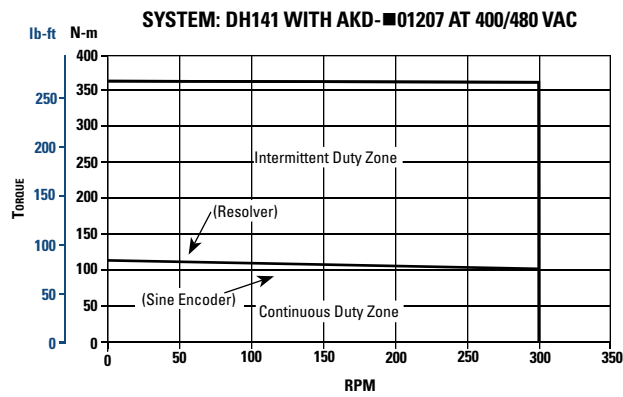
HOUSED DDR D14X PERFORMANCE DATA



Notes:
1. For 25°C ambient, multiply by 1.06.

400/480 VAC

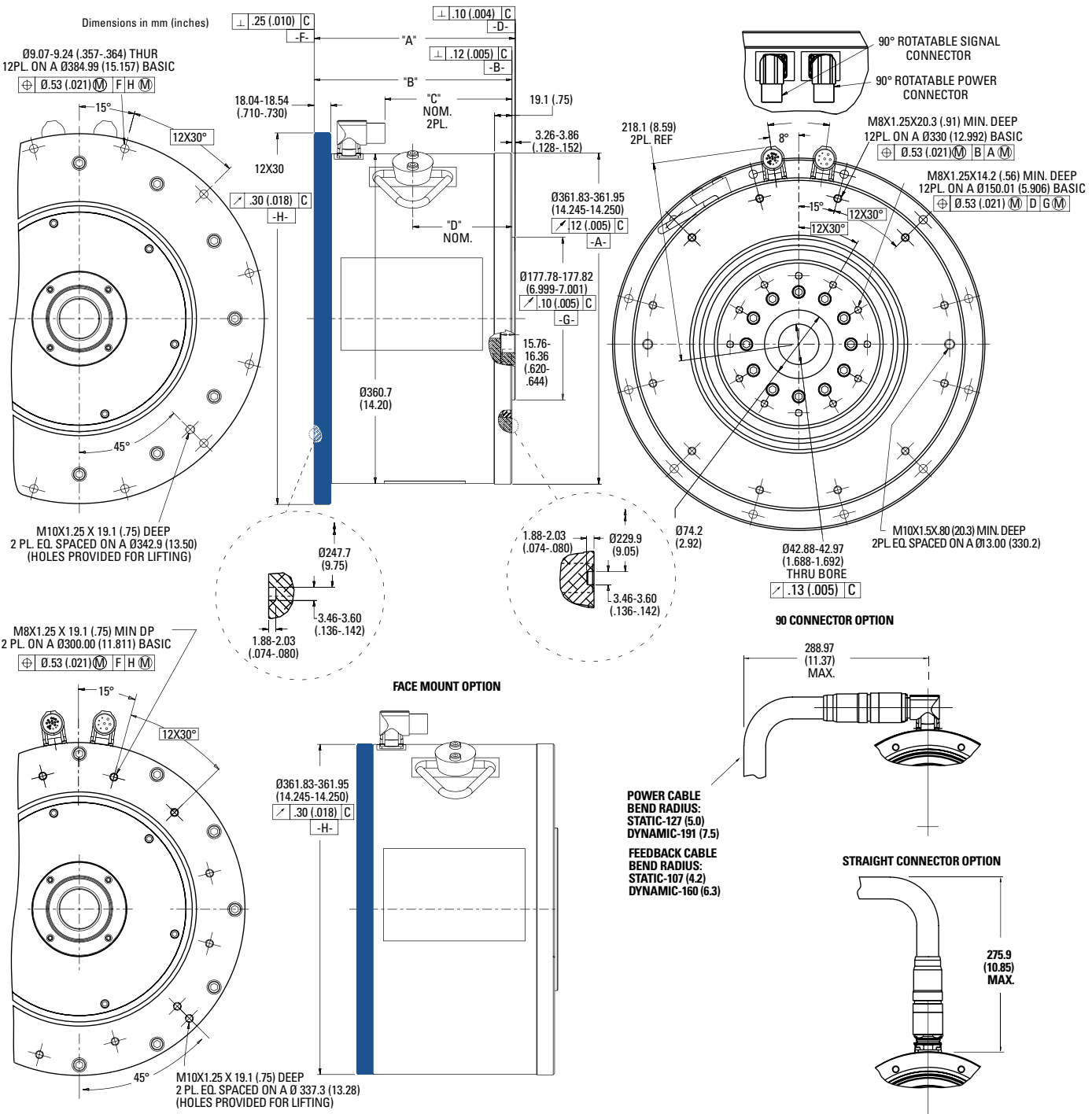
System Performance:		Symbols	Units	DH141M	DH142M	DH143M
Peak Torque		Tp	lb-ft (N-m)	271 (367)	383 (519)	989 (1341)
Continuous ¹ Torque 40°C	Sine Encoder	Tc	lb-ft (N-m)	80.0 (108)	135 (183)	250 (339)
Max. Operating Speed 400/480 V 3 Phase		N max	rpm (rps)	300 (5)	250/300 (4.2/5)	120 (2)
Sine Encoder System	Resolution	-	counts/rev	134,217,728	134,217,728	134,217,728
	Repeatability	-	arc/sec	< 1	< 1	< 1
	Accuracy	-	arc/sec	±26	±26	±26
System Performance:		Symbols	Units	DH141M	DH142M	DH143M
Mechanical:						
Weight		Wt	lb (kg)	131 (59.4)	191 (86.6)	323 (146)
Rotor Inertia		Jm	lb-ft-sec ² (kg-m ²)	0.120 (0.163)	0.202 (0.274)	0.400 (0.542)
Static Friction Adder for Sealed Units		Tf	lb-ft (N-m)	2.6 (3.5)	2.6 (3.5)	2.6 (3.5)
Max. Dynamic Axle Compression Load (See Page 11 for Details)		-	lbf (kg)	12,700 (5,760)	12,700 (5,760)	12,700 (5,760)



Notes:
1. For 25°C ambient, multiply by 1.06.

Housed DDR D14X Outline Drawings

HOUSED DDR D14X OUTLINE DRAWINGS



Model	"A"	"B"	"C"	"D"
D141	155.92-157.02 (6.138-6.182)	152.66-153.16 (6.010-6.030)	75.5 (2.97)	76.7 (3.02)
D142	219.42-220.52 (8.638-8.682)	216.16-216.66 (8.510-8.530)	138.9 (5.47)	108.5 (4.27)
D143	346.42-347.52 (13.638-13.682)	343.16-343.66 (13.510-13.530)	266.0 (10.47)	172.0 (6.77)

Model Nomenclature

Housed DDR Motor

DH 08 1 M - 1 2 - 1 3 1 0 - xxx

Direct Drive Series

D = 115/230 VAC winding
DH = 400/480 VAC winding

Motor Frame Size

06 = 6.93" O.D.
08 = 8.60" O.D.
10 = 11.19" O.D.
14 = 14.25" O.D.

Rotor Stack Length

1 = Short stack
2 = Mid stack
3 = Long stack

Winding Type

A = Std. w/ resolver¹
M = Std. w/ sine encoder

Mounting Option

1 = Face mount
2 = Flange mount

Designated for Specials

Unit Seal

0 = Non-sealed unit
5 = IP65² - length increase
7 = IP67² - length increase

Bearing Option

1 = Single bearing design
2 = Dual bearing design³

Feedback Device

2 = Resolver ("A" Winding Type)¹
3 = Sine Encoder ("M" Winding Type)

Shaft Option

1 = Straight thru bore w/ face coupling

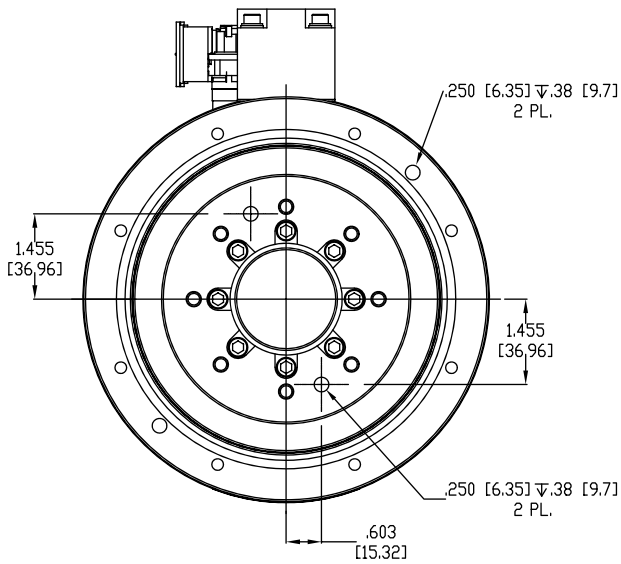
Connector Type

2 = Straight
3 = 90°, rotatable

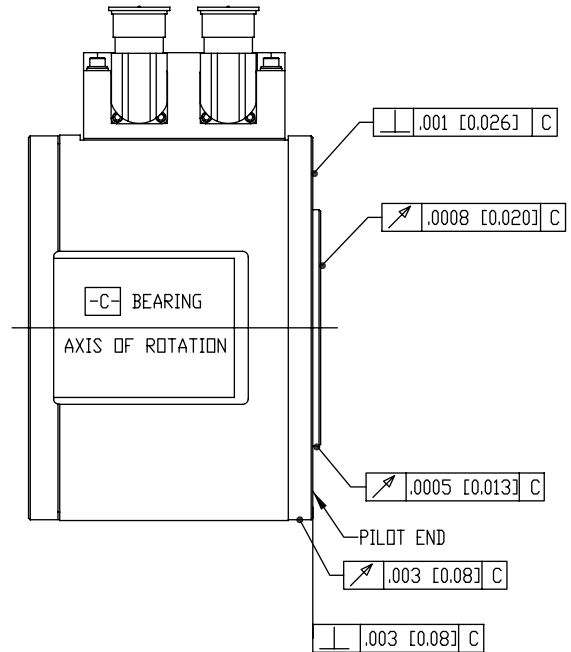
Notes:

1. Not available on D14x & DH14x.
2. Encoder sealed motors have increased length. See outline drawing.
3. Standard on D143 & DH143 models.
4. Options shown in blue text are considered standard.

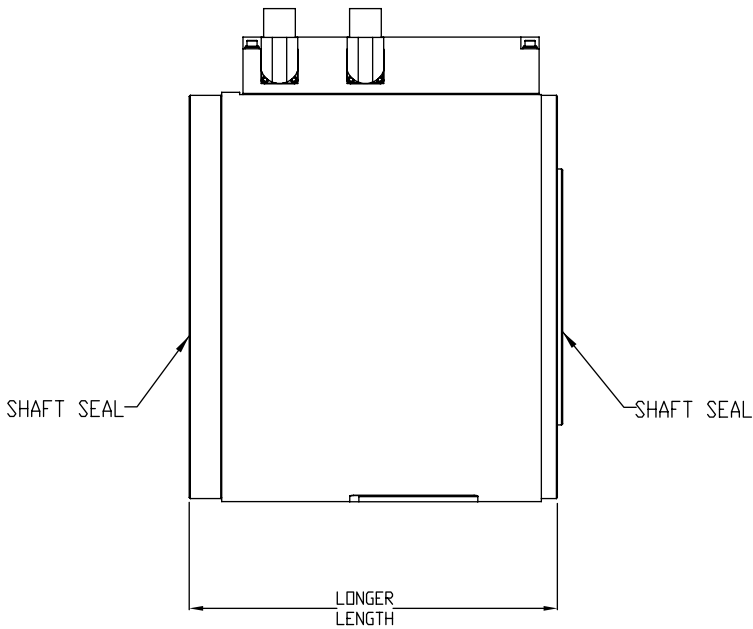
Custom Applications



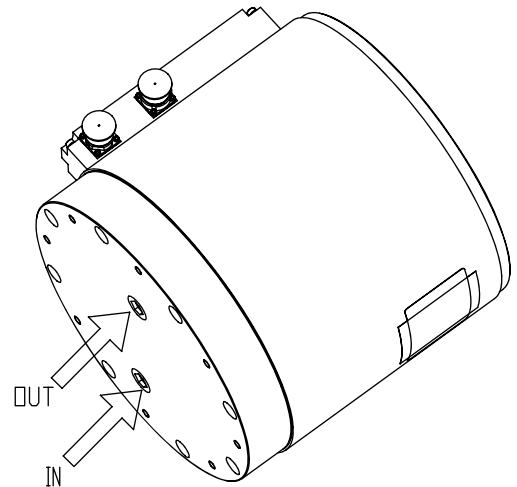
PRECISION DOWEL PIN HOLES 0.250" FOR CUSTOMER INDEXING



DDR WITH PRECISION TOLERANCE COMPONENTS FOR PRECISE POSITIONING



DDR MOTOR, ENCODER OPTION WITH DUAL SHAFT SEALS, IP67



DDR WITH AIR COOLING OPTION TO INCREASE CONTINUOUS OUTPUT TORQUE

Co-Engineering Capabilities

Kollmorgen offers 5-day lead-time on nearly 1,000,000 commercial off-the-shelf (COTS) products, all with best-in-class performance and quality.

When COTS is not quite the best way to realize a totally optimized system, Kollmorgen can offer co-engineered solutions to meet your most difficult challenges and advance your competitive position. Drawing on a wealth of knowledge and expertise, our engineering support team will work alongside with you to build a solution that differentiates your machine and improves your bottom line.

Here are just few examples of how Kollmorgen delivers real value to companies likes yours:

What You Need	Why Motion Matters	Kollmorgen Co-Engineering Results
30% Increase in Throughput	<ul style="list-style-type: none"> • Low inertia servomotors • High bandwidth servo loops • Simple, accurate, graphical programming tools 	Using the Kollmorgen Automation Suite™ graphical camming design tool, Pipe Network™ and low-inertia AKM® servomotors, a major supplier of diabetic test labs increased throughput by more than 30% while improving accuracy and reducing scrap.
50% Increase in Accuracy and Quality	<ul style="list-style-type: none"> • Low cogging frameless servomotor • Advanced observers and bi-quad filters • Fast control loop update rates (.67µs) 	Using our AKD® servo drive, a next-generation CT scanning manufacturer achieved more than 50% improvement in velocity ripple to produce the most accurate and detailed medical images possible while overcoming an extremely high moment of inertia.
25% Increase in Reliability (Overall Equipment Effectiveness)	<ul style="list-style-type: none"> • Innovative Cartridge Direct Drive Rotary™ (DDR®) motor • Eliminating parts on the machine • No additional wearing components 	Using Kollmorgen's award-winning Cartridge DDR® servomotor technology, we eliminated more than 60 parts in a die-cutting machine and increased the OEE by 25% and throughput by 20%.
50% Reduction in Waste	<ul style="list-style-type: none"> • Superior motor/drive system bandwidth • DDR technology: <ul style="list-style-type: none"> – eliminates gearbox – 20X more accurate than geared solution 	We helped a manufacturer of pharmaceutical packaging machines incorporate Housed DDR motors to increase the throughput by 35% and reduce scrap by more than 50% through more accurate alignment of the capsules.

▶ AKD[®] Servo Drive

Our AKD series is a complete range of Ethernet-based servo drives that are fast, feature-rich, flexible and integrate quickly and easily into any application. AKD ensures plug-and-play commissioning for instant, seamless access to everything in your machine. And, no matter what your application demands, AKD offers industry-leading servo performance, communication options, and power levels, all in a smaller footprint.

This robust, technologically advanced family of drives delivers optimized performance when paired with our best-in-class components, producing higher quality results at greater speeds and more uptime. With Kollmorgen servo components, we can help you increase your machine's overall equipment effectiveness (OEE) by 50%.

The Benefits of AKD Servo Drive

- Optimized Performance in Seconds
 - Auto-tuning is one of the best and fastest in the industry
 - Automatically adjusts all gains, including observers
 - Immediate and adaptive response to dynamic loads
 - Precise control of all motor types
 - Compensation for stiff and compliant transmission and couplings
- Greater Throughput and Accuracy
 - Up to 27-bit-resolution feedback yields unmatched precision and excellent repeatability
 - Very fast settling times result from a powerful dual processor system that executes industry-leading and patent pending servo algorithms with high resolution
 - Advanced servo techniques such as high-order observer and bi-quad filters yield industry-leading machine performance
 - Highest bandwidth torque-and-velocity loops. Fastest digital current loop in the market
- Easy-to-use Graphical User Interface (GUI) for Faster Commissioning and Troubleshooting
 - Six-channel real-time software oscilloscope commissions and diagnoses quickly
 - Multi-function Bode Plot allows users to quickly evaluate performance
 - Auto-complete of programmable commands saves looking up parameter names
 - One-click capture and sharing of program plots and parameter settings allow you to send machine performance data instantly
 - Widest range of programming options in the industry
- Flexible and Scalable to Meet any Application
 - 3 to 48 Arms continuous current; 9 to 96 Arms peak
 - Very high power density enables an extremely small package
 - True plug-and-play with all standard Kollmorgen servo motors and actuators
 - Supports a variety of single and multi-turn feedback devices—Smart Feedback Device (SFD), EnDat2.2, 01, BiSS, analog Sine/Cos encoder, incremental encoder, HIPERFACE®, and resolver
 - Tightly integrated Ethernet motion buses without the need to add large hardware: EtherCAT®, SynqNet®, Modbus® TCP, EtherNet/IP™, PROFINET® RT, SERCOS® III, and CANopen®
 - Scalable programmability from base torque-and-velocity through multi-axis master

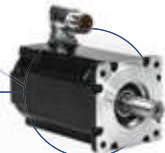
AKD[®] Servo Drive

The AKD servo drive delivers cutting-edge technology and performance with one of the most compact footprints in the industry. These feature-rich drives provide a solution for nearly any application, from basic torque-and-velocity applications, to indexing, to multi-axis programmable motion with embedded Kollmorgen Automation Suite™. The versatile AKD sets the standard for power density and performance.

AKD[®] SERVO DRIVE



AKMH[™] Hygienic Stainless Steel Motors



AKM[®] 2G Servo Motors



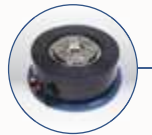
Frameless Brushless Direct Drive Motors



AKD[®]-N Decentralized Servo Drive



Cartridge DDR[®] Motors



Housed DDR[®] Motors



Direct Drive Linear Motors



Linear Actuators



Multi-Axis Precision Tables



AKD[®] Servo Drive



Control of motors with AKD[®] PDMM programmable multi-axis master

Best-in-Class Components

AKD works seamlessly with Kollmorgen motors and actuators—well-known for quality, reliability, and performance.



Industry-leading power density



48A @ 480V

General Specifications

120 / 240 Vac 1 & 3 Phase (85 - 265 V)	Continuous Current (Arms)	Peak Current (Arms)	Drive Continuous Output Power Capacity (Watts)	Internal Regen (Watts) (Ohms)		Height mm (in)	Width mm (in)	Depth mm (in)	Depth with Cable Bend Radius mm (in)
AKD-x00306	3	9	1100	0	0	168 (6.61)	59 (2.32)	156 (6.14)	184 (7.24)
AKD-x00606	6	18	2000	0	0	168 (6.61)	59 (2.32)	156 (6.14)	184 (7.24)
AKD-x01206	12	30	4000	100	15	196 (7.72)	78 (3.07)	187 (7.36)	215 (8.46)
AKD-x02406	24	48	8000	200	8	247 (9.72)	100 (3.94)	228 (8.98)	265 (10.43)
240/480 Vac 3 Phase (187-528 V)	Continuous Current (Arms)	Peak Current (Arms)	Drive Continuous Output Power Capacity (Watts)	Internal Regen (Watts) (Ohms)		Height mm (in)	Width mm (in)	Depth mm (in)	Depth with Cable Bend Radius mm (in)
AKD-x00307	3	9	2000	100	33	256 (10.08)	70 (2.76)	185 (7.28)	221 (8.70)
AKD-x00607	6	18	4000	100	33	256 (10.08)	70 (2.76)	185 (7.28)	221 (8.70)
AKD-x01207	12	30	8000	100	33	256 (10.08)	70 (2.76)	185 (7.28)	221 (8.70)
AKD-x02407	24	48	16,000	200	23	306 (12.01)	105 (4.13)	228 (8.98)	264 (10.39)
AKD-x04807	48	96	35,000	—	—	385 (15.16)	185 (7.28)	225 (8.86)	260 (10.23)

Note: For complete AKD model nomenclature, refer to page 34.



Model Nomenclature

AKD® Servo Drive

AKD – B 003 06 – NB AN – 0000

AKD Series

Version

B = Base drive

C = Central power supply for AKD-N (Requires CB Extension)

N = Decentralized drive (Requires DB, DF, or DS Extension)

P = Position indexer (motion tasking)

T = AKD BASIC Language Programmable drive (Requires IC or NB Extension)

M = Multi-axis Master Drive (Requires MC Extension option, and EC Connectivity option)

Current Rating

003 = 3 Amp

006 = 6 Amp

010 = 10kW (for AKD-C, this field refers to power.)

012 = 12 Amp

024 = 24 Amp

048 = 48 Amp

Voltage

06 = 120/240 Vac 1Ø/3Ø (24 Amp Drive: 240 Vac 3Ø only)

07 = 240/480 Vac 3Ø (Version C: 07 = 400/480 Vac 3Ø | Version N: 07 = 560/680 Vdc)

Variants

0000 = Standard

Connectivity*

AN = Analog command

CN = CANopen®

EC = EtherCAT®

EI = EtherNet/IP™

PN - PROFINET®

SQ = SynqNet®

Drive Version Availability

B, P, T

P

C, M, N, P

P

P

B

*Motion Tasking is included as a free upgrade with CN, EC, EI and PN

Extension

CB = without extension (AKD-C version only)

DB = hybrid motor cable (AKD-N version only)

DF = additional EtherCAT® port + feedback connector (AKD-N version only)

DS = local STO + feedback connector (AKD-N version only)

IC = Expanded I/O version and SD card slot (AKD-T version only)

NB = Without extensions

Note: Options shown in blue text are considered standard.

MOTIONEERING® Online

MOTIONEERING® Online – Kollmorgen has revamped, modernized and put online one of the most respected applications sizing programs of the last 20 years. You now can access this application sizing and selection tool wherever you have access to the internet. MOTIONEERING Online is just a start of a series of releases that will empower you to optimize solutions for your toughest applications. Sizing frameless motors and drive systems has never been easier. Using a mechanism project concept for collecting and saving multiple axes of load information, MOTIONEERING® Online can automatically calculate application results and compare against a catalog of systems - recommending the most optimized set of Kollmorgen system solutions available.

Versatile units-of-measure selection options for mechanism and motion profile data-entry, with the ability to convert data into other available units, makes this a convenient international tool. A user-friendly Help file teaches program functions and algorithms used to provide results.

Mechanism Projects

- Direct drive entry, lead screw, conveyor
- Rack and pinion, nip rolls
- Direct Drive Rotary
- Electric Cylinder
- Direct data entry



Solution Set Search Screen

- Color-coded indication of system's ability to meet application requirements
- Review system components specifications
- Save, print, or create a pdf application report
- Evaluate system performance curve with application points

MOTIONEERING® Online Features:

- Inertia Calculator - lets you build up inertia based on odd shapes by additive or subtractive methods
- Custom Motion Profile - easy to add entire segments or copy segments to repeat
- Environmental Factor - takes into account your ambient temperature
- Project by Project Units - You can tailor your units on a project by project basis, or use the global units settings

MOTIONEERING Online Supported Browsers

- IE, Chrome, Firefox, Safari



www.kollmorgen.com/motioneering

About Kollmorgen

Since its founding in 1916, Kollmorgen's innovative solutions have brought big ideas to life, kept the world safer, and improved peoples' lives. Today, its world-class knowledge of motion systems and components, industry-leading quality, and deep expertise in linking and integrating standard and custom products continually delivers breakthrough motion solutions that are unmatched in performance, reliability, and ease-of-use. This gives machine builders around the world an irrefutable marketplace advantage and provides their customers with ultimate peace-of-mind.

For assistance with your application needs
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www.kollmorgen.com for a global contact list.



KOLLMORGEN®

Because Motion Matters™

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