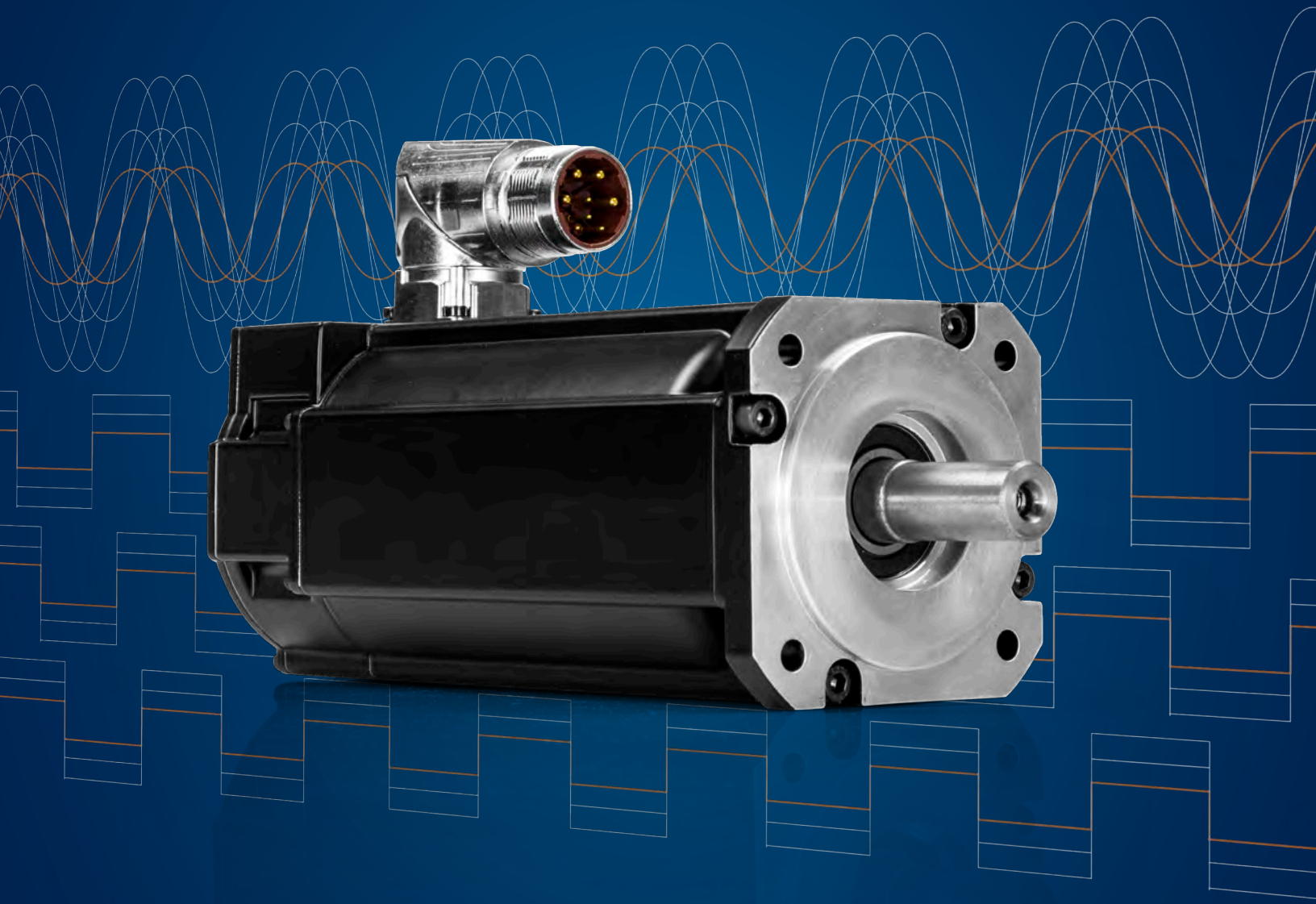
AKM®2G Low Voltage Servo Motor

Three-Phase AC Permanent Magnet Servo Motor

Selection Guide



KOLLMORGEN

A REGAL REXNORD BRAND

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 multi-axis motion controllers, Kollmorgen is one of the few companies in the world that 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 specific 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 focus their engineering manpower on the product design, 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, the 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 Regal Rexnord. A key driver in the growth of all Regal Rexnord segments is the Regal Rexnord 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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AKM® Servo Motor Family

Kollmorgen's AKM family of servo motors gives you unprecedented choice and flexibility from a wide range of standard products so you can select the best servo motor for your application.

From the Low Voltage (LV) motors in this Selection Guide to the broad range of AKM and AKM2G motors that support voltages up to 480 Vac, washdown, food grade, and the AKMH stainless steel hygienic motor for the toughest environments- Kollmorgen has a standard motor solution that can meet your needs right from the catalog.

Still need more? For your truly unique motion control applications, work with our engineering team to customize a solution for your machine design. Either way, standard product or customized, we can help you choose the motion control solution that meets your exact requirements.

The Benefits of AKM2G Low Voltage (LV) Servo Motors

Smaller footprint reduces machine space	» For equivalent power it is possible to use a smaller size motor than competitive motors. » Use of the smaller motor saves space achieving equivalent performance in a smaller footprint machine or saving space for other machine elements.
Voltage options to match application needs	» Standard voltage selections of 24, 48, 72 and 96 Vdc meet most available power sources » Kollmorgen can work with you to meet your specific requirements for the exact solution you need.
Wider speed range provides faster operation	» For many AKM2G sizes the maximum speeds are higher than competitive motors. » Higher speeds ⇨ operate machines faster ⇨ greater throughput.
Greater flexibility provides more options to match needs	» AKM2G is designed to support a wider array of feedback, brake, thermal sensor and shaft seal options – this greater flexibility means a higher probability of meeting application requirements with a standard product. » The AKM2G design has the potential for greater CoEngineering (modification) thanks to the new housing design. With a more flexible design for CoEngineering addressing applications not covered by catalog standards is increased.
Higher efficiency reduces energy consumption	» AKM2G has lower equivalent resistance than competitive solutions. For equivalent motor frame sizes AKM2G will typically be more energy efficient (2-5%). » Energy consumption is reduced with AKM2G compared to competitors. » When weight and space are critical such as on portable, mobile or battery power applications higher efficiency translates to a smaller motor with lower energy demand.

AKM®2G Servo Motor Frame Sizes

AKM2G Low Voltage Motors are a part of the AKM2G Servo Motor family - the next generation of motion for more ambitious machines built on more capable performance and more confident engineering.

AKM2G-2x
Flange: 58 mm
Power: 0.206 - 1.16 kW
Max Speed: 8000 RPM
Stacks: 4

AKM2G-3x
Flange: 72 mm
Power: 0.175 - 1.77 kW
Max Speed: 8000 RPM
Stacks: 3

AKM2G-4x
Flange: 88 mm
Power: 0.267 - 2.85 kW
Max Speed: 6000 RPM
Stacks: 4

AKM2G-5x
Flange: 114 mm
Power: 0.78 - 5.28 kW
Max Speed: 6000 RPM
Stacks: 4

Available with traditional AC voltage windings only*

AKM2G-6x
Flange: 142 mm
Power: 1.56 - 7.79 kW
Max Speed: 6000 RPM
Stacks: 4

Available with traditional AC voltage windings only*

AKM2G-7x
Flange: 192 mm
Power: 2.42 - 11.8 kW
Max Speed: 6000 RPM
Stacks: 4

Available with traditional AC voltage windings only*

*See the AKM2G AC Selection Guide

EN60034-1
EN60034-5
E61960
PS155-1

Looking for Traditional AC Voltage windings? To find performance specifications, outline drawings, 3D models and performance curves for AKM2G standard windings designed for 120 Vac to 480 Vac operation, please visit the AKM2G product page: kollmorgen.com/akm2g.

AKM2G Tested with AKD Servo Drives

The AKM2G performance data and curves in this guide were acquired using Kollmorgen's AKD family of servo drives. Please go to https://www.kollmorgen.com/en-us/products/drives/servo/servo-drives or contact Kollmorgen Customer Support for detailed specifications and to learn how pairing them with the AKM2G servo motor can optimized system peformance.

AKD® Product Family

Parameter	AKD2G	AKD	AKD BASIC	AKD PDMM	AKD-N/AKD-C
Base I/O	12 digital 2 analog	11 digital 2 analog	11 digital 2 analog	17 digital 2 analog	5 digital
Expansion I/O[1]	8 digital 2 analog *Drive size is the same	No	20 digital 2 analog *adds 30 mm to the drive width for drives up to 12A	Up to 1000+ remote I/O via EtherCAT	No
Safe I/O	2 digital inputs for Safey option 1 4 digital inputs for SafeMotion options	No	No	No	No
SafeMotion[2]	Yes	STO only	STO only	STO only	STO only
Optimized for single cable[3]	Yes	No	No	No	Yes
Continuous current limit[4]	24A	48A	48A	48A	12A
Connectivity[5]	Analog, EtherCAT, CANopen, Profinet IRT, Ethernet/IP, TCP/IP, Modbus/TCP	Analog, EtherCAT, CANopen, Profinet RT, Ethernet/IP, TCP/IP, Modbus/TCP	Analog	EtherCAT, CANopen, Profinet RT, Ethernet/IP, TCP/IP, Modbus/TCP	EtherCAT
Axis Configuration	single or dual	single	single	single	single
Drive-resident controller	No	No	No	Yes	No
Programmability	parameterized, 2 axes control loops, actlon table	parameterized	parameterized, BASIC programmable	parameterized, IEC 61131-3 via PLCo-pen or Pipe Network	parameterized
Graphical Display	160x128-pixel display	2 digit LED	2 digit LED	3 digit LED	Status LED
Removeable Memory[6]	Yes	No	Yes	Yes	No
System Architecture	Centralized	Centralized	Centralized	Centralized	Decentralized
IP Rating	IP20	IP20	IP20	IP20	IP67 (AKD-N)

Notes:
1: Add EtherCAT multi-axis master, PCMM, to the AKD drive family to enable remote I/O expansion via EtherCAT. PCMM controller functionality is built into the PDMM
2: SafeMotion includes FSoE, STO, SS1, SS2, SOS, SDB, SBC/SBT, SLS, SSR, SSM, SDI, SAR, SLA, SLI, SLP, SCA up to SIL3 / PLe
3: Single cable optimized means one single cable for power & motor feedback with 1 connector at motor end and 1 connector at drive end
4: Higher power variants under development in some models. Consult factory for availability.
5: Consult factory on connectivity options for AKD2G. Profinet and Ethernet/IP will be added in 2021
6: Optional integrated SD card for easy backup and drive cloning

AKM2G Low Voltage (LV) Servo Motors

AKM®2G LV Brushless Servo Motor Nomenclature

AKM2G – 3 2 ML – A N C N DA 1 0

AKM2G Series

Flange Size

2 58mm
3 72 mm
4 88 mm

Rotor Length

1, 2, 3, 4

Winding Type

LL, KL, ML, NL, PL, QL Low-voltage options
S Special

Mount

A IEC with accuracy N

Shaft

C Keyway
N Smooth shaft
S Special

Connections

For all options see following page
S Special

Brake

2 24 V holding brake
N Without brake
S Special

Feedback Device

For all options see following page
S Special

Thermal Sensor

0 PT-1000 + PTC
1 PT-1000
2 PTC
3 KTY84-130 Equivalent
S Special

Customization

0 Standard
T Mineral filled PTFE seal (Teflon®)
V Viton® shaft seal
x Special

AKM®2G LV Brushless Servo Motor Nomenclature (continued)

Feedback Unit Options

Functional Safety Capable/Pending: Contact Customer Support

Code[3]	Description	AKM2Gx[4]	Connector	Single-turn or Multi-turn	Feedback Type/Size	Feedback Resolution: Device Resolution (Sin/Cos per Rev., Bits or Lines/Rev.)	Feedback Resolution: AKD Internal Resolution	Feedback Resolution: AKD2G Internal Resolution	Feedback Resolution: # of Absolute revs.	Accuracy[1,2] (arc-sec)
2-	Commutating Encoder	3, 4	AD, C	Single-turn	15	2048 Lines	8,192	8,192	None	±218.2"
AA	BiSS B Optical Sine Encoder	3, 4	AD, C	Single-turn	AD58	2048 Sin/Cos	27-Bits	32-Bits	1	±36"
AB				Multi-turn					4096	
CA	SFD3 Smart Feedback Device Gen. 3	2-4	AH, D	Single-turn	15	24-Bits	24-Bits	24-Bits	1	±585"
CB	SFD-M Smart Feedback Device Multi-turn	2-4 ≤ 20A	AH, D	Multi-turn	15	24-Bits	24-Bits	24-Bits	65,536	±60"
GU	HIPERFACE DSL® Capacitive	2-4	D	Multi-turn	EEM37	18-Bits	18-Bits	18-Bits	4096	±240"
DA	EnDat® 2.1 Optical	3, 4	AD, C	Single-turn	ECN1113	512 Sin/Cos	25-Bits	32-Bits	1	±120"
DB				Multi-turn	EQN1125				4096	
LD	EnDat® 2.2 Inductive	2-4	D	Multi-turn	EQI 1131	19-Bits	19-Bits	19-Bits	4096	±120"
R-	Resolver Inductive	3-4	AD, C	Single-turn	15	1 pole pair (16-Bits)	16-Bits	16-Bits	1	±600"

AH = M23 Hybrid power/SFD3/SFD-M connector pinned for use with legacy AKM performance cables – not compatible with AKM2G cables.
AD = M23 Dual connectors with power connector pinned for use with legacy AKM performance cables – not compatible with AKM2G cables.

1. AKD drives have a resolver measurement accuracy of ±45", for a drive w/ motor accuracy of ±585" and RMS Noise of ±9.9" Accuracy & RMS Noise data when used with other drives may be different.
2. Accuracy refers to overall system accuracy once installed in the motor. Noise refers to the RMS position noise when at stand-still.
3. All feedback options, except R- and 2-, have Motor ID support with embedded electronic motor nameplate data included for easy plug-and-play commissioning with Kollmorgen servo drives.
4. AKM2G-LV Size 2 models are only available in single-connector configurations.

With AKD drives, all received positions are interpolated to a 32-bit resolution per revolution. When using a drive other than AKD consult the drive manufacturer for this information.

AKM2G Low Voltage (LV) Servo Motors

AKM®2G LV Brushless Servo Motor Nomenclature (continued)

Connector Options

Model Designation	Connection	Compatible AKM2Gx	Position of connection
A* (Hybrid)	1 SpeedTec® M23 (AKM cable pinned)	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
A (Dual)	2 SpeedTec® M23 (AKM cable pinned)	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
C	2 SpeedTec® M23	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
D*	1 htec® M23	AKM2G2 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted

* Hybrid connectors valid for SFD3, SFD-M, DSL, and EnDat 2.2 Feedback only.

Connector Description

Connector	Usage	Contacts - Pins Power/Signal	Max. Current [A] Power/Signal	Max. Cross Section [mm²] Power/Signal	Protection Class
M23 SpeedTec® right angle connectors (Size 1)	Power & Brake	4 / 5	20 / 10	4 / 1.5	IP65
	Comcoder	- / 15	- / 10	4 / 1.5	IP65
	Resolver	- / 12	- / 10	- / 0.5	IP65
	DSL	5 / 2 / 2	20 / 10	4 / 1.5	IP65
	SFD3/SFD-M	4 / 5	20 / 10	4 / 1.5	IP65
	EnDat 2.2	5 / 4 / 6	20 / 10	4 / 1.5	IP65
	EnDat 2.1 / BiSS B	- / 12	- / 10	4 / 1.5	IP65

Feedback and Connector Availablity

AKM2G-2x

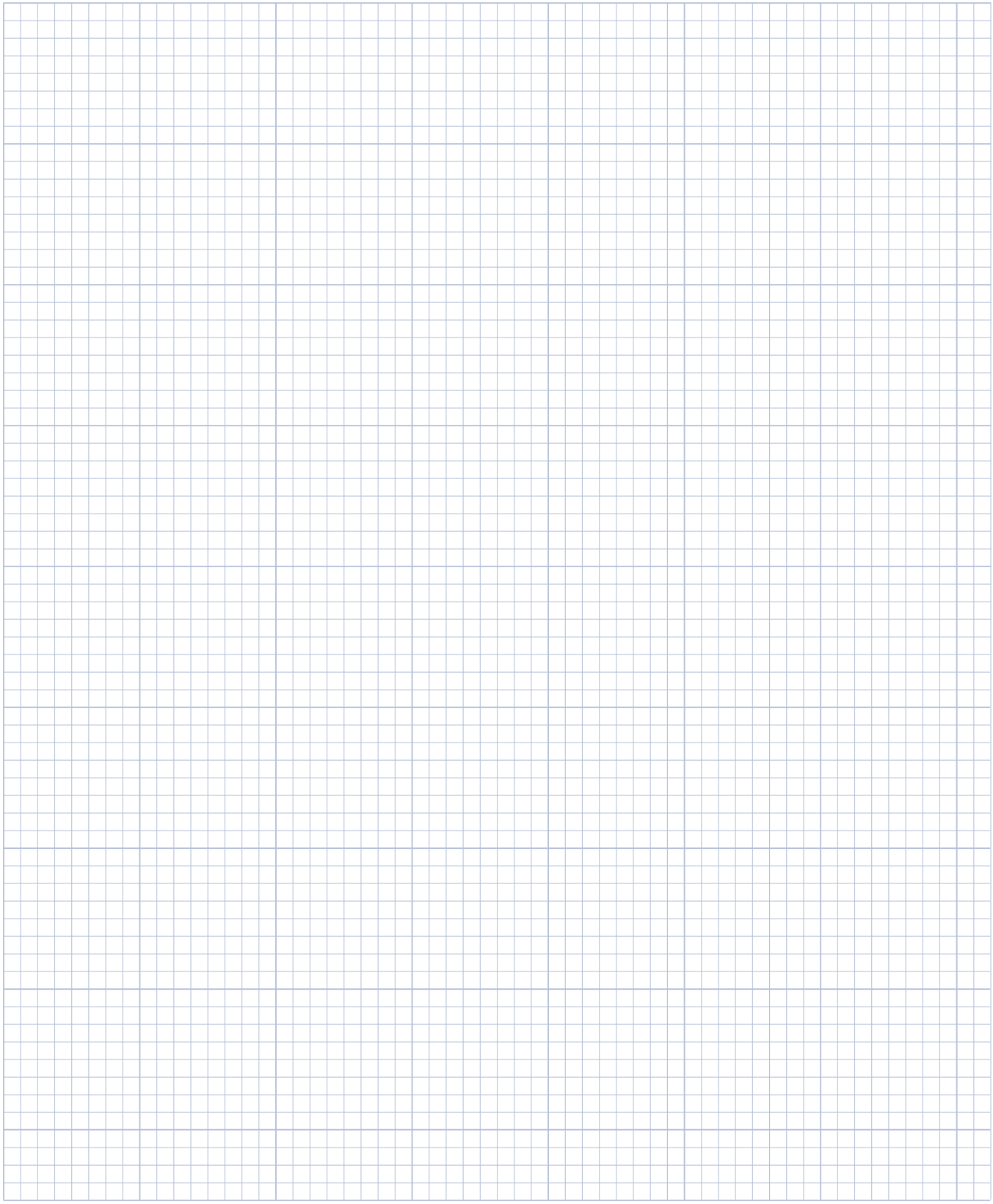
Feedback Code	Connector Code A	Connector Code D
Cx	•	•
GU		•
LD		•

AKM2G-3x -4x

Feedback Code	Connector Code A	Connector Code C	Connector Code D
2-	•	•	
Ax	•	•	
Cx	•		•
GU			•
Dx	•	•	
LD			•
R-	•	•	

• = Hybrid (power + feedback) single connector
• = Dual power and feedback connectors

Notes



0.125 inch divisions

AKM®2G-2x Series LV Servo Motors

AKM2G-2x Low Voltage Servo Motor Performance Data – Up to 96 Vdc

					AKM2G-21			AKM2G-22			AKM2G-23			AKM2G-24		
	Parameters	Tol	Symbol	Units	KL	ML	PL	KL	NL	PL	KL	ML	PL	KL	ML	PL
	Max Rated Equivalent Line Voltage	Max	Vbus	Vdc	170	170	170	170	170	170	170	170	170	170	170	170
	Max Continuous Torque for ΔT winding = 100°C ①②③	Nom	T_{mc}	Nm	0.640	0.642	0.642	1.10	1.11	1.12	1.48	1.49	1.50	1.79	1.79	1.82
				lb-in	5.66	5.68	5.68	9.76	9.85	9.92	13.1	13.2	13.3	15.9	15.9	16.1
	Continuous Current for ΔT winding = 100°C ①②③	Nom	I_{mc}	A_{rms}	9.87	14.2	19.7	9.83	15.2	18.9	9.82	13.5	19.2	9.92	13.7	19.1
	Max Continuous Torque for ΔT winding = 60°C ②③	Nom	T_{mc}	Nm	0.497	0.498	0.498	0.855	0.863	0.871	1.15	1.15	1.17	1.39	1.39	1.41
				lb-in	4.39	4.41	4.41	7.57	7.64	7.70	10.1	10.2	10.3	12.3	12.3	12.5
	Max Mechanical Speed ④	Nom	N_{max}	rpm	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
	Peak Torque ①②③	Nom	T_p	Nm	1.78	1.79	1.79	3.32	3.34	3.35	4.69	4.70	4.73	5.92	5.92	5.97
				lb-in	15.8	15.8	15.8	29.4	29.5	29.6	41.5	41.6	41.9	52.4	52.3	52.8
	Peak Current	Nom	I_p	A_{rms}	39.5	56.8	78.6	39.3	60.8	75.6	39.3	54.0	76.9	39.7	54.9	76.4
24 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	-	0.605	0.587	-	1.08	1.08	-	-	1.46	-	-	1.77
				lb-in	-	5.35	5.20	-	9.59	9.55	-	-	12.9	-	-	15.7
	Rated Speed		N_{rtd}	rpm	-	3400	4700	-	2200	2900	-	-	1900	-	-	1600
	Rated Power (speed) ①②③		P_{rtd}	kW	-	0.215	0.289	-	0.250	0.328	-	-	0.291	-	-	0.297
				Hp	-	0.289	0.388	-	0.335	0.439	-	-	0.390	-	-	0.399
48 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	0.574	0.539	0.534	1.05	1.02	0.997	1.42	1.40	1.35	1.73	1.69	1.65
				lb-in	5.08	4.77	4.73	9.31	9.02	8.82	12.6	12.4	12.0	15.3	15.0	14.6
	Rated Speed		N_{rtd}	rpm	5600	8000	8000	3300	5200	6400	2400	3400	4900	2000	2900	4000
	Rated Power (speed) ①②③		P_{rtd}	kW	0.337	0.452	0.45	0.363	0.555	0.67	0.358	0.498	0.694	0.363	0.514	0.692
				Hp	0.451	0.606	0.600	0.487	0.744	0.896	0.480	0.668	0.930	0.487	0.689	0.928
72 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	0.537	-	-	1.01	0.944	0.942	1.37	1.31	1.18	1.67	1.58	1.46
				lb-in	4.76	-	-	8.92	8.35	8.33	12.1	11.6	10.4	14.8	14.0	12.9
	Rated Speed		N_{rtd}	rpm	8000	-	-	5300	8000	8000	4000	5500	8000	3300	4700	6500
	Rated Power (speed) ①②③		P_{rtd}	kW	0.450	-	-	0.559	0.791	0.789	0.574	0.755	0.989	0.578	0.779	0.994
				Hp	0.604	-	-	0.750	1.06	1.06	0.770	1.01	1.33	0.775	1.05	1.33
96 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	0.533	-	-	0.956	-	-	1.30	1.19	-	1.59	1.44	1.30
				lb-in	4.71	-	-	8.46	-	-	11.5	10.6	-	14.1	12.8	11.5
	Rated Speed		N_{rtd}	rpm	8000	-	-	7300	-	-	5500	7600	-	4600	6500	8000
	Rated Power (speed) ①②③		P_{rtd}	kW	0.446	-	-	0.731	-	-	0.751	0.951	-	0.766	0.982	1.085
				Hp	0.598	-	-	0.980	-	-	1.01	1.27	-	1.03	1.32	1.46

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② All data referenced to sinusoidal commutation.
③ Motor with standard feedback and standard heat sink.
④ May be limited at some values of Vbus.

AKM2G-2x Low Voltage Servo Motor Performance Data – Up to 96 Vdc (continued)

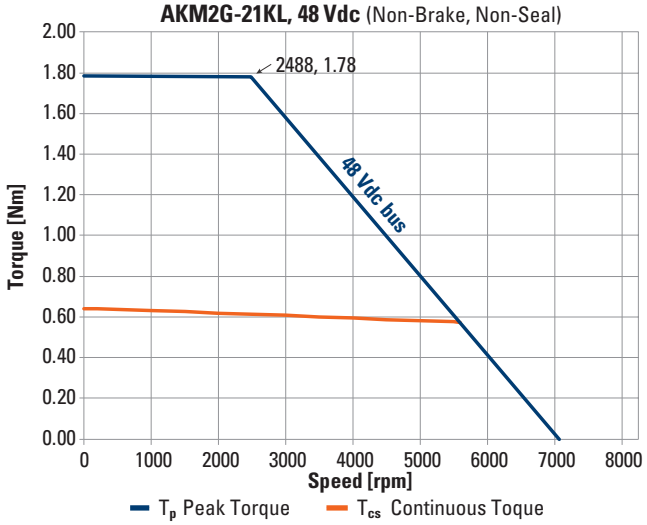
				AKM2G-21			AKM2G-22			AKM2G-23			AKM2G-24		
Parameters	Tol	Symbol	Units	KL	ML	PL	KL	NL	PL	KL	ML	PL	KL	ML	PL
Torque Constant ①	±10%	K_t	Nm/A_{rms}	0.0655	0.0457	0.0330	0.113	0.0740	0.0599	0.152	0.111	0.0789	0.183	0.132	0.0962
			$lb\text{-}in/A_{rms}$	0.580	0.405	0.292	1.00	0.655	0.530	1.35	0.985	0.698	1.62	1.169	0.852
Back EMF Constant ②	±10%	K_e	V_{rms}/k_{rpm}	4.31	3.01	2.17	7.41	4.84	3.92	9.88	7.23	5.12	11.81	8.52	6.21
Motor Constant ⑥	Nom	K_m	N-m/√W	0.0899	0.0902	0.0902	0.143	0.145	0.146	0.186	0.188	0.190	0.223	0.224	0.227
			lb-in/√W	0.796	0.798	0.798	1.27	1.28	1.29	1.65	1.66	1.68	1.98	1.98	2.01
Resistance (line-line) ②	±10%	R_m	Ohm	0.354	0.171	0.089	0.416	0.174	0.112	0.444	0.234	0.115	0.448	0.233	0.120
Inductance Q-Axis (line-line)		Lqll	mH	0.79	0.39	0.20	1.06	0.45	0.30	1.22	0.65	0.33	1.28	0.66	0.35
Inductance Saturation Current		Lisat	Arms	69	99	137	79	121	150	89	121	171	99	137	188
Inertia ③	±10%	J_m	$kg\text{-}cm^2$	0.093			0.155			0.217			0.279		
			$lb\text{-}in\text{-}s^2$	8.23E-05			1.37E-04			1.92E-04			2.47E-04		
Optional Brake Inertia (additional)	±10%	J_m	$kg\text{-}cm^2$	0.040			0.040			0.040			0.040		
			$lb\text{-}in\text{-}s^2$	3.54E-05			3.54E-05			3.54E-05			3.54E-05		
Weight without brake ④		W	kg	1.1			1.4			1.7			2.0		
			lb	2.4			3.1			3.7			4.4		
Static Friction ①⑤		T_f	Nm	0.006			0.011			0.015			0.019		
			lb-in	0.05			0.10			0.13			0.17		
Viscous Damping ①		K_{dv}	Nm/k_{rpm}	0.0015			0.0030			0.0045			0.0060		
			$lb\text{-}in/k_{rpm}$	0.013			0.027			0.040			0.053		
Thermal Time Constant		TCT	minutes	9.6			10.8			11.9			13.0		
Thermal Resistance ①		$R_{thw\text{-}a}$	K/W	1.33			1.14			1.07			1.04		
Pole Pairs		PP		3			3			3			3		
Heat Sink Size				10"x10"x1/4" Aluminum Plate			10"x10"x1/4" Aluminum Plate			10"x10"x1/4" Aluminum Plate			10"x10"x1/4" Aluminum Plate		

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② Measured at 25° C.
③ Add parking brake if applicable for total inertia.
④ Brake motor adds 0.45 kg [1.0 lbs]
⑤ Shaft seal increases Static Friction by 0.020 Nm [0.18 lb-in]
⑥ This value is calculated from the Torque Constant and Resistance. Refer to those values and notes ① & ② for additional details.

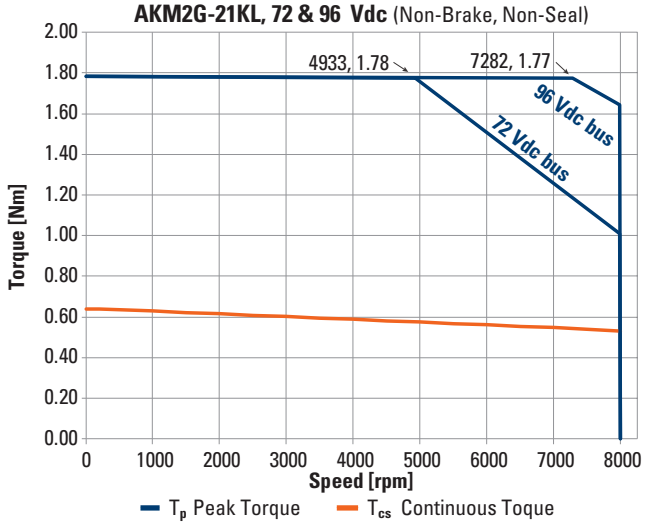
AKM®2G-2x Series LV Servo Motors

AKM2G-2x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc

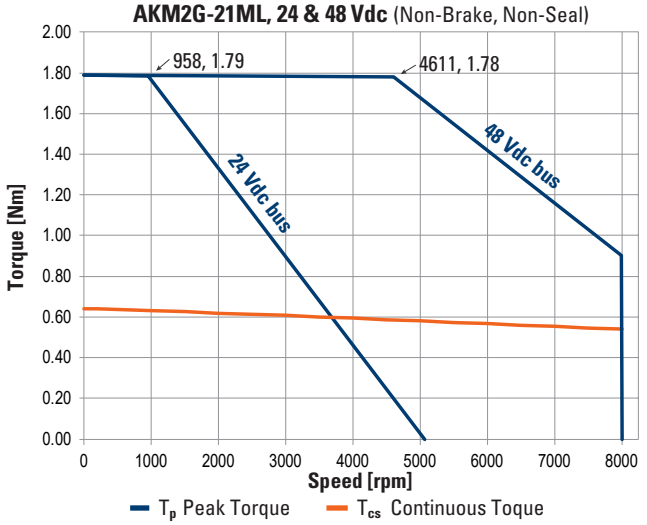
AKM2G-21KL, 48 Vdc (Non-Brake, Non-Seal)



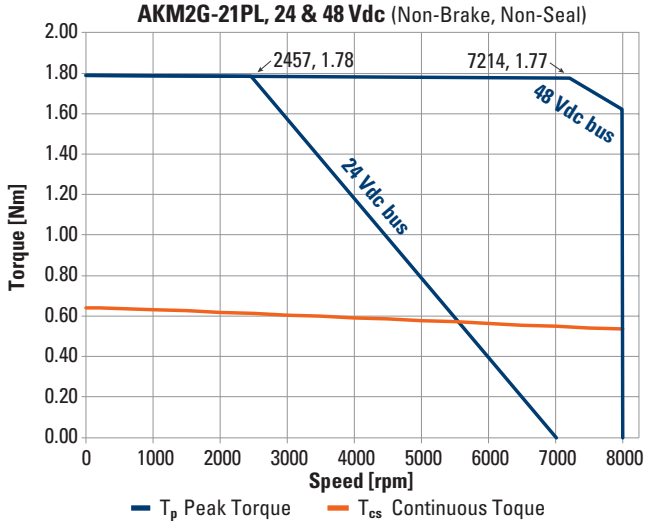
AKM2G-21KL, 72 & 96 Vdc (Non-Brake, Non-Seal)



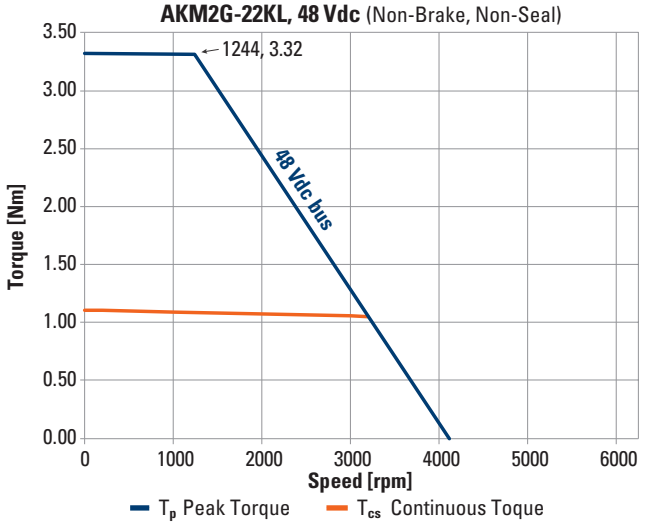
AKM2G-21ML, 24 & 48 Vdc (Non-Brake, Non-Seal)



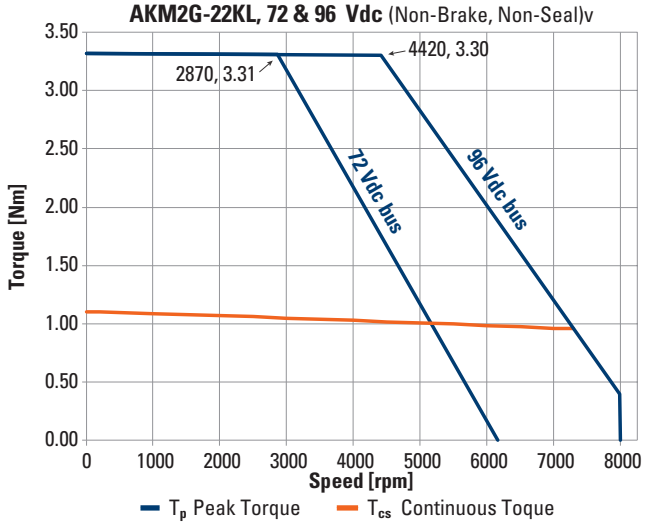
AKM2G-21PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



AKM2G-22KL, 48 Vdc (Non-Brake, Non-Seal)



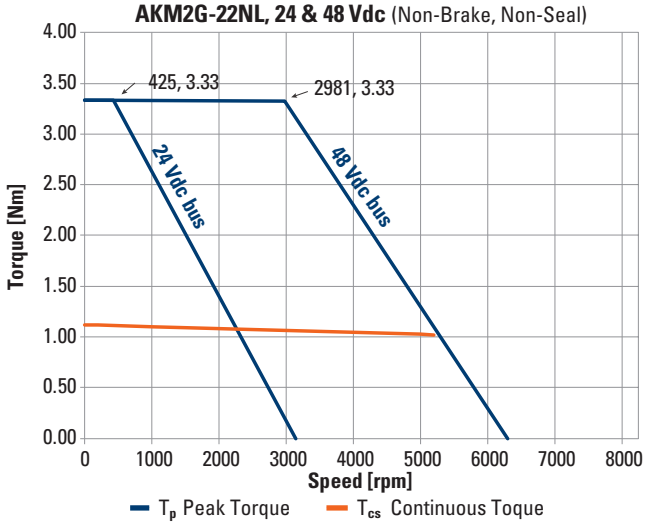
AKM2G-22KL, 72 & 96 Vdc (Non-Brake, Non-Seal)v



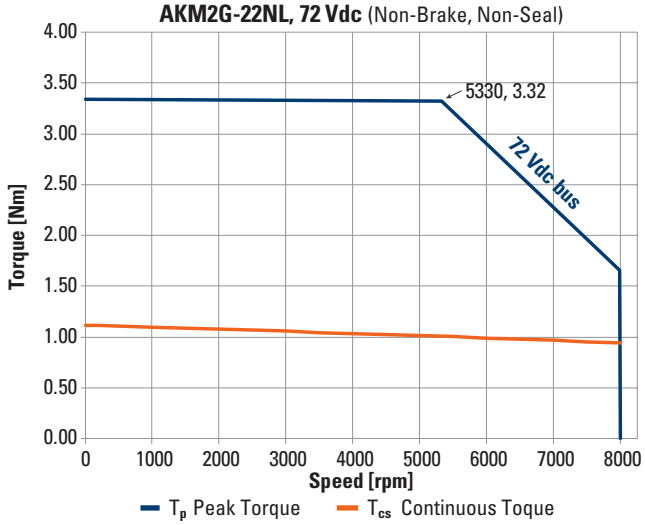
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM2G-2x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)

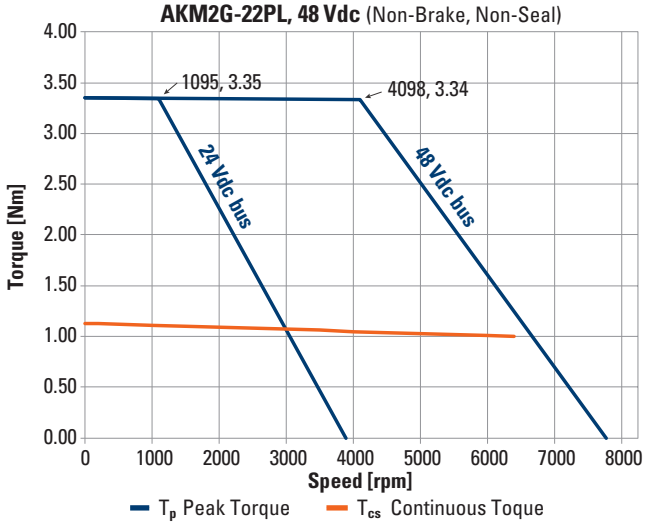
AKM2G-22NL, 24 & 48 Vdc (Non-Brake, Non-Seal)



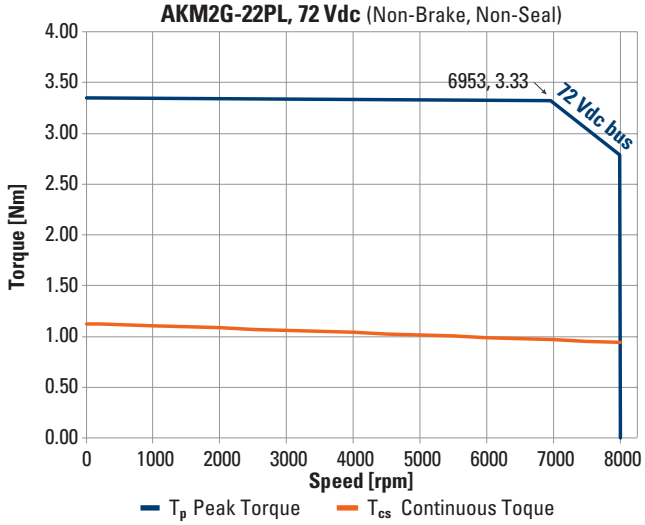
AKM2G-22NL, 72 Vdc (Non-Brake, Non-Seal)



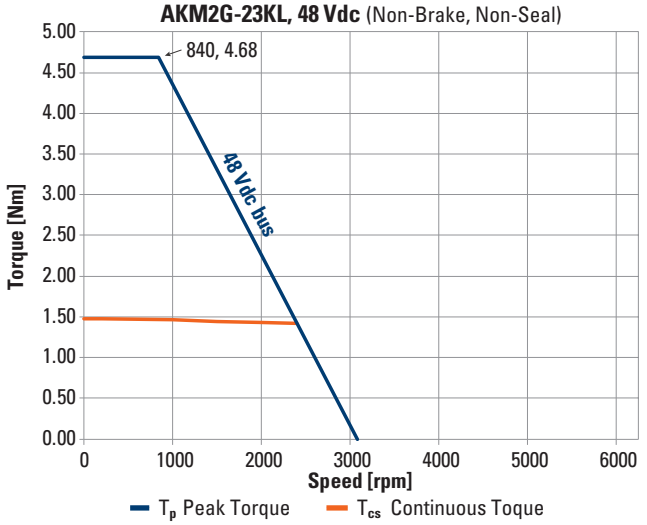
AKM2G-22PL, 48 Vdc (Non-Brake, Non-Seal)



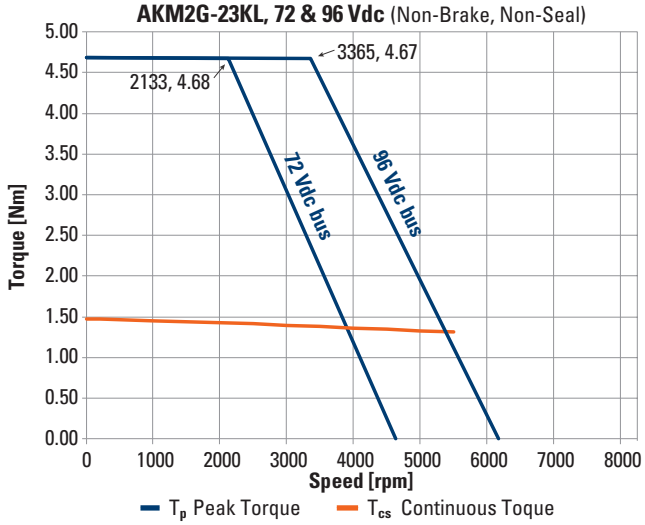
AKM2G-22PL, 72 Vdc (Non-Brake, Non-Seal)



AKM2G-23KL, 48 Vdc (Non-Brake, Non-Seal)



AKM2G-23KL, 72 & 96 Vdc (Non-Brake, Non-Seal)

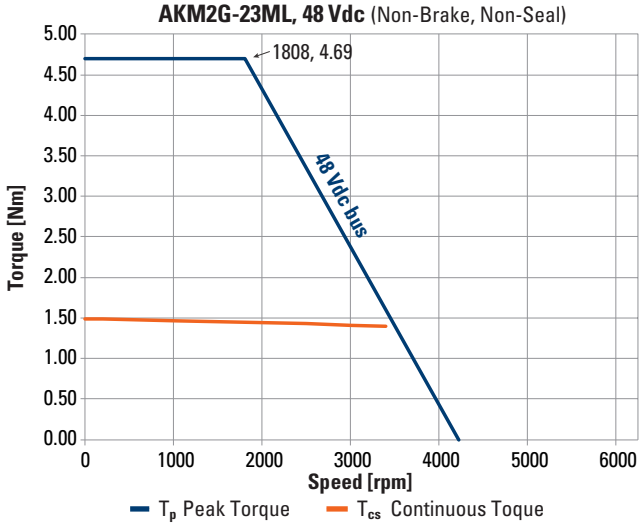


Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

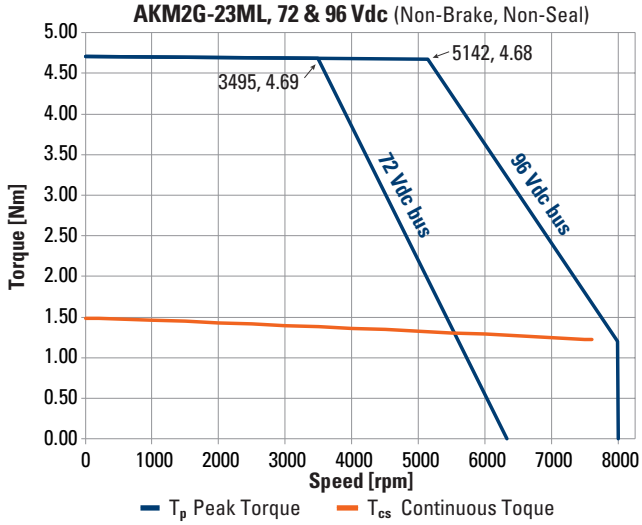
AKM®2G-2x Series LV Servo Motors

AKM2G-2x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)

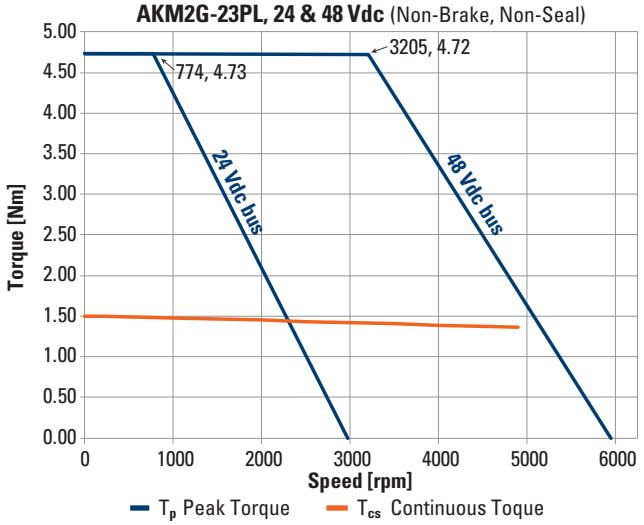
AKM2G-23ML, 48 Vdc (Non-Brake, Non-Seal)



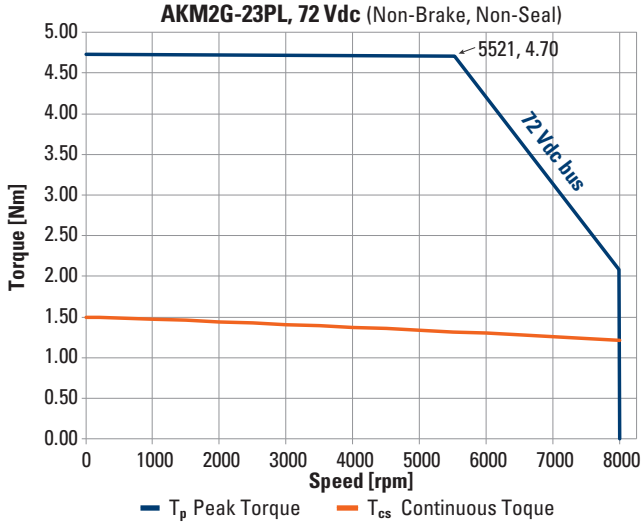
AKM2G-23ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



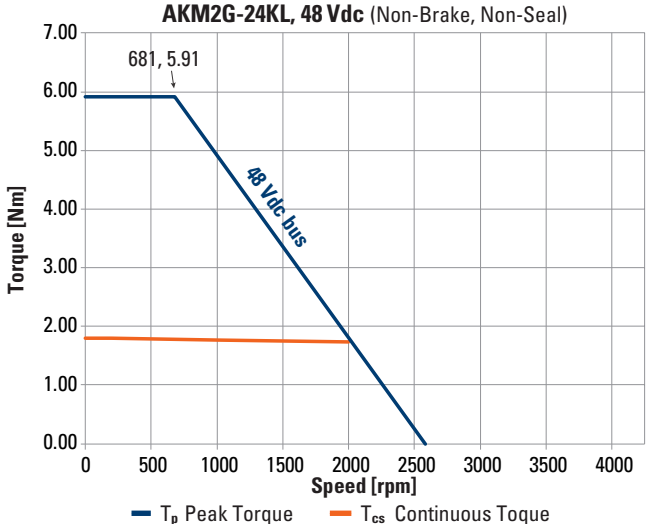
AKM2G-23PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



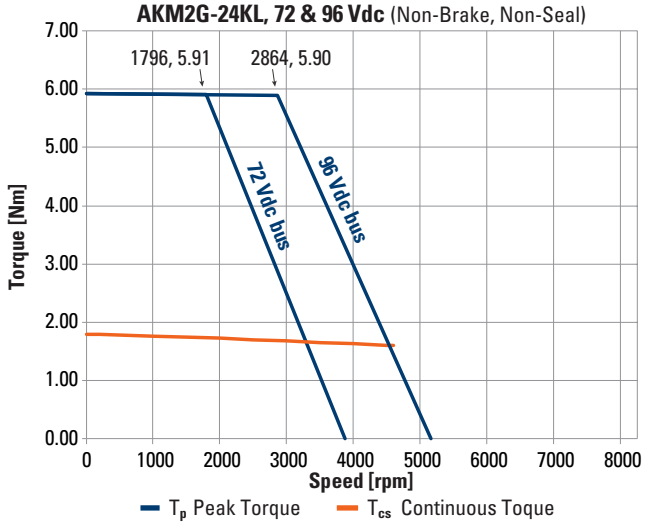
AKM2G-23PL, 72 Vdc (Non-Brake, Non-Seal)



AKM2G-24KL, 48 Vdc (Non-Brake, Non-Seal)

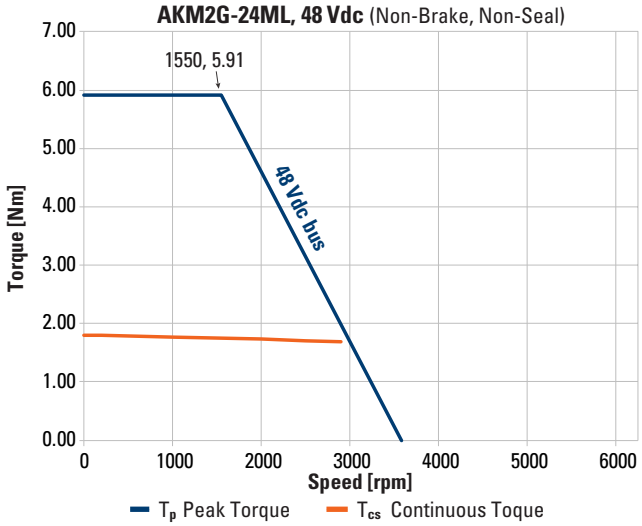


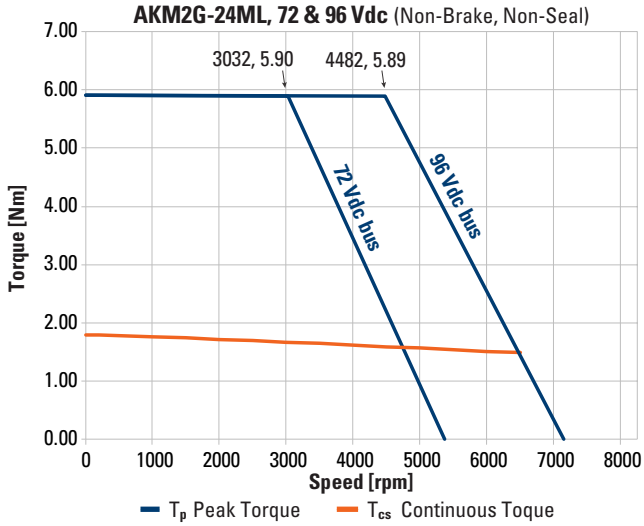
AKM2G-24KL, 72 & 96 Vdc (Non-Brake, Non-Seal)

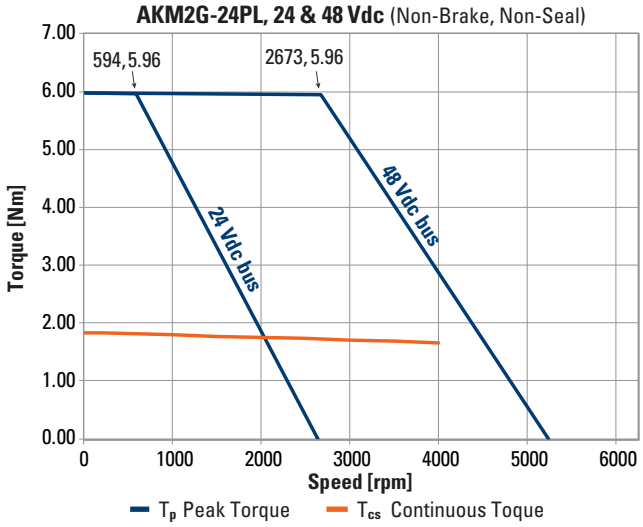


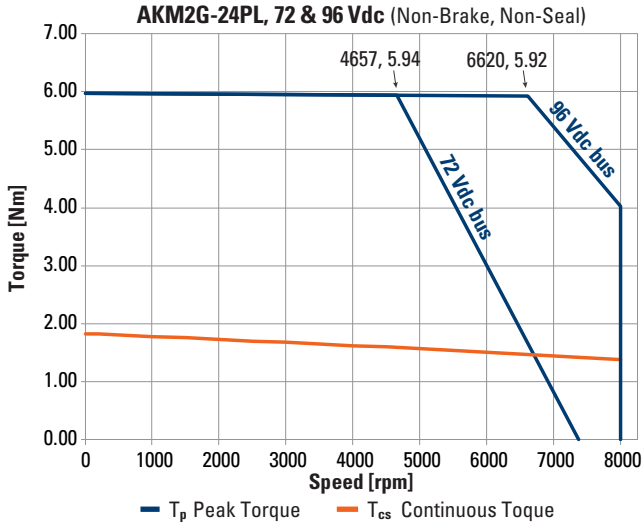
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM2G-2x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)





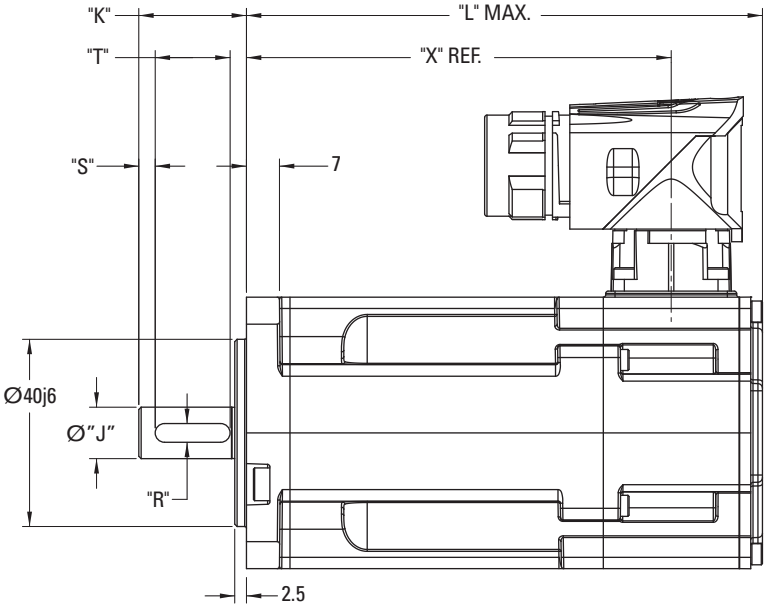


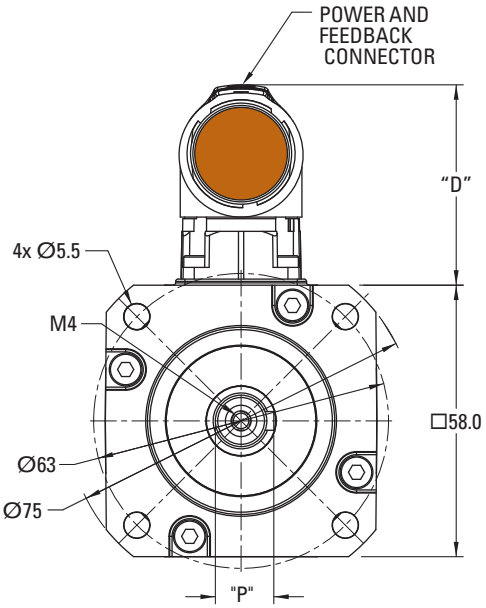


Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM®2G-2x Series LV Servo Motors

AKM2G-2x Single A-, D- Connector Frame





AKM2G-2x Mounting Flange-Shaft Dimensional Data

Mounting Flange-Shaft	Shaft Diameter	Shaft Length	Shaft Dia. w/ Key	Key Width	–	Key Length
	"J"	"K"	"P"	"R"	"S"	"T"
AC	11k6	23	12.5	4	3.5	16
AN	11k6	23	–	–	–	–

All dimensions in mm

AKM2G-2x Connector Height

Connector Feedback	"D"
SFD3 (CA), SFD-M (CB)	42.8
DSL (GU) & EnDat 2.2/22 (LD)	44.1

AKM2G-2x "X" and "L" Dimensions

	No Brake (N)		
	"L" MAX		"X" REF
Connector	A-, D-	D-	A-, D-
Feedback Option	Cx	GU, LD	Cx, GU, LD
AKM2G-21	111.15	118.15	90.75
AKM2G-22	130.40	137.40	110.00
AKM2G-23	149.65	156.65	149.65
AKM2G-24	168.90	175.90	148.50
+ Brake ("2" option)	All AKM2G-2x: Add +39.00 mm to both "L" and "X" dimensions		

All dimensions in mm

Note: Product designed in metric.

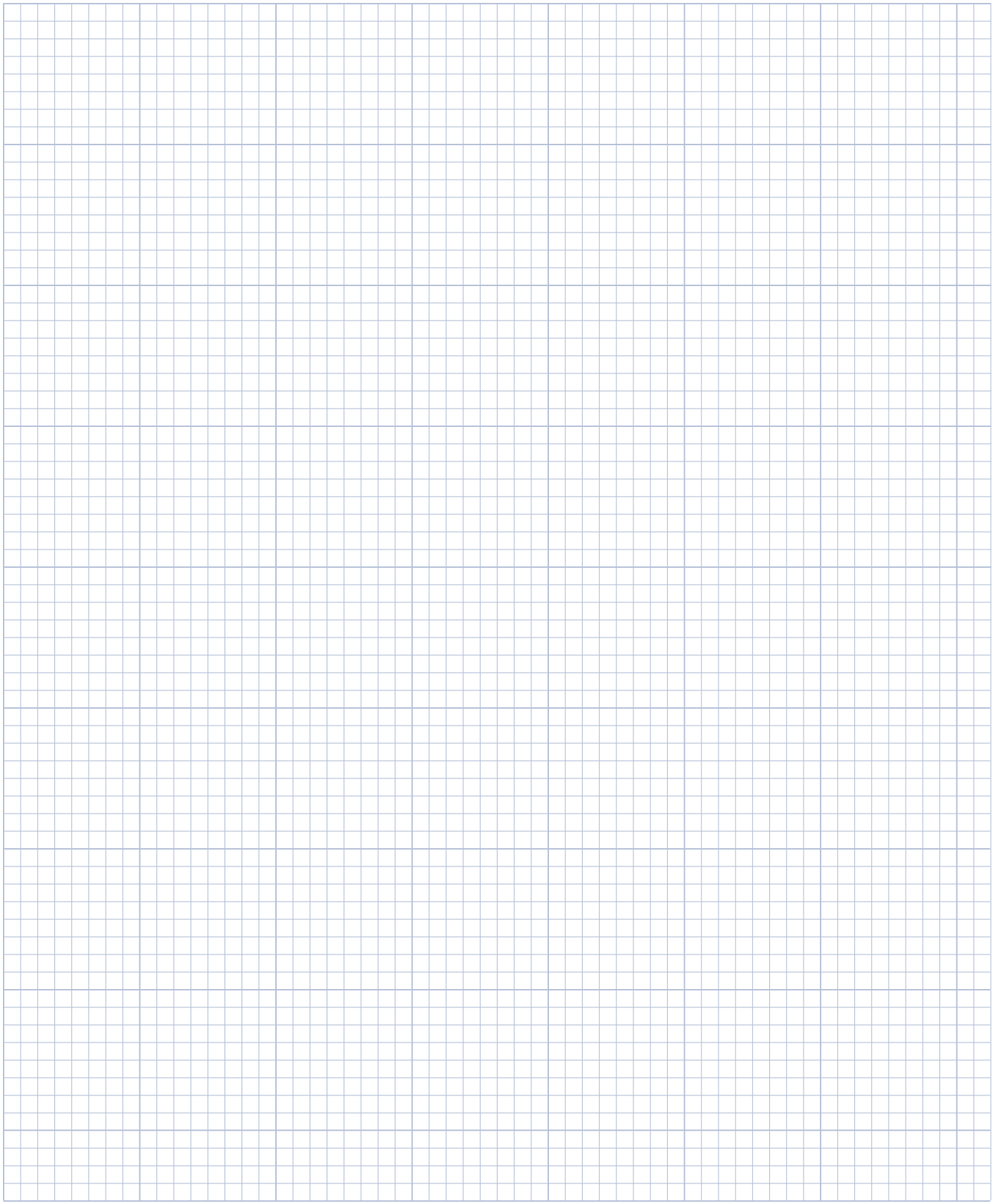
Related Topics:

Feedback Options and Specifications
Connector Options and Pinouts

Notes

AKM2G – 2 1 ML AN D N LD 10

- AKM2G: Motor Series
- 2: Frame Size
- 1: Rotor Length
- ML: Winding
- AN: Flange
- Shaft
- D: Connection
- N: Brake
- LD: Feedback
- 10: Thermal Sensor
- Customization



0.125 inch divisions

AKM®2G-3x Series Servo Motors

AKM2G-3x Low Voltage Servo Motor Performance Data – Up to 96 Vdc

					AKM2G-31		AKM2G-32		AKM2G-33	
	Parameters	Tol	Symbol	Units	ML	PL	ML	PL	ML	PL
	Max Rated Equivalent Line Voltage	Max	Vbus	Vdc	170	170	170	170	170	170
	Continuous Torque for ΔT winding = 100°C ①②③	Nom	T_{cs}	Nm	1.73	1.69	2.89	2.77	3.82	3.83
				lb-in	15.3	15.0	25.6	24.6	33.8	33.9
	Continuous Current for ΔT winding = 100°C ①②③	Nom	I_{cs}	A_{rms}	14.2	20.0	14.8	20.0	14.8	20.0
	Continuous Torque for ΔT winding = 60°C ②③	Nom	T_{cs}	Nm	1.34	1.33	2.25	2.23	2.97	3.01
				lb-in	11.9	11.8	19.9	19.7	26.3	26.7
	Max Mechanical Speed ④	Nom	N_{max}	rpm	8000	8000	8000	8000	8000	8000
	Peak Torque ①②③	Nom	T_p	Nm	6.14	6.09	10.7	10.6	14.5	14.6
				lb-in	54.3	53.9	94.6	93.7	128	130
	Peak Current	Nom	I_p	A_{rms}	56.8	80.7	59.1	82.4	59.0	80.8
24 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	-	1.67	-	2.79	-	3.82
				lb-in	-	14.8	-	24.7	-	33.8
	Rated Speed		N_{rtd}	rpm	-	2200	-	1300	-	800
	Rated Power (speed) ①②③		P_{rtd}	kW	-	0.385	-	0.379	-	0.320
				Hp	-	0.517	-	0.509	-	0.430
48 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	1.65	1.57	2.81	2.70	3.69	3.64
				lb-in	14.6	13.9	24.9	23.9	32.6	32.2
	Rated Speed		N_{rtd}	rpm	3300	4900	2000	3000	1500	2100
	Rated Power (speed) ①②③		P_{rtd}	kW	0.570	0.804	0.589	0.849	0.579	0.801
				Hp	0.764	1.08	0.790	1.138	0.777	1.07
72 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	1.57	1.41	2.70	2.51	3.54	3.38
				lb-in	13.9	12.4	23.9	22.2	31.3	30.0
	Rated Speed		N_{rtd}	rpm	5200	7800	3200	4700	2400	3400
	Rated Power (speed) ①②③		P_{rtd}	kW	0.853	1.15	0.906	1.23	0.890	1.21
				Hp	1.14	1.54	1.215	1.66	1.19	1.62
96 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	1.46	-	2.57	2.26	3.34	3.06
				lb-in	12.9	-	22.7	20.0	29.6	27.1
	Rated Speed		N_{rtd}	rpm	7200	-	4400	6400	3400	4700
	Rated Power (speed) ①②③		P_{rtd}	kW	1.10	-	1.18	1.51	1.19	1.50
				Hp	1.47	-	1.59	2.03	1.60	2.02

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② All data referenced to sinusoidal commutation.
③ Motor with resolver feedback and standard heat sink.
④ May be limited at some values of Vbus.

AKM2G-3x Low Voltage Servo Motor Performance Data – Up to 96 Vdc (continued)

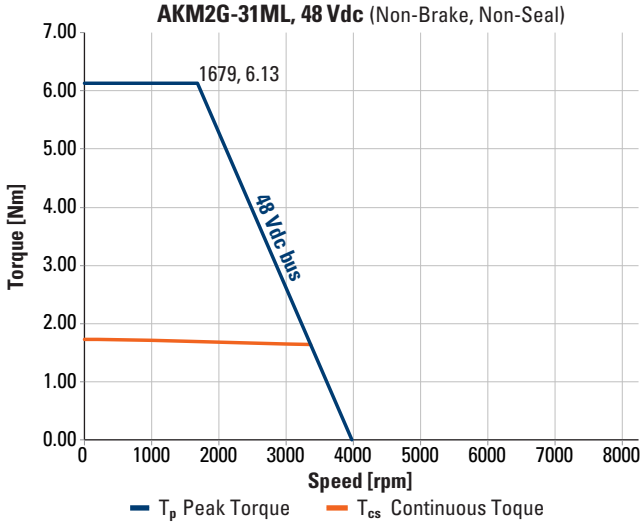
				AKM2G-31		AKM2G-32		AKM2G-33	
Parameters	Tol	Symbol	Units	ML	PL	ML	PL	ML	PL
Torque Constant ①	±10%	K_t	Nm/A_{rms}	0.124	0.087	0.201	0.142	0.265	0.196
			$lb\text{-}in/A_{rms}$	1.10	0.766	1.78	1.261	2.34	1.731
Back EMF Constant ②	±10%	K_e	V_{rms}/k_{rpm}	8.09	5.64	13.09	9.28	17.2	12.7
Motor Constant ⑥	Nom	K_m	$N\text{-}m/\sqrt{W}$	0.211	0.210	0.335	0.332	0.422	0.428
			$lb\text{-}in/\sqrt{W}$	1.87	1.85	2.97	2.94	3.74	3.79
Resistance (line-line) ②	±10%	R_m	Ohm	0.230	0.114	0.240	0.122	0.262	0.139
Inductance Q-Axis (line-line)		Lqll	mH	0.54	0.26	0.57	0.29	0.61	0.33
Inductance Saturation Current		Lisat	Arms	188	270	236	333	270	366
Inertia ③	±10%	J_m	$kg\text{-}cm^2$	0.426		0.813		1.200	
			$lb\text{-}in\text{-}s^2$	3.77E-04		7.20E-04		1.06E-03	
Optional Brake Inertia (additional)	±10%	J_m	$kg\text{-}cm^2$	0.120		0.120		0.120	
			$lb\text{-}in\text{-}s^2$	1.06E-04		1.06E-04		1.06E-04	
Weight without brake ④		W	kg	1.8		2.5		3.3	
			lb	4.0		5.6		7.2	
Static Friction ①⑤		T_f	Nm	0.013		0.023		0.031	
			lb-in	0.12		0.20		0.27	
Viscous Damping ①		K_{dv}	Nm/k_{rpm}	0.0039		0.0078		0.0117	
			$lb\text{-}in/k_{rpm}$	0.035		0.069		0.104	
Thermal Time Constant		TCT	minutes	17		21		25	
Thermal Resistance ①		$R_{thw\text{-}a}$	K/W	0.980		0.868		0.795	
Pole Pairs		PP		4		4		4	
Heat Sink Size				10"x10"x1/4" Aluminum Plate		10"x10"x1/4" Aluminum Plate		10"x10"x1/4" Aluminum Plate	

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② Measured at 25° C.
③ Add parking brake if applicable for total inertia.
④ Brake motor adds 0.72 kg [1.6 lbs]
⑤ Shaft seal increases Static Friction by 0.017 Nm [0.15 lb-in]
⑥ This value is calculated from the Torque Constant and Resistance. Refer to those values and notes ① & ② for additional details.

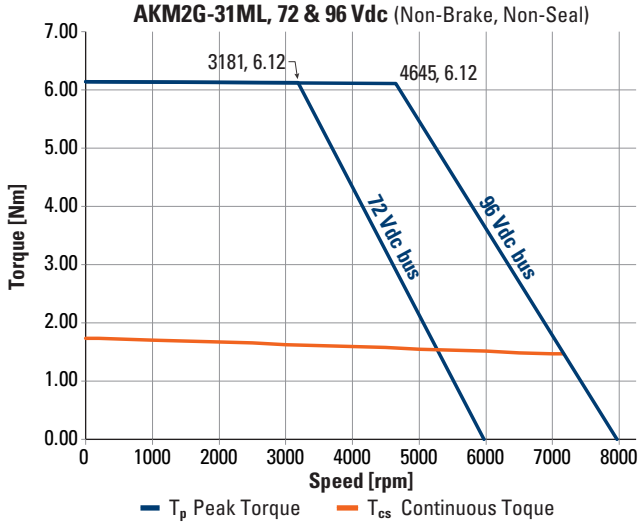
AKM®2G-3x Series Servo Motors

AKM2G-3x Torque-Speed Performance Curves – Up to 96 Vdc

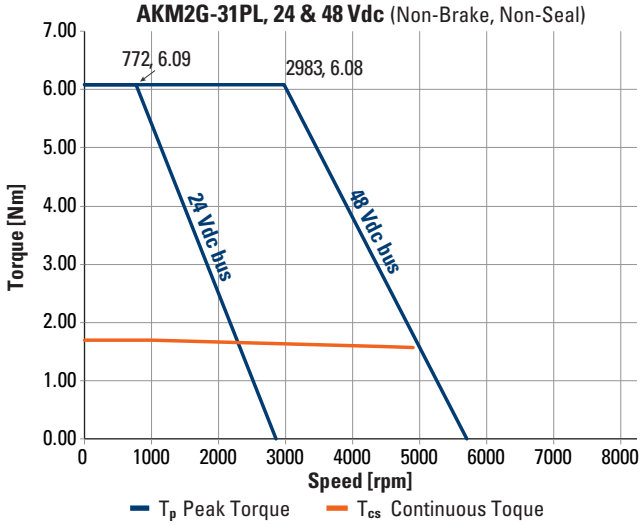
AKM2G-31ML, 48 Vdc (Non-Brake, Non-Seal)



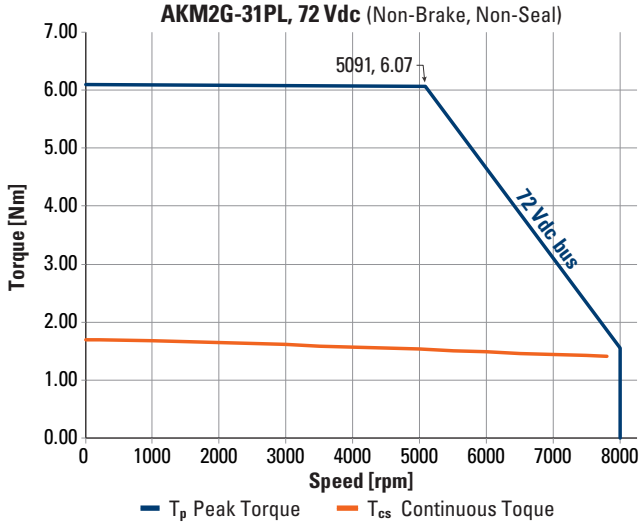
AKM2G-31ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



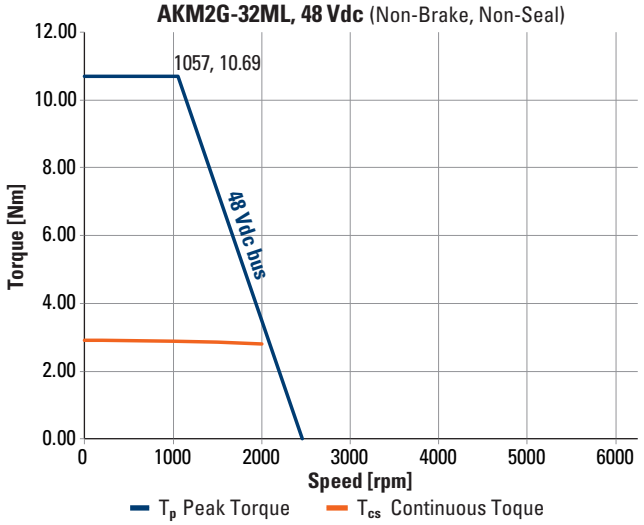
AKM2G-31PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



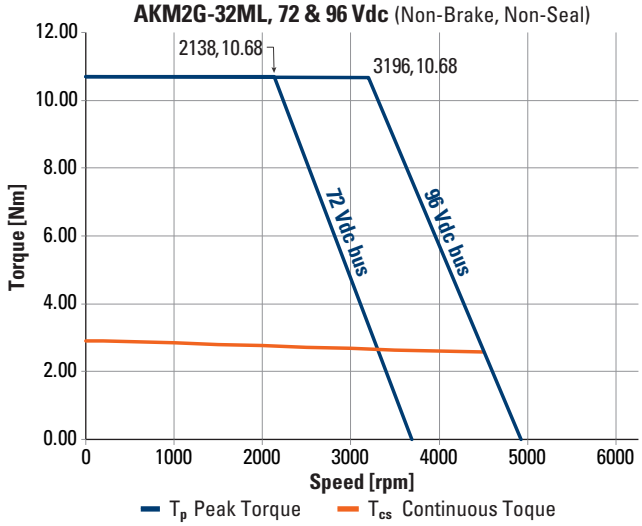
AKM2G-31PL, 72 Vdc (Non-Brake, Non-Seal)



AKM2G-32ML, 48 Vdc (Non-Brake, Non-Seal)



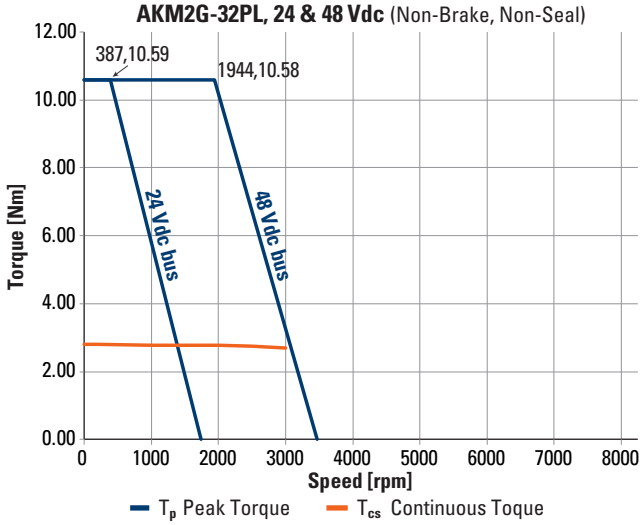
AKM2G-32ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



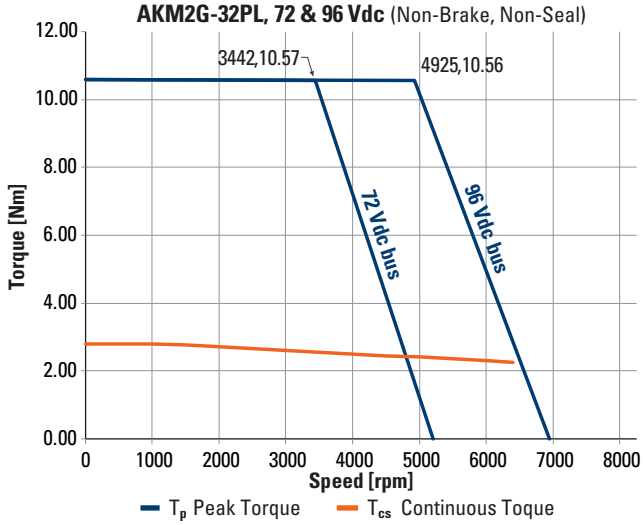
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM2G-3x Torque-Speed Performance Curves – Up to 96 Vdc (continued)

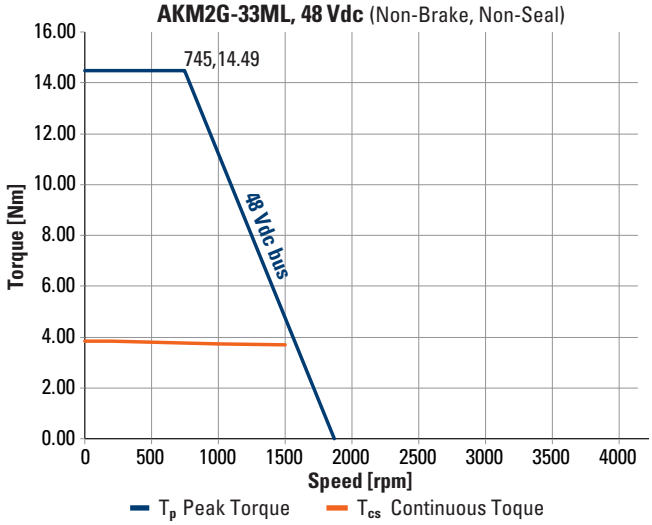
AKM2G-32PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



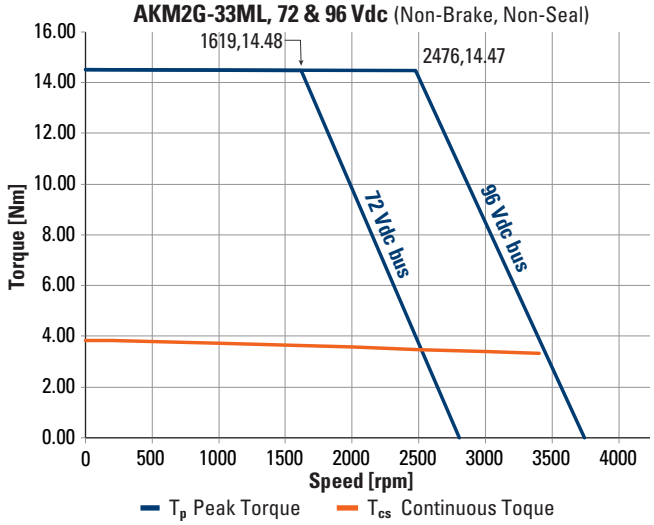
AKM2G-32PL, 72 & 96 Vdc (Non-Brake, Non-Seal)



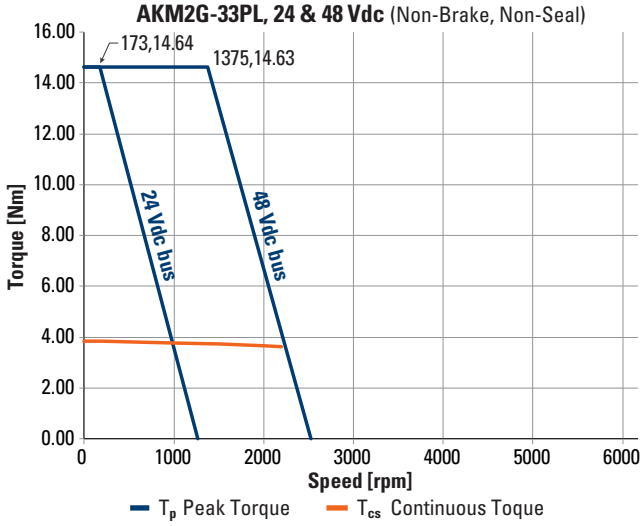
AKM2G-33ML, 48 Vdc (Non-Brake, Non-Seal)



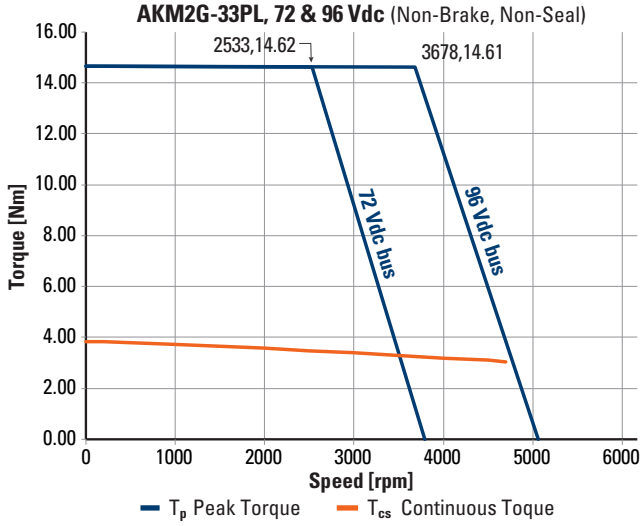
AKM2G-33ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



AKM2G-33PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



AKM2G-33PL, 72 & 96 Vdc (Non-Brake, Non-Seal)

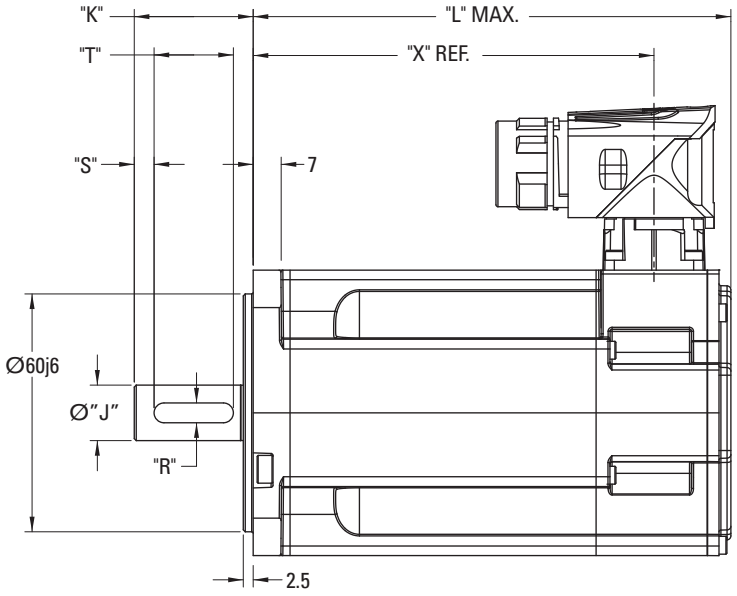


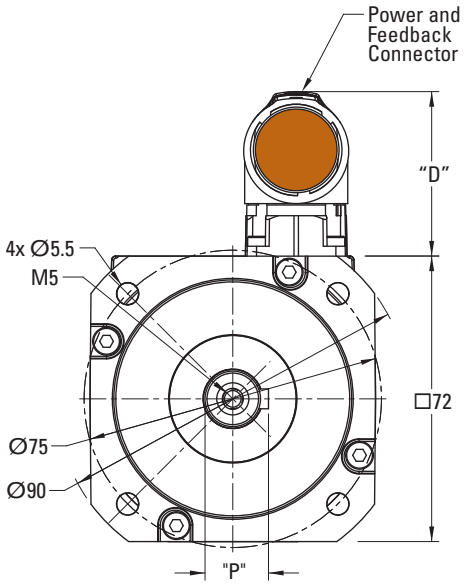
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM®2G-3x Series Servo Motors

AKM2G-3x Dimensional Drawings

AKM2G-3x A-, D- Single Connector Frame





AKM2G-3x Mounting Flange-Shaft Dimensional Data

Mounting Flange-Shaft	Shaft Diameter	Shaft Length	Shaft Dia. w/ Key	Key Width	–	Key Length
	"J"	"K"	"P"	"R"	"S"	"T"
AC	14k6	30	16	5	5	20
AN	14k6	30	–	–	–	–
GC	11k6	23	12.5	4	3.5	16
GN	11k6	23	–	–	–	–

All dimensions in mm

AKM2G-3x Connector Height

Connector Feedback	"D"
SFD3 (CA), SFD-M	42.8
DSL (GU) & EnDat 2.2/22 (LD)	44.1

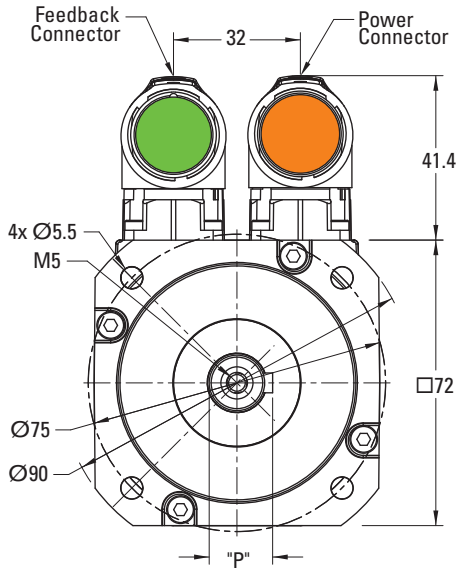
AKM2G-3x "X" and "L" Dimensions

	No Brake (N)		
	"L" MAX		"X" REF
Connector	A-, C-, D-	A-, C-, D-	A-, D-, Y-
Feedback Option	Cx, 2-, Ax, R-	Dx, GU, LD	Cx, 2-, Ax, Dx, GU, LD, R-
AKM2G-31	121.4	129.4	101.10
AKM2G-32	152.55	160.55	132.25
AKM2G-33	183.7	191.7	163.4
+ Brake ("2" option)	All AKM2G-3x: Add +41.20 mm to both "L" and "X" dimensions		

All dimensions in mm

Note: Product designed in metric.

AKM2G-3x A-, C- Dual Connector Option



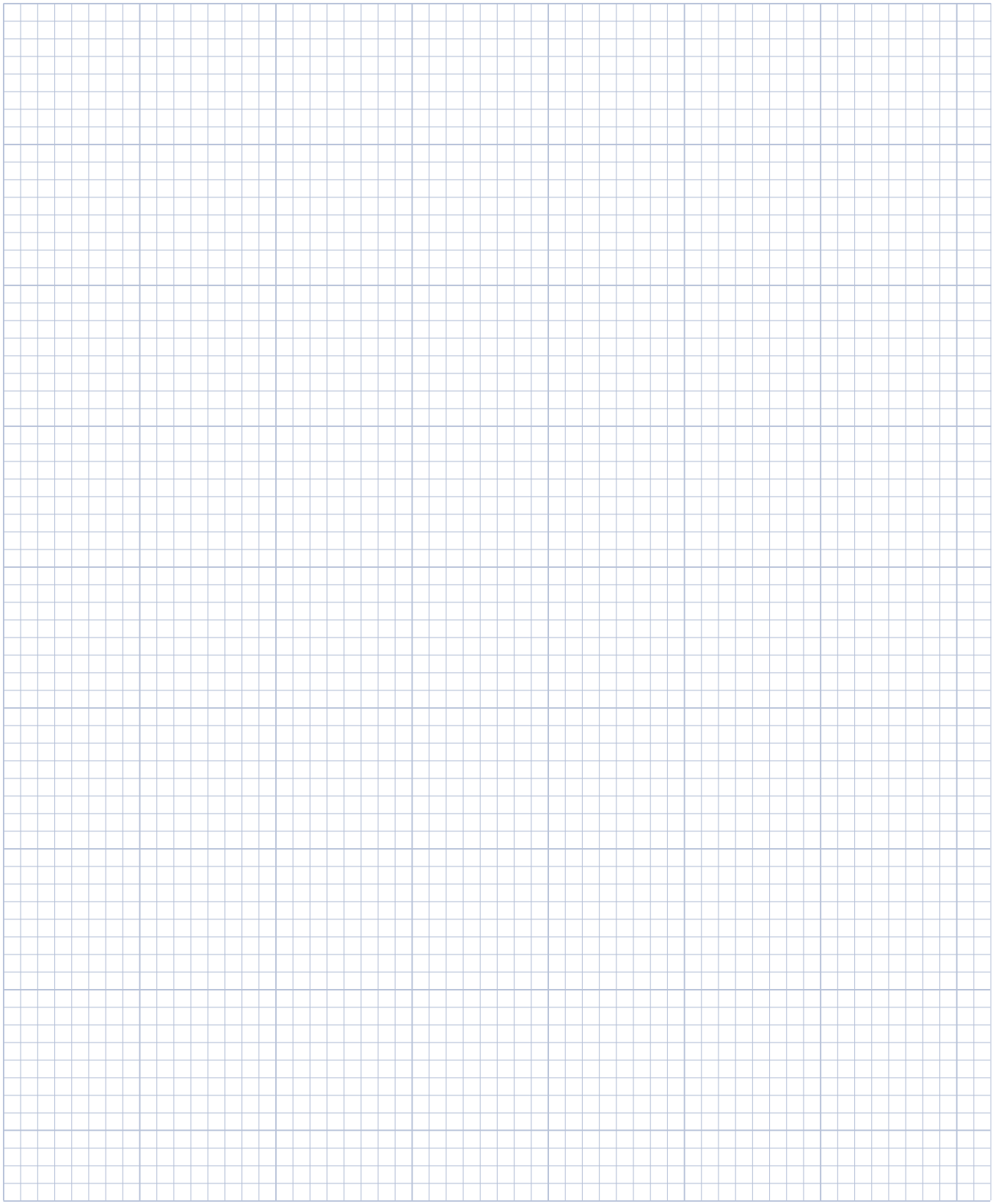
Related Topics:

Feedback Options and Specifications
Connector Options and Pinouts

Notes

AKM2G – 3 2 ML AN C N 2- 10

- AKM2G: Motor Series
- 3: Frame Size
- 2: Rotor Length
- ML: Winding
- AN: Shaft Flange
- C: Connection
- N: Brake
- 2-: Feedback
- 10: Customization Thermal Sensor



0.125 inch divisions

AKM®2G-4x Series Servo Motors

AKM2G-4x Low Voltage Servo Motor Performance Data – Up to 96 Vdc

					AKM2G-41		AKM2G-42			AKM2G-43			AKM2G-44		
	Parameters	Tol	Symbol	Units	ML	PL	ML	NL	PL	LL	ML	NL	LL	ML	NL
	Max Rated Equivalent Line Voltage	Max	Vbus	Vdc	170	170	170	170	170	170	170	170	170	170	170
	Continuous Torque for ΔT winding = 100°C ①②③	Nom	T_{cs}	Nm	2.91	2.91	5.17	5.17	5.16	7.07	7.06	7.06	8.59	8.60	8.59
				lb-in	25.7	25.8	45.7	45.7	45.7	62.6	62.5	62.5	76.0	76.1	76.0
	Continuous Current for ΔT winding = 100°C ①②③	Nom	I_{cs}	A_{rms}	14.1	19.9	13.8	17.4	19.7	12.5	14.0	18.0	12.8	14.5	16.4
	Continuous Torque for ΔT winding = 60°C ②③	Nom	T_{cs}	Nm	2.26	2.27	4.03	4.03	4.02	5.51	5.50	5.51	6.70	6.71	6.70
				lb-in	20.0	20.1	35.6	35.7	35.6	48.7	48.7	48.7	59.3	59.4	59.3
	Max Mechanical Speed ④	Nom	N_{max}	rpm	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
	Peak Torque ①②③	Nom	T_p	Nm	7.28	7.28	14.5	14.5	14.5	21.2	21.2	21.2	27.1	27.1	27.1
				lb-in	64.4	64.4	128	128	128	188	188	188	240	240	240
	Peak Current	Nom	I_p	A_{rms}	56.2	79.7	55.1	69.8	78.8	50.2	56.0	71.8	51.3	58.2	65.7
24 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	-	2.89	-	-	-	-	-	-	-	-	-
				lb-in	-	25.6	-	-	-	-	-	-	-	-	-
	Rated Speed		N_{rtd}	rpm	-	1000	-	-	-	-	-	-	-	-	-
	Rated Power (speed) ①②③		P_{rtd}	kW	-	0.303	-	-	-	-	-	-	-	-	-
				Hp	-	0.406	-	-	-	-	-	-	-	-	-
36 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	-	-	-	5.12	5.10	-	-	7.01	-	-	-
				lb-in	-	-	-	45.3	45.1	-	-	62.0	-	-	-
	Rated Speed		N_{rtd}	rpm	-	-	-	800	900	-	-	600	-	-	-
	Rated Power (speed) ①②③		P_{rtd}	kW	-	-	-	0.429	0.480	-	-	0.440	-	-	-
				Hp	-	-	-	0.575	0.64	-	-	0.590	-	-	-
48 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	2.85	2.80	5.10	5.08	5.04	-	7.00	6.96	-	8.54	8.50
				lb-in	25.2	24.8	45.1	44.9	44.6	-	62.0	61.6	-	75.6	75.2
	Rated Speed		N_{rtd}	rpm	1600	2300	900	1100	1300	-	600	800	-	500	600
	Rated Power (speed) ①②③		P_{rtd}	kW	0.477	0.674	0.481	0.585	0.686	-	0.440	0.58	-	0.447	0.534
				Hp	0.639	0.904	0.645	0.78	0.92	-	0.59	0.78	-	0.600	0.716
72 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	2.78	2.68	5.02	4.96	4.89	6.94	6.91	6.83	8.46	8.41	8.36
				lb-in	24.6	23.7	44.5	43.9	43.3	61.4	61.1	60.4	74.9	74.4	74.0
	Rated Speed		N_{rtd}	rpm	2500	3600	1400	1800	2100	900	1000	1300	700	900	1000
	Rated Power (speed) ①②③		P_{rtd}	kW	0.727	1.01	0.736	0.93	1.08	0.654	0.724	0.93	0.620	0.793	0.875
				Hp	0.97	1.35	0.988	1.25	1.44	0.88	0.97	1.25	0.832	1.06	1.17
96 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	2.69	2.51	4.93	4.81	4.73	6.86	6.80	6.65	8.35	8.29	8.20
				lb-in	23.8	22.2	43.6	42.6	41.8	60.7	60.2	58.8	73.9	73.4	72.5
	Rated Speed		N_{rtd}	rpm	3400	5000	1900	2500	2800	1200	1400	1900	1000	1200	1400
	Rated Power (speed) ①②③		P_{rtd}	kW	0.96	1.31	0.98	1.26	1.39	0.86	1.00	1.32	0.874	1.04	1.20
				Hp	1.28	1.76	1.32	1.69	1.86	1.16	1.34	1.77	1.17	1.40	1.61
108 Vdc	Rated Torque (speed) ①②③		T_{rtd}	Nm	-	-	-	-	-	-	-	-	8.28	8.21	8.11
				lb-in	-	-	-	-	-	-	-	-	73.2	72.6	71.7
	Rated Speed		N_{rtd}	rpm	-	-	-	-	-	-	-	-	1200	1400	1600
	Rated Power (speed) ①②③		P_{rtd}	kW	-	-	-	-	-	-	-	-	1.040	1.20	1.36
				Hp	-	-	-	-	-	-	-	-	1.39	1.61	1.82

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② All data referenced to sinusoidal commutation.
③ Motor with resolver feedback and standard heat sink.
④ May be limited at some values of Vbus.

AKM2G-4x Low Voltage Servo Motor Performance Data – Up to 96 Vdc (continued)

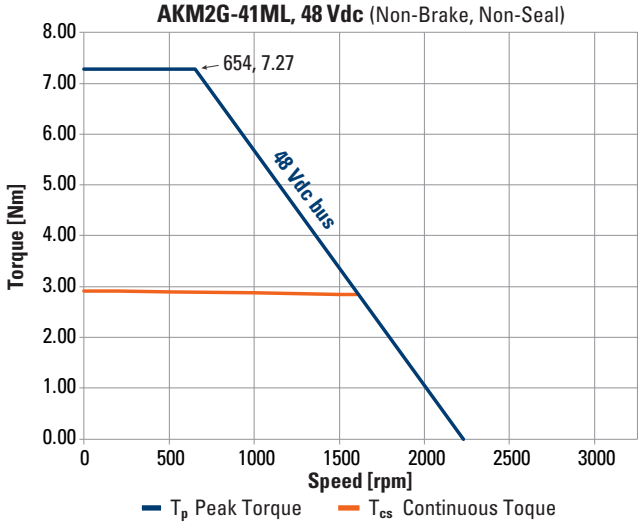
				AKM2G-41		AKM2G-42			AKM2G-43			AKM2G-44		
Parameters	Tol	Symbol	Units	ML	PL	ML	NL	PL	LL	ML	NL	LL	ML	NL
Torque Constant ①	±10%	K_t	Nm/A_{rms}	0.209	0.147	0.378	0.298	0.263	0.567	0.507	0.395	0.674	0.595	0.525
			$lb\text{-}in/A_{rms}$	1.85	1.30	3.34	2.64	2.33	5.02	4.49	3.50	5.97	5.26	4.65
Back EMF Constant ②	±10%	K_e	V_{rms}/k_{rpm}	13.8	9.75	25.2	19.9	17.6	38.0	34.0	26.5	45.5	40.1	35.5
Motor Constant ⑥	Nom	K_m	N-m/√W	0.333	0.334	0.536	0.536	0.536	0.687	0.686	0.687	0.809	0.810	0.809
			lb-in/√W	2.95	2.96	4.74	4.75	4.74	6.08	6.07	6.08	7.16	7.17	7.16
Resistance (line-line) ②	±10%	R_m	Ohm	0.262	0.130	0.331	0.206	0.161	0.454	0.364	0.221	0.463	0.359	0.281
Inductance Q-Axis (line-line)		Lqll	mH	1.6	0.80	2.3	1.5	1.1	3.4	2.7	1.6	3.6	2.8	2.2
Inductance Saturation Current		Lisat	Arms	71	101	80	101	114	80	89	114	89	101	114
Inertia ③	±10%	J_m	$kg\text{-}cm^2$	0.774		1.36			1.95			2.53		
			$lb\text{-}in\text{-}s^2$	6.85E-04		1.20E-03			1.72E-03			2.24E-03		
Optional Brake Inertia (additional)	±10%	J_m	$kg\text{-}cm^2$	0.36		0.36			0.36			0.36		
			$lb\text{-}in\text{-}s^2$	3.19E-04		3.19E-04			3.19E-04			3.19E-04		
Weight without brake ④		W	kg	2.90		3.86			4.81			5.76		
			lb	6.39		8.5			10.6			12.7		
Static Friction ①⑤		T_f	Nm	0.0230		0.030			0.0380			0.0450		
			lb-in	0.2036		0.27			0.336			0.398		
Viscous Damping ①		K_{dv}	Nm/k_{rpm}	0.00450		0.009			0.0125			0.0163		
			$lb\text{-}in/k_{rpm}$	0.0398		0.08			0.111			0.144		
Thermal Time Constant		TCT	minutes	17		22			27			32		
Thermal Resistance ①		$R_{thw\text{-}a}$	K/W	0.880		0.725			0.637			0.598		
Pole Pairs		PP		5		5			5			5		
Heat Sink Size				10"x10"x1/4" Aluminum Plate		10"x10"x1/4" Aluminum Plate			10"x10"x1/4" Aluminum Plate			10"x10"x1/4" Aluminum Plate		

Notes:
① Motor winding temperature rise, ΔT = 100° C, at 40° C ambient.
② Measured at 25° C.
③ Add parking brake if applicable for total inertia.
④ Brake motor adds 1.36 kg [3.0 lbs]
⑤ Shaft seal increases Static Friction by 0.023 Nm [0.20 lb-in]
⑥ This value is calculated from the Torque Constant and Resistance. Refer to those values and notes ① & ② for additional details.

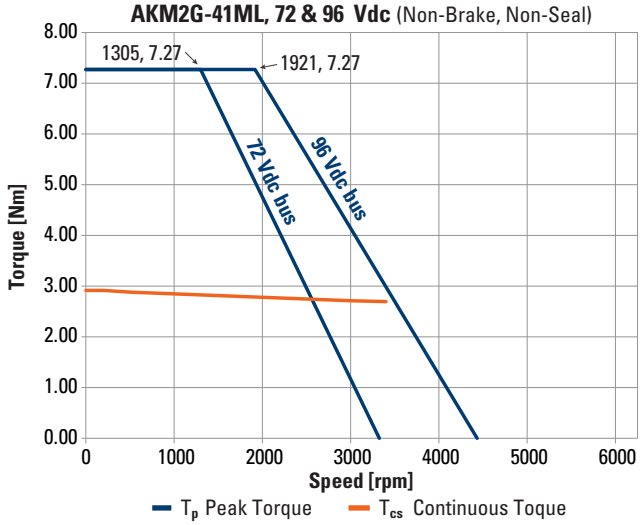
AKM®2G-4x Series Servo Motors

AKM2G-4x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc

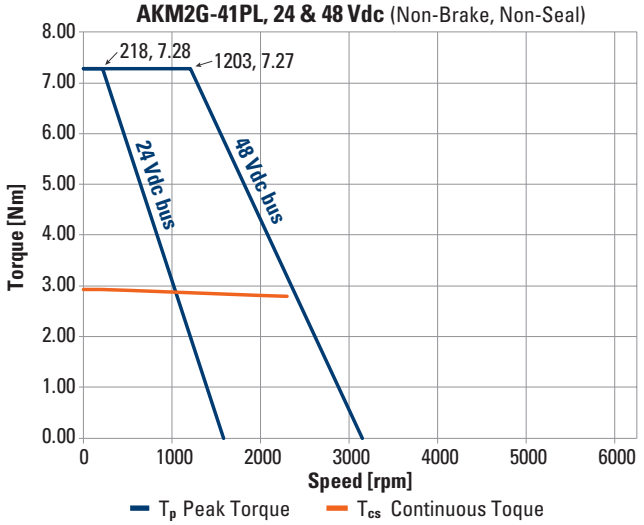
AKM2G-41ML, 48 Vdc (Non-Brake, Non-Seal)



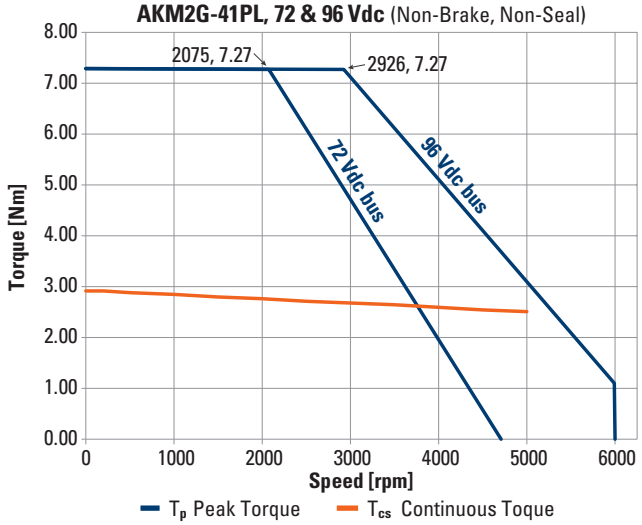
AKM2G-41ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



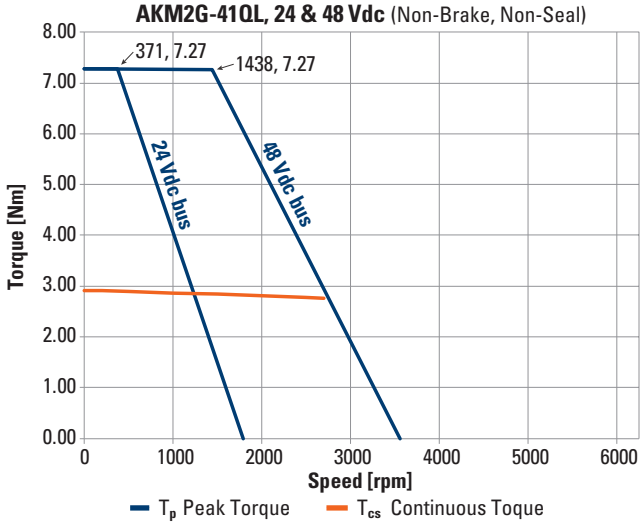
AKM2G-41PL, 24 & 48 Vdc (Non-Brake, Non-Seal)



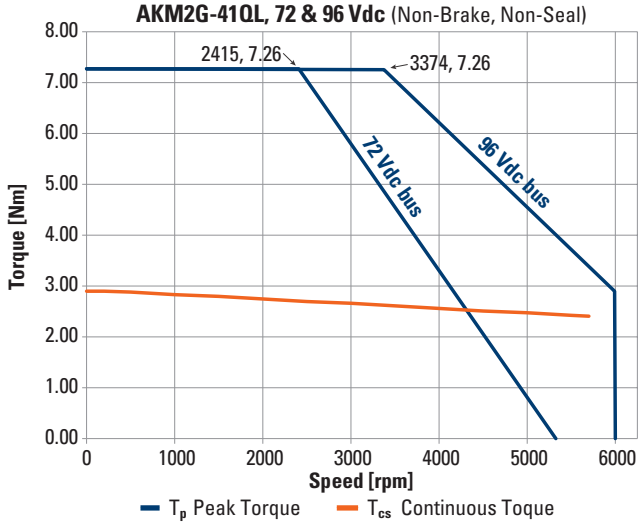
AKM2G-41PL, 72 & 96 Vdc (Non-Brake, Non-Seal)



AKM2G-41QL, 24 & 48 Vdc (Non-Brake, Non-Seal)



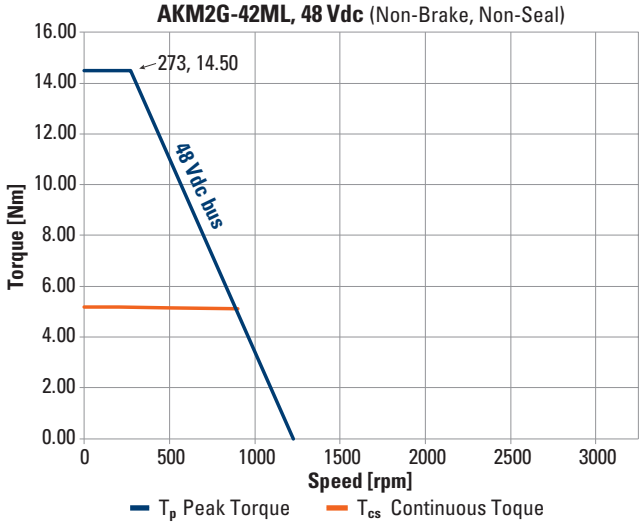
AKM2G-41QL, 72 & 96 Vdc (Non-Brake, Non-Seal)



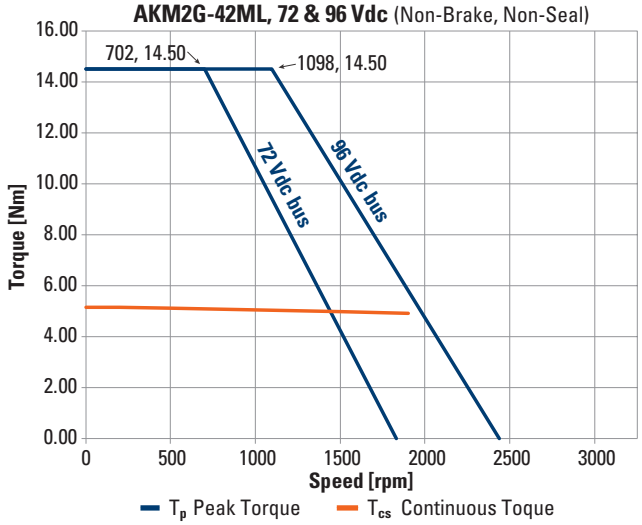
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM2G-4x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)

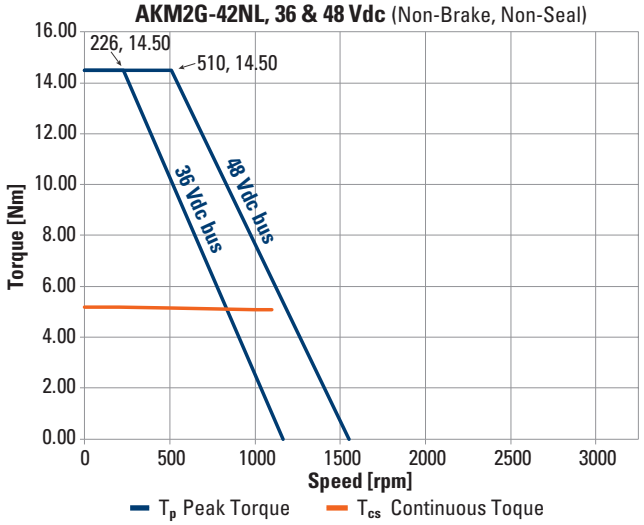
AKM2G-42ML, 48 Vdc (Non-Brake, Non-Seal)



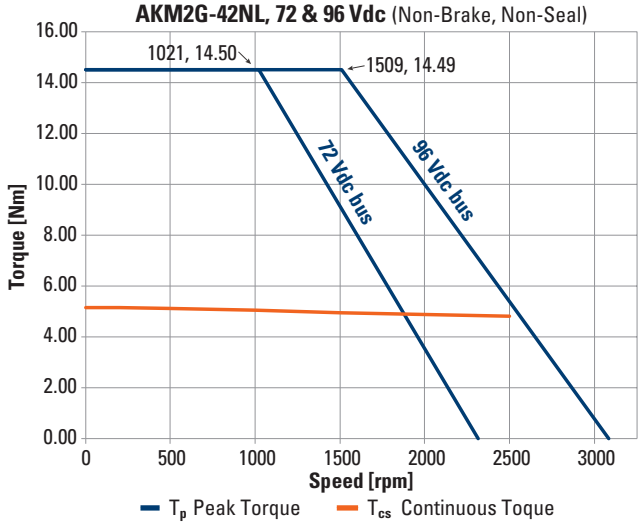
AKM2G-42ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



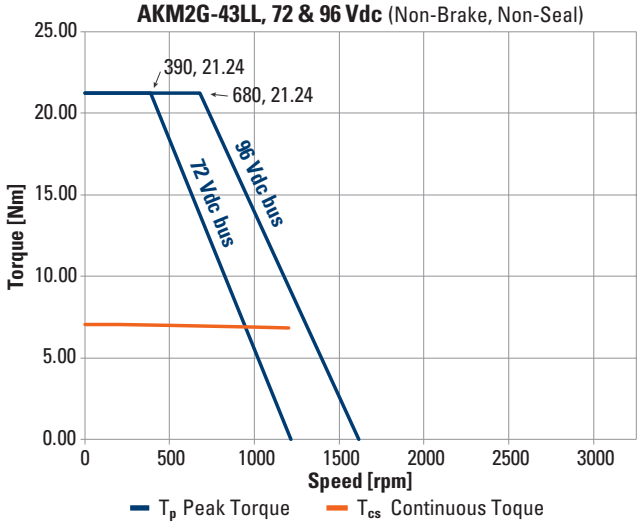
AKM2G-42NL, 36 & 48 Vdc (Non-Brake, Non-Seal)



AKM2G-42NL, 72 & 96 Vdc (Non-Brake, Non-Seal)



AKM2G-43LL, 72 & 96 Vdc (Non-Brake, Non-Seal)

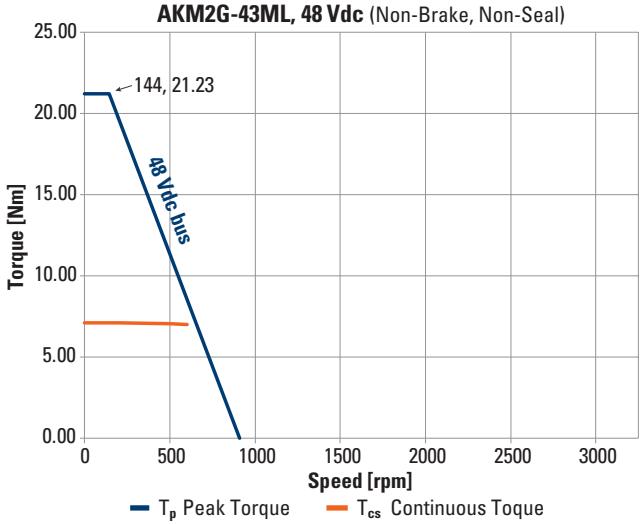


Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

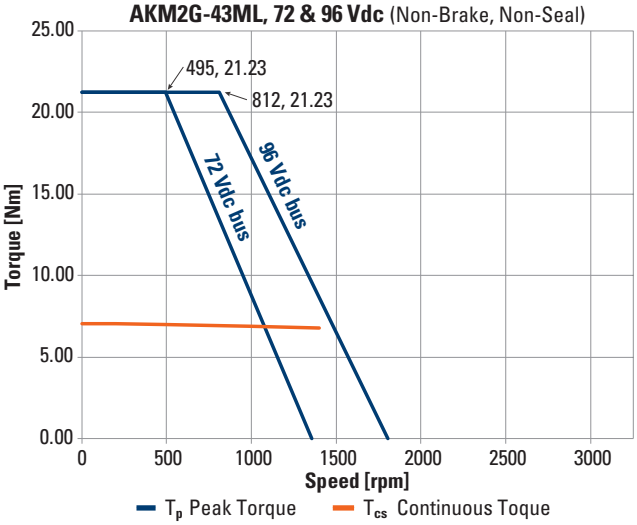
AKM®2G-4x Series Servo Motors

AKM2G-4x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)

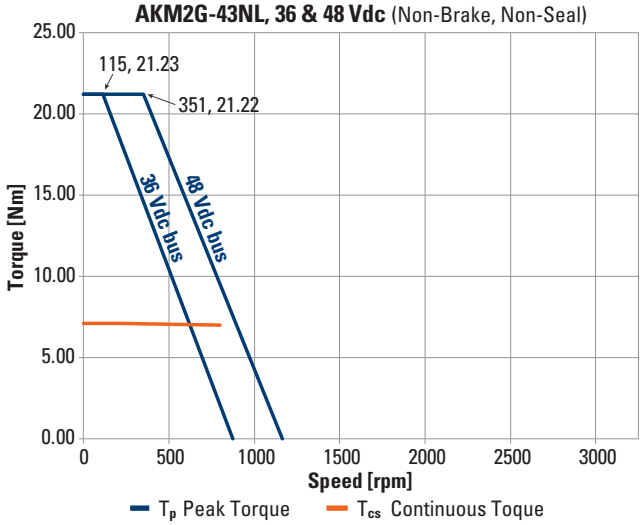
AKM2G-43ML, 48 Vdc (Non-Brake, Non-Seal)



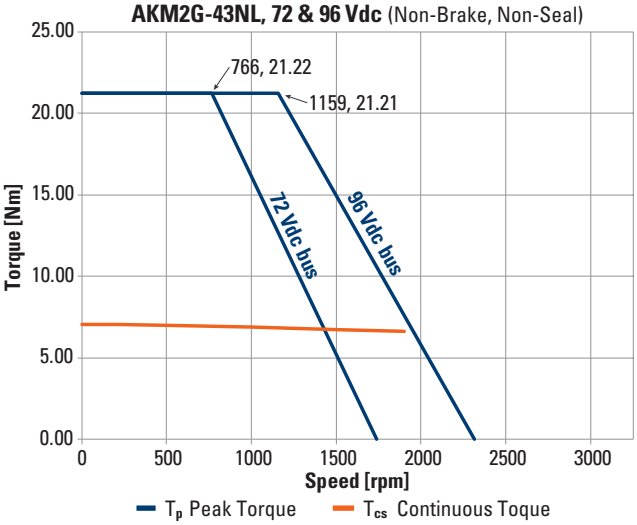
AKM2G-43ML, 72 & 96 Vdc (Non-Brake, Non-Seal)



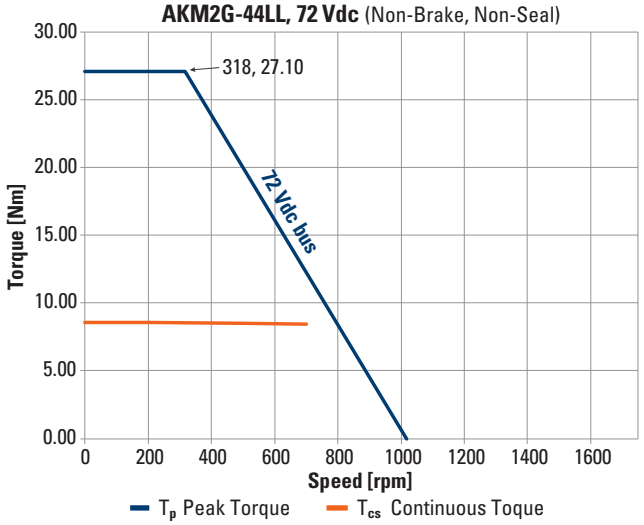
AKM2G-43NL, 36 & 48 Vdc (Non-Brake, Non-Seal)



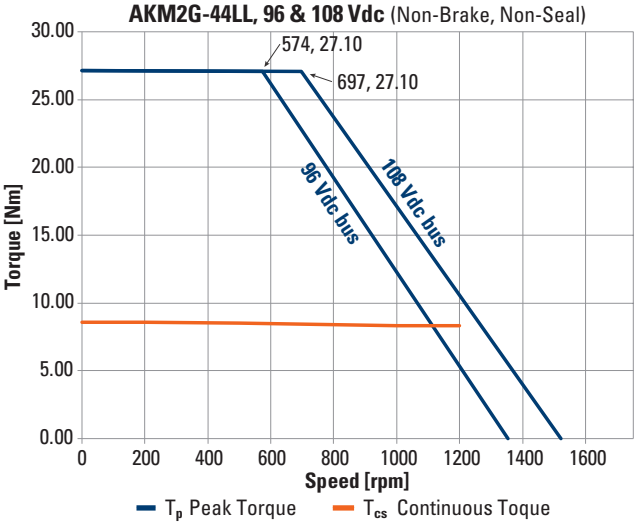
AKM2G-43NL, 72 & 96 Vdc (Non-Brake, Non-Seal)



AKM2G-44LL, 72 Vdc (Non-Brake, Non-Seal)



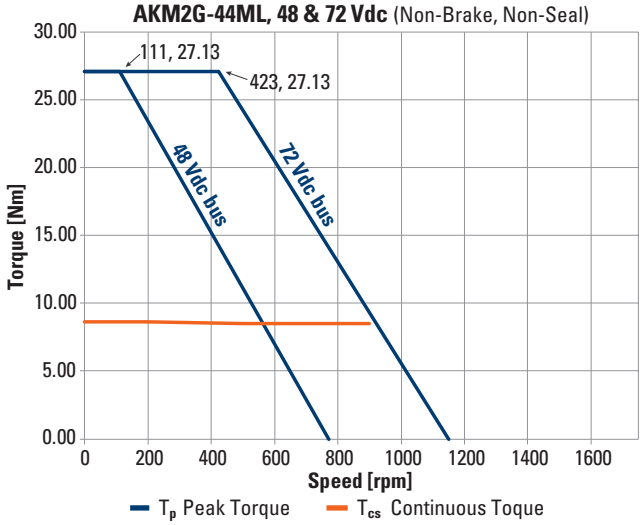
AKM2G-44LL, 96 & 108 Vdc (Non-Brake, Non-Seal)



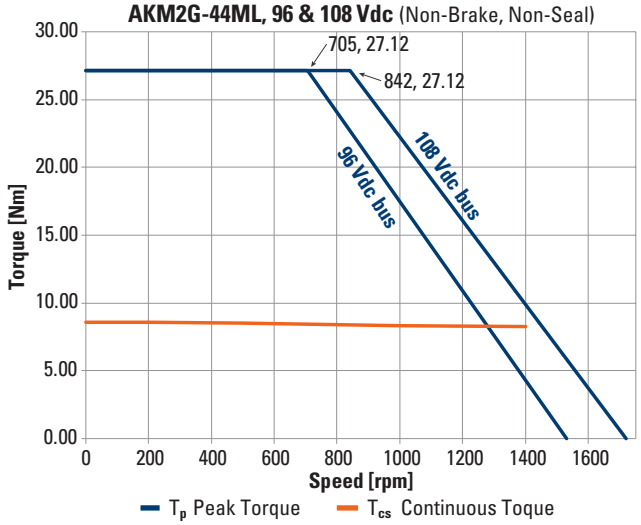
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM2G-4x Low Voltage Servo Motor Performance Curves – Up to 96 Vdc (continued)

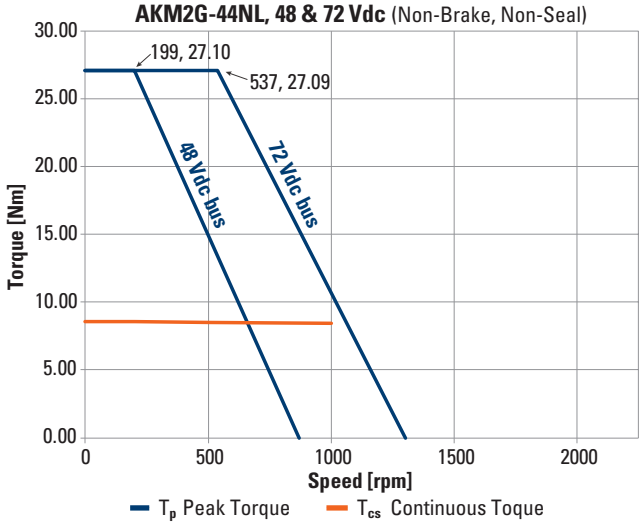
AKM2G-44ML, 48 & 72 Vdc (Non-Brake, Non-Seal)



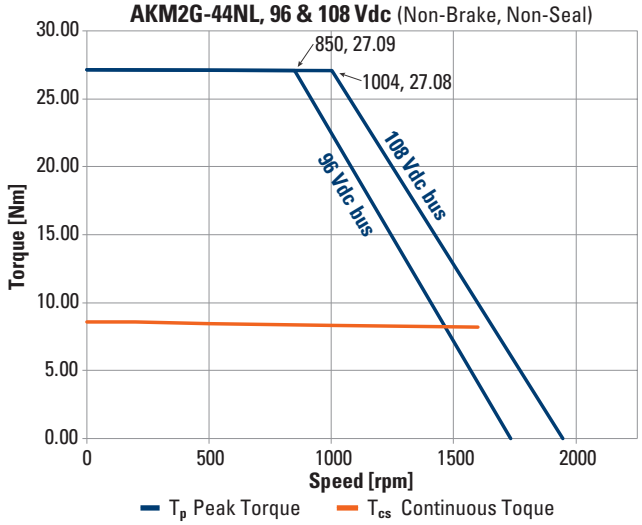
AKM2G-44ML, 96 & 108 Vdc (Non-Brake, Non-Seal)



AKM2G-44NL, 48 & 72 Vdc (Non-Brake, Non-Seal)



AKM2G-44NL, 96 & 108 Vdc (Non-Brake, Non-Seal)

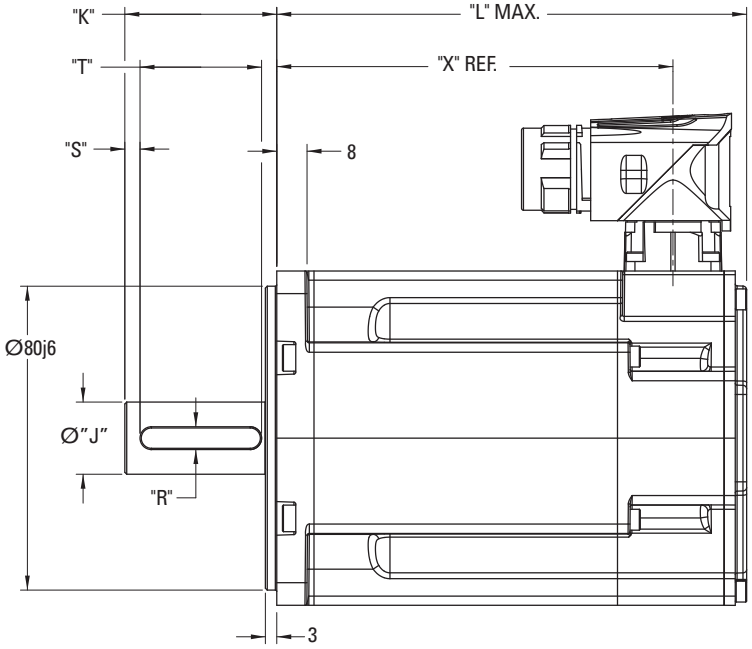


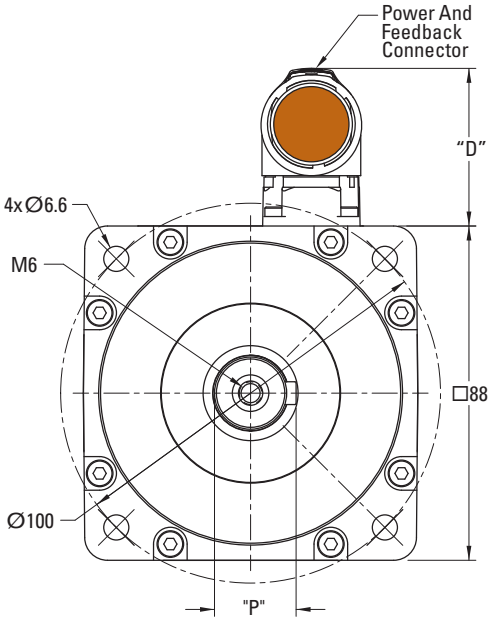
Refer to Servo Motor Performance Curve Overview for torque-speed curve properties.

AKM®2G-4x Series Servo Motors

AKM2G-4x Dimensional Drawings and Data

AKM2G-4x A-, D- Single Connector Frame





AKM2G-4x Mounting Flange-Shaft Dimensional Data

Mounting Flange-Shaft	Shaft Diameter	Shaft Length	Shaft Dia. w/ Key	Key Width	–	Key Length
	"J"	"K"	"P"	"R"	"S"	"T"
AC	19k6	40	21.5	6	4	32
AN	19k6	40	–	–	–	–
GC	14k6	30	16	5	5	20
GN	14k6	30	–	–	–	–

All dimensions in mm

AKM2G-4x Connector Height

Connector Feedback	"D"
SFD3 (CA), SFD-M	42.8
DSL (GU) & EnDat 2.2/22 (LD)	44.1

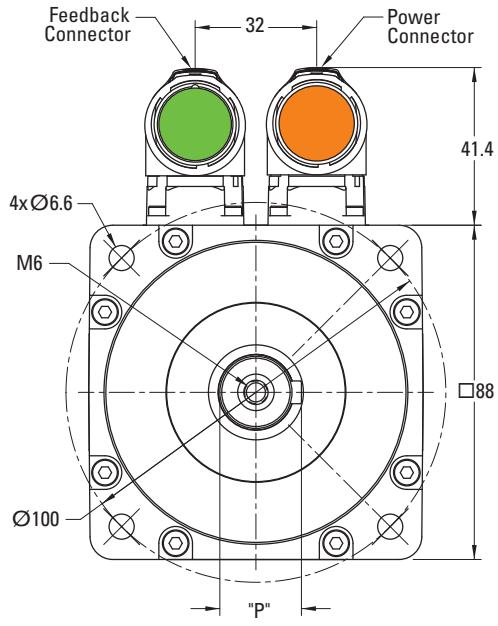
Note: Product designed in metric.

AKM2G-4x "X" and "L" Dimensions

	No Brake (N)		
	"L" MAX		"X" REF
Connector	A-, C-, D-	A-, C-, D-	A-, D-
Feedback Option	Cx, 2-, Ax, R-	Dx, GU, LD	Cx, 2-, Ax, Dx, GU, LD, R-
AKM2G-41	124.60	132.60	104.30
AKM2G-42	150.85	158.85	130.55
AKM2G-43	177.10	185.10	156.80
AKM2G-43	203.35	211.35	183.05
+ Brake ("2" option)	All AKM2G-4x: Add +47.80 mm to both "L" and "X" dimensions		

All dimensions in mm

AKM2G-4x A-, C- Dual Connector Option



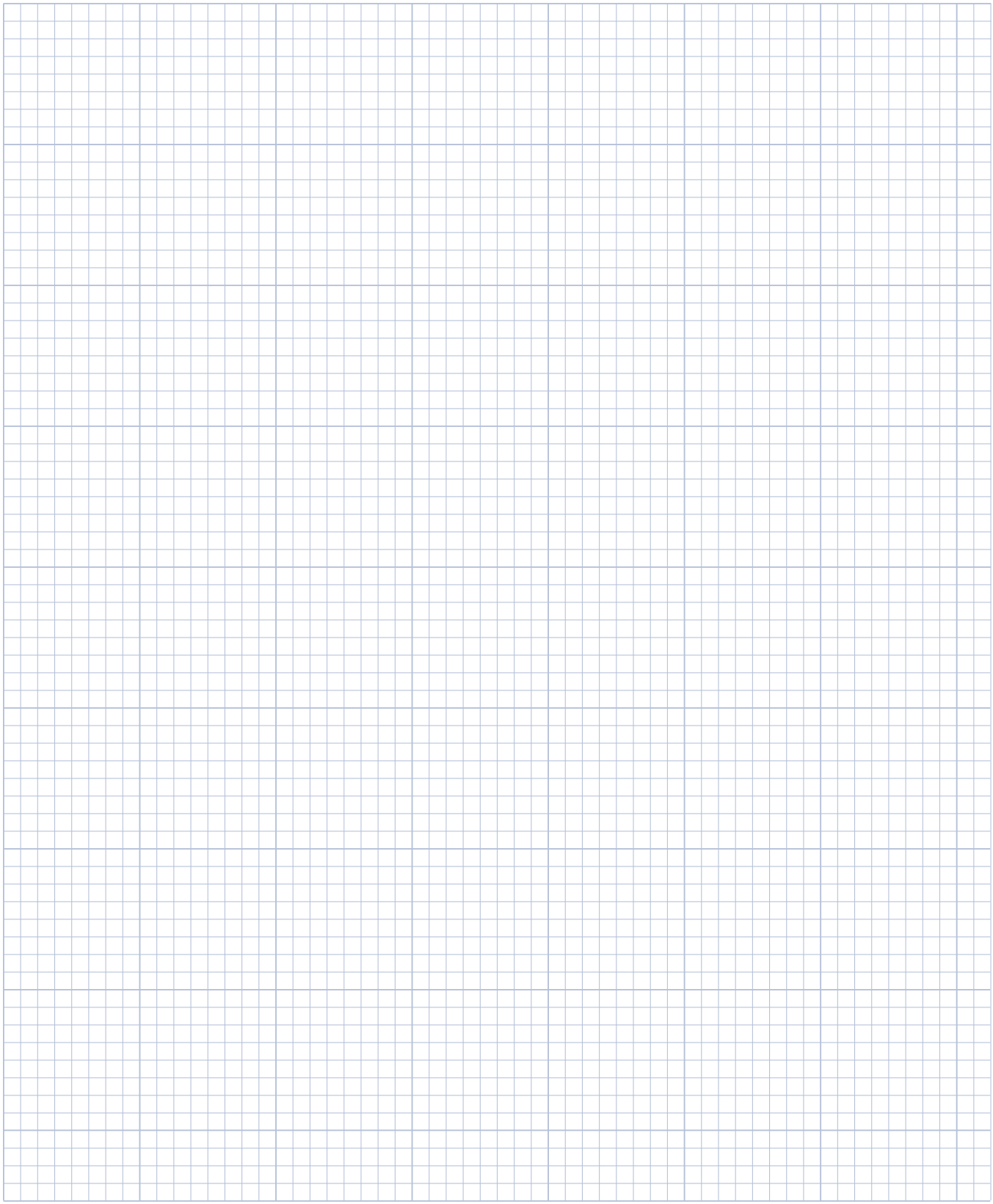
Related Topics:

Feedback Options and Specifications
Connector Options and Pinouts

Notes

AKM2G – 4 2 ML AN C N 2- 10

- AKM2G: Motor Series
- 4: Frame Size
- 2: Rotor Length
- ML: Winding
- AN: Shaft Flange
- C: Connection
- N: Brake
- 2-: Feedback
- 10: Customization Thermal Sensor



0.125 inch divisions

Brake Option

Failsafe, Holding Brake

The holding brake is designed to provide static holding torque to the motor shaft with the brake coil de-energized. The brake must first be released (coil energized) prior to commanding motor rotation as determined by its drop-out time. The brake is intended for holding or "parking" of a stationary motor. It is not intended for dynamic braking. There should be absolutely no motion of the rotor when power is removed from the brake coil.

AKM2G Motor Brake Specifications

Motor Family	Minimum Static Torque @120°C		Weight Adder		Power Consumption Nominal	Current[1] @24 V, 20°C	Inertia Adder		Closing Time (engage)	Opening Time (release)	Backlash[2]	
											Maximum	Typical
	Nm	lb-in	Kg	lb	Watts ±7%	ADC	kg-cm²	lb-in-sec²	msec	msec	deg.	deg.
AKM2G-2	2	17.7	0.45	1.0	11.4	0.47	0.04	3.5E-05	10	40	1	0.32
AKM2G-3	3.3	29.205	0.72	1.6	12.6	0.53	0.12	1.1E-04	17	55	1	0.6
AKM2G-4	7	62.0	1.36	3.0	14.7	0.61	0.36	3.2E-04	20	85	1	0.55

Contamination of the motor internal compartment by oil or other foreign materials will result in failure of the brake. Check the suitability of motor sealing for the working environment.
Note 1: Operating Voltage: 24 Vdc ± 10%.
Note 2: Maximum backlash is calculated using worst-case tolerancing, and typical backlash is calculated using statistical tolerancing.

AKM2G Motor Feedback Options

AKM2G LV Servo Motor Feedback Summary

Feedback Unit Options

Functional Safety Capable/Pending: Contact Customer Support

Code[3]	Description	AKM2Gx[4]	Connector	Single-turn or Multi-turn	Feedback Type/Size	Feedback Resolution: Device Resolution (Sin/Cos per Rev., Bits or Lines/Rev.)	Feedback Resolution: AKD Internal Resolution	Feedback Resolution: AKD2G Internal Resolution	Feedback Resolution: # of Absolute revs.	Accuracy[1,2] (arc-sec)
2-	Commutating Encoder	3, 4	AD, C	Single-turn	15	2048 Lines	8,192	8,192	None	±218.2"
AA	BiSS B Optical Sine Encoder	3, 4	AD, C	Single-turn	AD58	2048 Sin/Cos	27-Bits	32-Bits	1	±36"
AB				Multi-turn					4096	
CA	SFD3 Smart Feedback Device Gen. 3	2-4	AH, D	Single-turn	15	24-Bits	24-Bits	24-Bits	1	±585"
CB	SFD-M Smart Feedback Device Multi-turn	2-4 ≤ 20A	AH, D	Multi-turn	15	24-Bits	24-Bits	24-Bits	65,536	±60"
GU	HIPERFACE DSL® Capacitive	2-4	D	Multi-turn	EEM37	18-Bits	18-Bits	18-Bits	4096	±240"
DA	EnDat® 2.1 Optical	3, 4	AD, C	Single-turn	ECN1113	512 Sin/Cos	25-Bits	32-Bits	1	±120"
DB				Multi-turn	EQN1125				4096	
LD	EnDat® 2.2 Inductive	2-4	D	Multi-turn	EQI 1131	19-Bits	19-Bits	19-Bits	4096	±120"
R-	Resolver Inductive	3-4	AD, C	Single-turn	15	1 pole pair (16-Bits)	16-Bits	16-Bits	1	±600"

AH = M23 Hybrid power/SFD3/SFD-M connector pinned for use with legacy AKM performance cables – not compatible with AKM2G cables.
AD = M23 Dual connectors with power connector pinned for use with legacy AKM performance cables – not compatible with AKM2G cables.

1. AKD drives have a resolver measurement accuracy of ±45", for a drive w/ motor accuracy of ±585" and RMS Noise of ±9.9" Accuracy & RMS Noise data when used with other drives may be different.
2. Accuracy refers to overall system accuracy once installed in the motor. Noise refers to the RMS position noise when at stand-still.
3. All feedback options, except R- and 2-, have Motor ID support with embedded electronic motor nameplate data included for easy plug-and-play commissioning with Kollmorgen servo drives.
4. AKM2G-LV Size 2 models are only available in single-connector configurations.

Feedback and Connector Availablity

AKM2G-2x

Feedback Code \ Connector Code	A	D
Cx	•	•
GU		•
LD		•

AKM2G-3x -4x

Feedback Code \ Connector Code	A	C	D
2-	•	•	
Ax	•	•	
Cx	•		•
GU			•
Dx	•	•	
LD			•
R-	•	•	

• = Hybrid (power + feedback) single connector
• = Dual power and feedback connectors

AKM2G Motor Feedback Specifications

Absolute Digital Encoder Options

Kollmorgen Smart Feedback Device, Multi-turn (SFD-M) (CB)

The SFD-M Feedback uses a single motor cable, requiring just one cable between the drive and motor.

The feedback has both power and communication on a single wire pair, reducing overall wiring costs. SFD-M offers 24-bit absolute single-turn resolution, batteryless 16-bit (65,536) multi-turn absolute revolutions and an absolute angular accuracy of +/- 1 arc-min.

In addition, the device includes onboard memory for an electronic motor datasheet which enables device auto-recognition for faster setup and commissioning when paired with any Kollmorgen KED, AKD or AKD2G drive.

Angle Measurement:

Single-Turn Resolution: 2^{24} = 16,777,216 counts per rev
Multi-Turn Absolute Range: 2^{16} = 65,536 absolute revolutions* (batteryless)
Accuracy: < +/- 1 arc-min typical 25° C
< +/- 3 arc-min worst case
Electrical Noise: < 2^{-22} Rev rms at full bandwidth
Bandwidth: > 2 kHz at -3 dB
> 1 kHz at -45° phase lag
Max Continuous Speed: 10,000 RPM
Velocity Ripple: < 1% p-p (typical)
Velocity Noise: < 0.3 RPM rms at full bandwidth

Power Supply:

Input Voltage: 7 V - 12 V accepted (at motor terminals)
Input current maximum: 140 mA DC

Digital Communications:

Baud rate: 2.5 MBaud
Signaling: RS-485 differential using differential Manchester encoding
Update period: New position sample every 51.2 µs
Error detection: 5-bit CRC and running parity check

Environmental:

Feedback Operating Temperature: -40 to 120° C
Humidity: 10% to 90% non-condensing
Vibration Resistance: 30g (294 m/s^2) @ 55-2000 Hz (EN60068-2-6)
Shock Resistance: 100g (981 m/s^2) @ 6 ms (EN60068-2-27)

* When paired with AKD, this is limited to 4096 absolute revolutions (12-bits)

Kollmorgen Smart Feedback Device, Gen 3 (SFD3) (CA)

Kollmorgen's proprietary SFD3 Feedback uses a single motor cable, requiring just one cable between the drive and motor. The feedback has both power and communication on a single wire pair, reducing overall wiring costs. In addition, the device includes onboard memory for an electronic motor datasheet.

Angle Measurement:

Resolution: 24 bits, 2^{24} = 16,777,216 counts per rev
Accuracy: < ± 0.75 arc-min electrical + sensor error
Size 15 sensor ± 9.75 arc-min net (AKM2G 2,3,4)
Size 21 sensor ± 9.75 arc-min net (AKM2G 5,6,7)
Electrical noise: < 2^{-17} Rev rms at full bandwidth
Bandwidth: > 2000 Hz at -3 dB
> 1000 Hz at -45° phase lag
Max tracking rate: > 50,000 RPM
Velocity ripple: < 0.2% p-p electronics only
Size 15 sensor < 1.5% p-p net (AKM2G 2,3,4)
Size 21 sensor < 1.5% p-p net (AKM2G 5,6,7)
Velocity noise: < 4 RPM rms at full bandwidth

Environmental:

Operating ambient: -20 to 120° C
Humidity: 10% to 90% non-condensing
Storage temperature: -40 to 135° C

Digital Communications:

Baud rate: 2.5 MBaud
Signaling: RS-485 differential using differential Manchester encoding
Update period: New position sample every 51.28 µs
Error detection: 5-bit CRC and running parity check

Power Supply:

Supply at Drive: 7 to 12 V
Supply at SFD in motor: 7 to 12 V
Nominal Supply Current: 65 mA at 10 V
Worst Case Supply: 110 mA at 10 V
Cable Resistance: Com+, Com- net < 10 Ohm net

Absolute Digital Encoder Options

HIPERFACE DSL® Capacitive (GU)

Type		Multi-Turn "GU"
Frame Size		AKM2G 2-4
Number of Absolute Ascertainable Revolutions		4096
Supply Voltage Range	Vdc	7 to 12
Current Consumption	mA MAX.	150
Operating Temperature	°C MIN/MAX	-40/115
Inertia	kg-cm²	0.001
Output Interface		SICK HIPERFACE DSL®
Vibration Resistance – EN 60068-2-6	g [m/s²]	50 g [490 m/s²] – 10 to 2000 Hz
Shock Resistance – EN 60068-2-27	g [m/s²]	≤100 g [981 m/s²] – 6 ms
Manufacturer Product Type		EEM37

Functional Safety Capable

EnDat Inductive (LD)

Type		Multi-Turn "LD"
Frame Size		AKM2G 2-4
Number of Absolute Ascertainable Revolutions		4096
Input Voltage	Vdc	3.6 to 14
Current Consumption	mA Typical	5 V: 115 (without load)
Operating Temperature	°C MIN/MAX	-40/115
Inertia	kg-cm²	0.003
Output Interface		HEIDENHAIN EnDat 2.2/22
Vibration Resistance – EN 60068-2-6	g [m/s²]	Stator ≤41 g [400 m/s²] – Rotor ≤61 g [600 m/s²] – 55 to 2000 Hz
Shock Resistance – EN 60068-2-27	g [m/s²]	≤100 g [981 m/s²] – 6 ms
Manufacturer Product Type		EQI 1131

Functional Safety Capable/Pending: Contact Customer Support

Encoder Alignment: With positive DC current into phase W and out of phase V (U floats) the encoder is aligned to ±3 electrical degrees.

EnDat Optical (DA / DB)

Type		Single-Turn "DA"	Multi-Turn "DB"
Frame Size		AKM2G 3-4	AKM2G 3-4
Cycles per Revolution (# of abs. revs.)	-	512 (1)	512 (4096)
Input Voltage	Vdc	3.6 to 14	3.6 to 14
Current Consumption	mA Typical	85 (no load)	105 (no load)
Feedback Operating Temperature	°C MIN./MAX.	-40/115	-40/115
Inertia	kg-cm²	0.04	0.04
Output Interface		HEIDENHAIN EnDat 2.2/01	
Manufacturer Product Type		ECN1113	EQN1125

Encoder Alignment: With positive DC current into phase W and out of phase V (U floats) the encoder is aligned to ±1 electrical degree.

AKM2G Motor Feedback Specifications

Absolute Sine Encoder Options

BiSS Optical (AA / AB)

Type		Single-Turn "AA"	Multi-Turn "AB"
Frame Size		AKM2G 3-4	AKM2G 3-4
Cycles per Revolution (# of abs. revs.)	-	2048 (1)	2048 (4096)
Input Voltage	Vdc (tolerance)	5 (-5%/+10%)	5 (-5%/+10%)
Current Consumption	mA Typical	100 (without load)	150 (without load)
Feedback Operating Temperature	°C MIN./MAX.	-15/120	-15/120
Inertia	kg-cm^2	0.025	0.025
Output Interface		BiSS B	
Manufacturer Product Type		AD34	AD34

Encoder Alignment: With positive DC current into phase W and out of phase V (U floats) the encoder is aligned to ±1 electrical degree.

Resolver Options

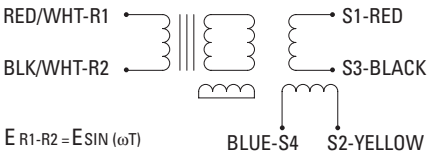
Resolver (R-)

Type		R- 1 Speed
Frame Size		AKM2G 3, 4
Input Voltage	V_{RMS}	7.0
	k Hz	10
Input Current Max.	mA	50
Transformation Ratio	N/A	0.5 ±10%
Null Voltage	mV_{RMS}	30
Max. Error (pk-pk)	MINS.	18
Phase Shift	Degrees	0
Operating Temperature	°C	-55° to 155°
Rotor Inertia Max.	kg-cm^2	0.046
Vibration and Shock Resistance		High Vibration and Shock Resistance Please contact Kollmorgen Customer Support

Resolver Alignment

With positive DC current into phase W and out of phase V (U floats), the resolver is aligned. ie. Voltage S1-S3 set to null and voltage S2-S4 max in phase with reference (R1-R2).

Resolver Winding Configuration

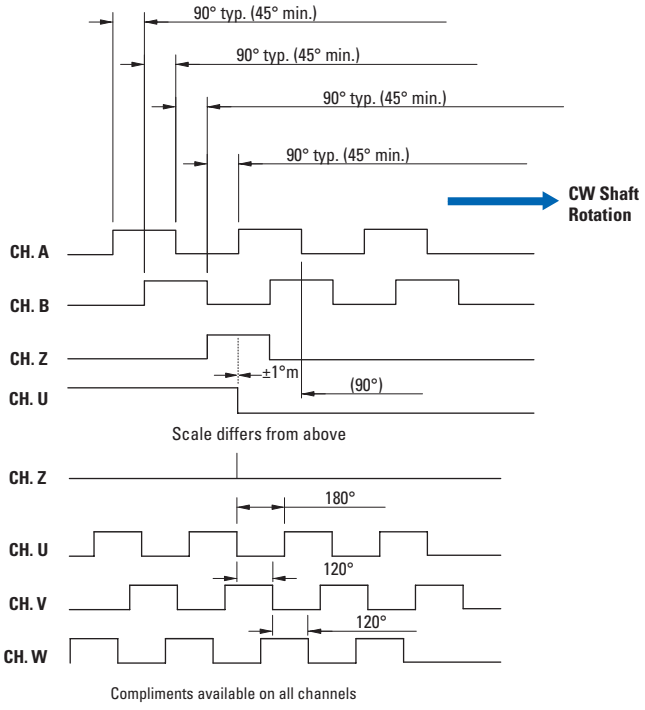


$E_{R1-R2} = E_{SIN(\omega T)}$
$E_{S1-S3} = KE_{R1-R2} SIN\theta$
$E_{S2-S4} = KE_{R1-R2} COS\theta$

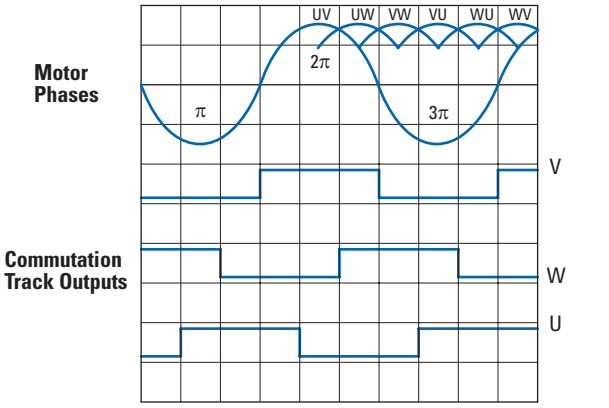
Commutating Encoder Option

Commutating Encoder (2–)

Parameter		2–
Frame Size		AKM2G–3x, –4x LV
Input Voltage	Vdc ±10%	5
Output Data	–	26LS31 Diff. Line Driver. Sink/Source 40mA Max
Line Count per revolution	–	2,048
Frequency Response	KHz	200
Max. Speed	RPM	8,000
Min. Edge Separation of Incremental Channel	°e MIN.	45
Index to U Comm Channel	–	±1°m Index Center to U Falling Edge
Index Pulse Width	–	Gated With B Low
Incremental Channel Accuracy	–	±1 Arc Min. Max. Edge to Edge
Max. Acceleration	Rad/s^2	100,000
Feedback Operating Temperature	°C	-20 to 120
Storage Temperature	°C	-25 to 120
Vibration Resistance – EN 60068-2-6	g [m/s^2]	10 g [98 m/s^2] – 58 to 500 Hz
Shock Resistance – EN 60068-2-27	g [m/s^2]	80 g [785 m/s^2] – 11 ms
Commutating Channel	–	Open Collector – 20 mA max per channel
Moment of Interia	kg-cm^2	0.0048

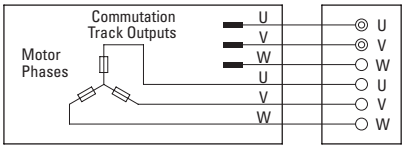


Compliments available on all channels



Max. Misalignment between rising edge of commutation track V & zero crossing of back EMF UV <= 5° electrical.

Motor Connections



Output Comm: Open Collector W 2.2 k OHMS ExternalL Pull Ups (SINK 8 mA MAX.)

AKM2G Motor Connector Options

Connector Options

Model Designation	Connection	Compatible AKM2Gx	Position of connection
A* (Hybrid)	1 SpeedTec® M23 (AKM cable pinned)	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
A (Dual)	2 SpeedTec® M23 (AKM cable pinned)	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
C	2 SpeedTec® M23	AKM2G3 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted
D*	1 htec® M23	AKM2G2 - AKM2G4 ≤ 20 Amps	Angular, rotatable, motor mounted

* Hybrid connectors valid for SFD3, SFD-M, DSL, and EnDat 2.2 Feedback only.

Connector Description

Connector	Usage	Contacts - Pins Power/Signal	Max. Current [A] Power/Signal	Max. Cross Section [mm²] Power/Signal	Protection Class
M23 SpeedTec® right angle connectors (Size 1)	Power & Brake	4 / 5	20 / 10	4 / 1.5	IP65
	Comcoder	- / 15	- / 10	4 / 1.5	IP65
	Resolver	- / 12	- / 10	- / 0.5	IP65
	DSL	5 / 2 / 2	20 / 10	4 / 1.5	IP65
	SFD3/SFD-M	4 / 5	20 / 10	4 / 1.5	IP65
	EnDat 2.2	5 / 4 / 6	20 / 10	4 / 1.5	IP65
	EnDat 2.1 / BiSS B	- / 12	- / 10	4 / 1.5	IP65

Feedback and Connector Availablity

AKM2G-2x

Feedback Code	Connector Code A	Connector Code D
Cx	•	•
GU		•
LD		•

AKM2G-3x -4x

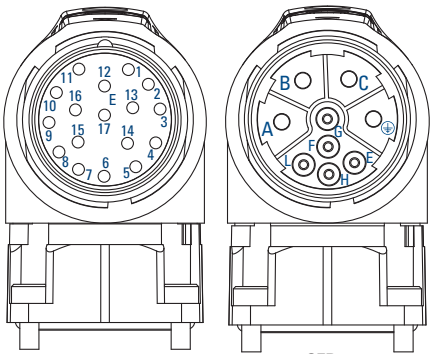
Feedback Code	Connector Code A	Connector Code C	Connector Code D
2-	•	•	
Ax	•	•	
Cx	•		•
GU			•
Dx	•	•	
LD			•
R-	•	•	

• = Hybrid (power + feedback) single connector
• = Dual power and feedback connectors

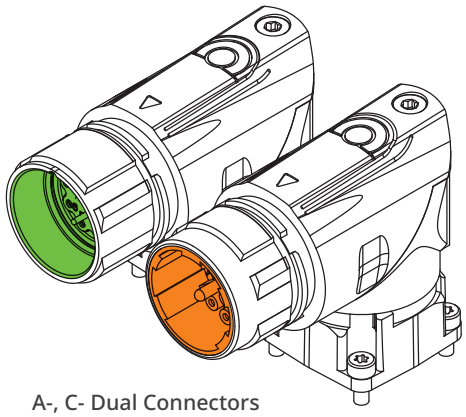
AKM2G Servo Motor Connector Pinouts

Dual Cable Options – Power & Feedback

A-, C- Dual Connector Pinouts – AKM2G 3-4 ≤ 20 Amps Continous

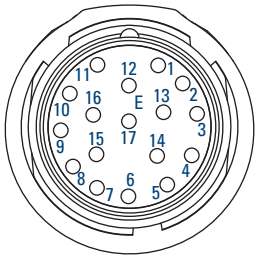


A-, C- Dual Connectors
C- Power Pinout Shown



A-, C- Dual Connectors

A-, C- Feedback Connector Pinouts



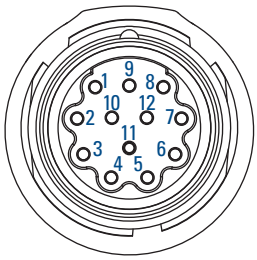
A-, C- Connector

Commutating Encoder Feedback

Pin	Function
1	B
2	$\bar{B}$
3	A
4	$\bar{A}$
5	Z
6	$\bar{Z}$
7	GND
8	Thermal Sensor +
9	Thermal Sensor –
10	Vcc
11	N/C
12	N/C
13	N/C
14	N/C
15	U
16	V
17	W

Resolver Connector

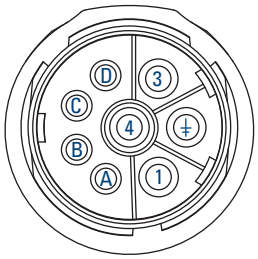
Pin	Function
1	N/C
2	Thermal Sensor +
3	S4, COS-
4	S3, SIN-
5	R2, REF-
6	Thermal Sensor –
7	S2, COS+
8	S1, SIN+
9	R1, REF+
10	N/C
11	N/C
12	N/C



A-, C- Connector

Shield is Not Connected at Motor End.
On motor mounted connectors, the thermal sensor lead colors are (+) Blue, (–) Black.

A- Power Connector Pinout



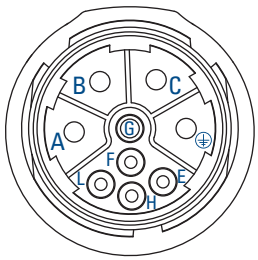
A- Connector

Power Connector

Pin	Function
1	U
‡	PE
3	W
4	V
A	Brake +
B	Brake -
C	N/C
D	N/C

Note: Only for use with legacy AKM cables - not compatible with 2G Cables

C- Power Connector Pinout



C- Connector

Power Connector

Pin	Function
A	U
⏚	PE
C	W
B	V
F	Brake +
G	Brake -
E	N/C
H	N/C
L	N/C

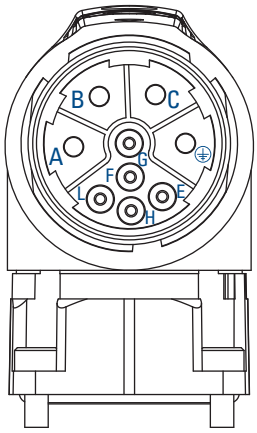
Shield Connected to Motor Ground Internal to Motor

AKM2G Servo Motor Connector Pinouts

Single Cable Options – Power & Feedback

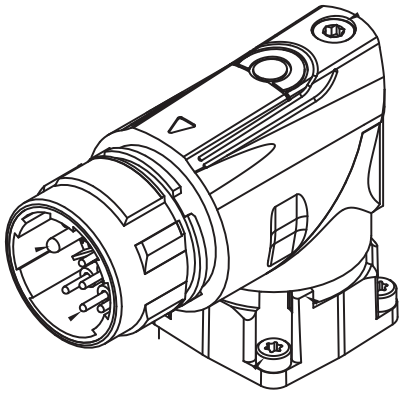
D– Connector Pinouts – Hybrid power and feedback for SFD3, SFD-M, DSL, and EnDat for all AKM2G < 20 Amps Continuous

D- Hybrid Power + SFD3/SFD-M Connector Option

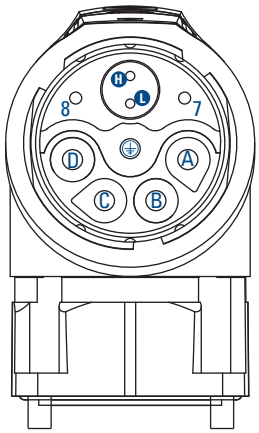


Power + SFD3/SFD-M

Pin	Function
A	Phase U
B	Phase V
C	Phase W
⏚	PE
E	N/C
F	Brake +
G	Brake –
H	SFD +
L	SFD –

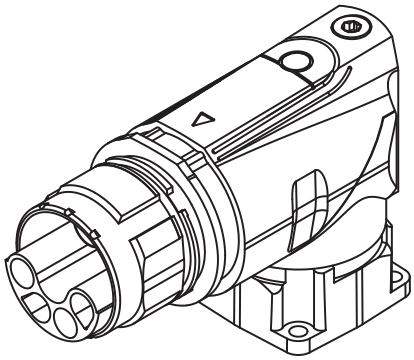


D- Hybrid Power + HIPERFACE DSL® Connector Option

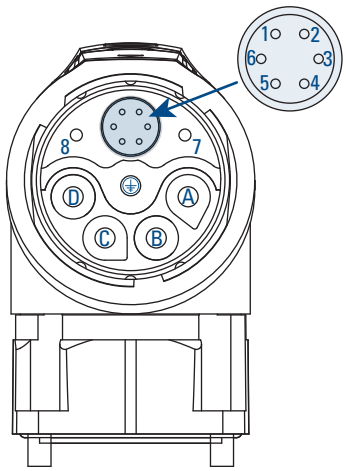


Power + DSL

Pin	Function
A	Phase U
B	Phase V
C	Phase W
D	N/C
⏚	PE
8	Brake +
7	Brake -
L	DSL -
H	DSL +

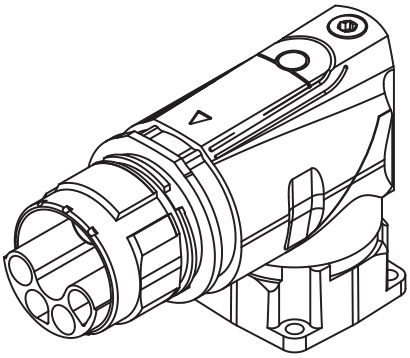


D- Hybrid Power + EnDat® Connector Option



Power + EnDat

Pin	Function
A	Phase U
B	Phase V
C	Phase W
D	N/C
⏚	PE
8	Brake +
7	Brake -
Ethernet 1	Up
Ethernet 2	0 V
Ethernet 3	Data +
Ethernet 4	Data -
Ethernet 5	Clock +
Ethernet 6	Clock -

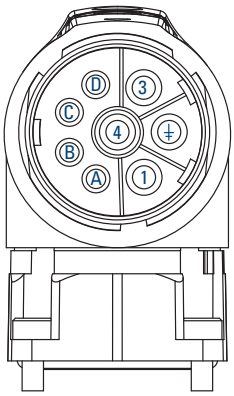


Single Cable Options – Power & Feedback

A– Connector Pinout – AKM2G 2-4 ≤ 20 Amps Continuous SFD3/SFD-M motors

Note: Only for use with legacy AKM cables - not compatible with 2G Cables

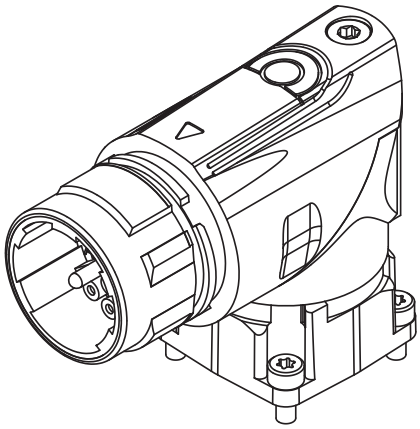
A- Hybrid Power + SFD3/SFD-M Connector Option



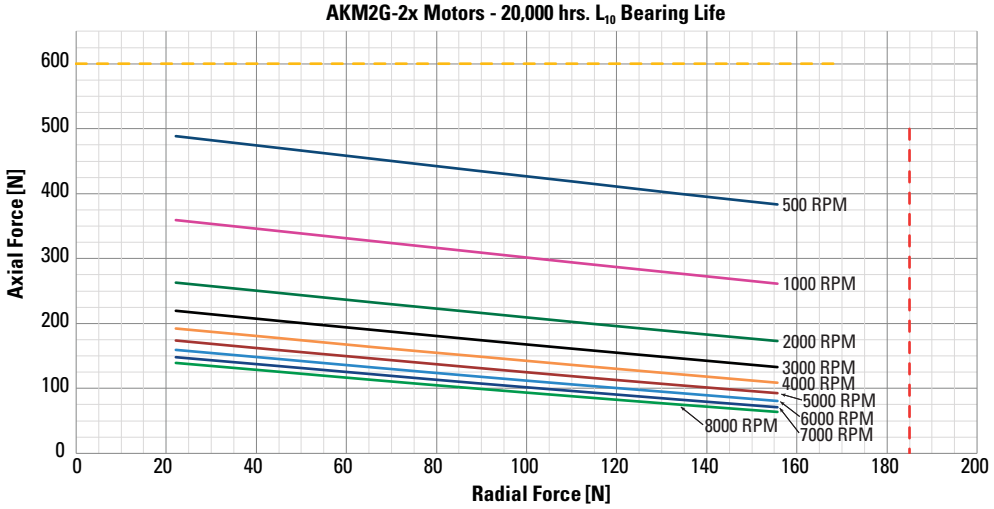
Power + SFD3/SFD-M

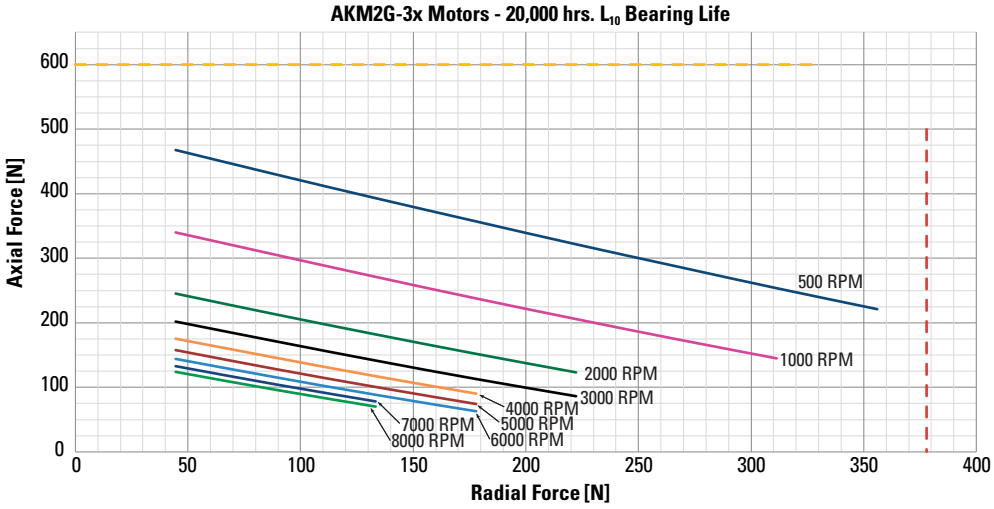
Pin	Function
1	U
⏚	PE
3	W
4	V
A	Brake +
B	Brake -
C	SFD3/-M +
D	SFD3/-M –

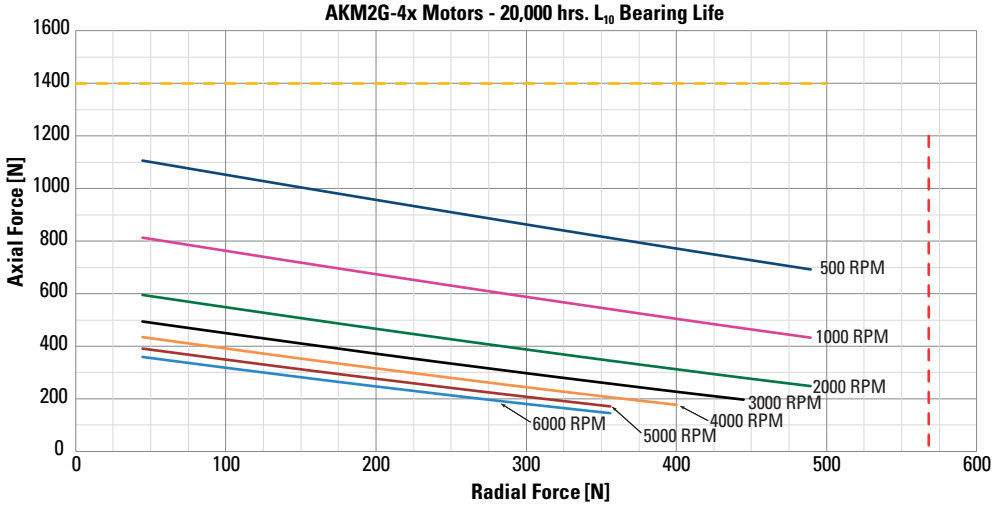
Connector Part Number:
BEDC-110-NN-00-00-1216-000



I. L_{10} Bearing Fatique





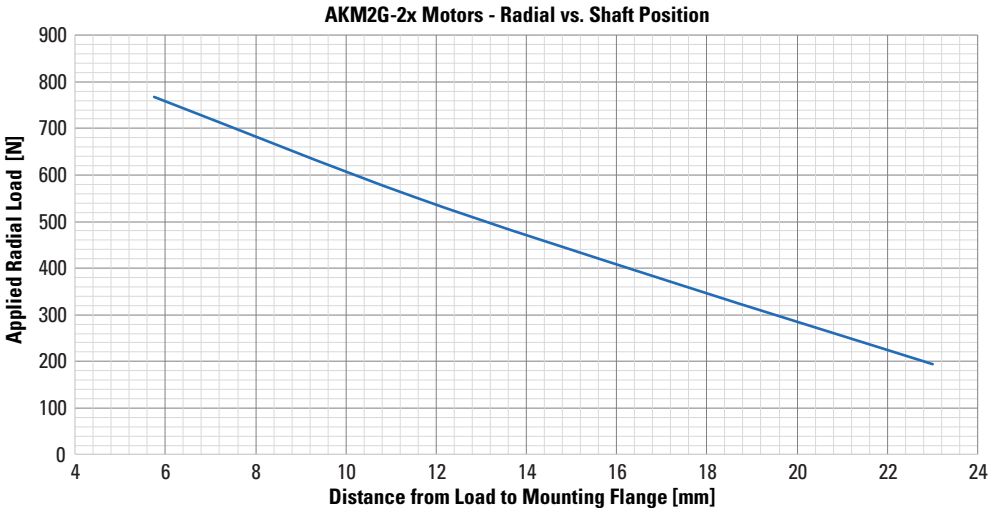


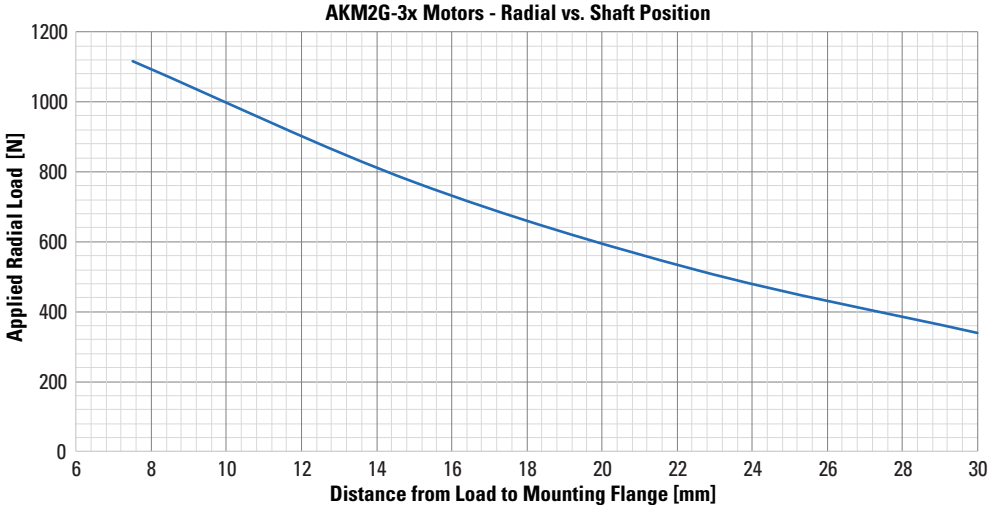
II. Shaft Loading

Motor	Max. Radial Force (N)	Max. Axial Force (N)
AKM2G-2	195	600
AKM2G-3	340	600
AKM2G-4	560	1400

The maximum radial load ratings reflect the following assumptions:

1. Motors are operated with peak torque of the longest member of the frame size.
2. Fully reversed load applied to the end of the smallest diameter standard mounting shaft extension.
3. Infinite life with 99% reliability.
4. Safety factor = 2.



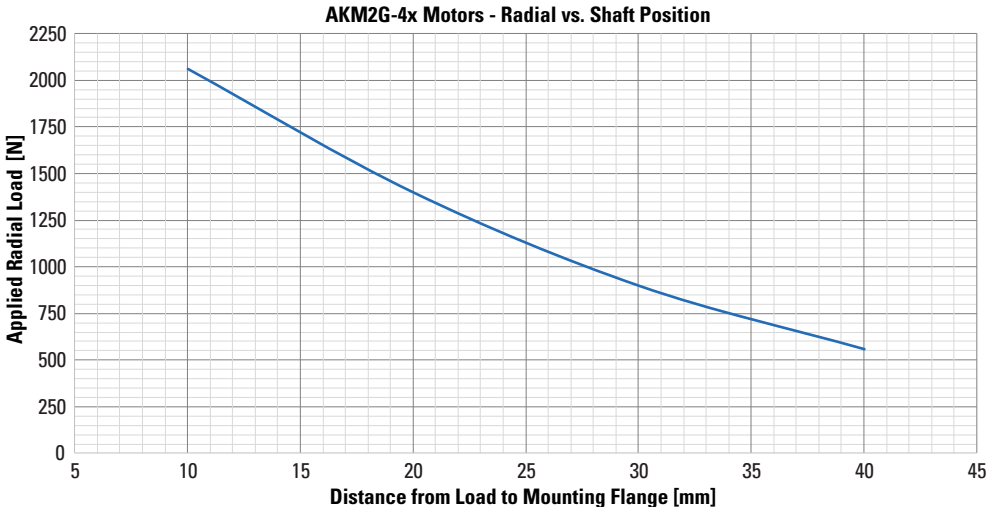


III. Mineral-filled PTFE Teflon® Shaft Seals

There is a normal break-in period for our Mineral-filled PTFE Teflon® shaft seals. Best conditions during the break-in period would be at the operational temperature and speed that would be typical for the application.

During the break-in period, some "shedding" of mineral-filled PTFE Teflon material is normal. The debris is not a sign of seal deterioration or failure. The material "shed" should be reduced with usage.

Typically, a few hours at operational speed is enough to break-in the shaft seal.



IV. Thermal Sensor Protective Devices

The standard version of each motor is fitted with an electrically isolated PT-1000. The thermal sensors do not provide any protection against short, heavy overloading.

The motor can be delivered with a PT-1000 + PTC, PTC, or KTY 84-130 equivalent sensors optionally (see Thermal Sensor options 2, 3, 0).

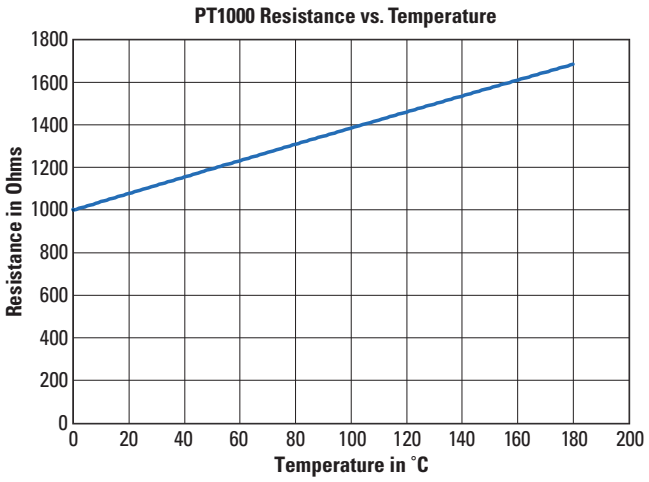
With digital feedback systems SFD3 (CA), SFD-M (CB), Hiperface DSL (GU) and EnDat 2.2 (LD) the temperature sensor status is transmitted digitally and evaluated in the drive.

Provided that our configured feedback cables are used, the sensor is integrated into the monitoring system of the digital servo amplifiers.

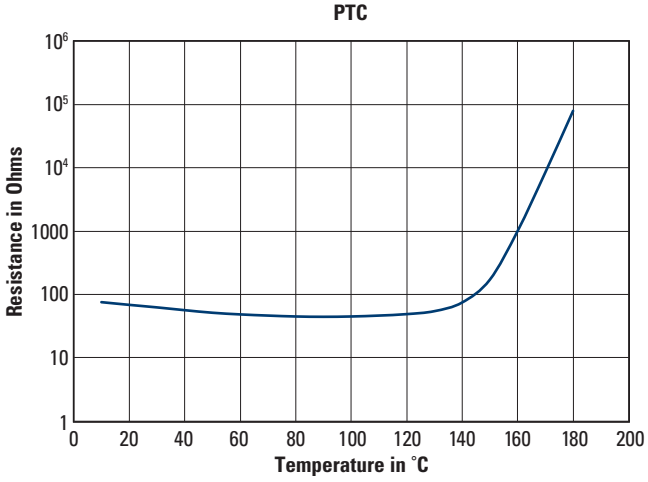
Thermal Device Options: Resistance vs. Temperature Graphs

Kollmorgen AKD drives can directly interpret information from the motor thermal sensors to properly reflect the motor winding temperature. For other drives please refer to the graph Delta Between Motor Winding and Thermal Device on the following page.

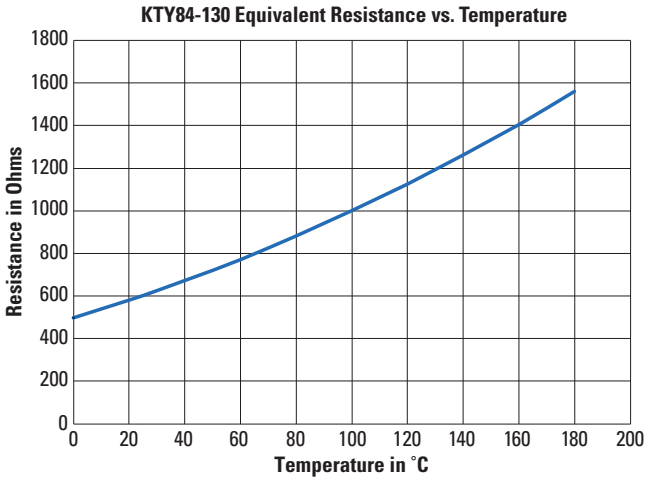
Standard 1



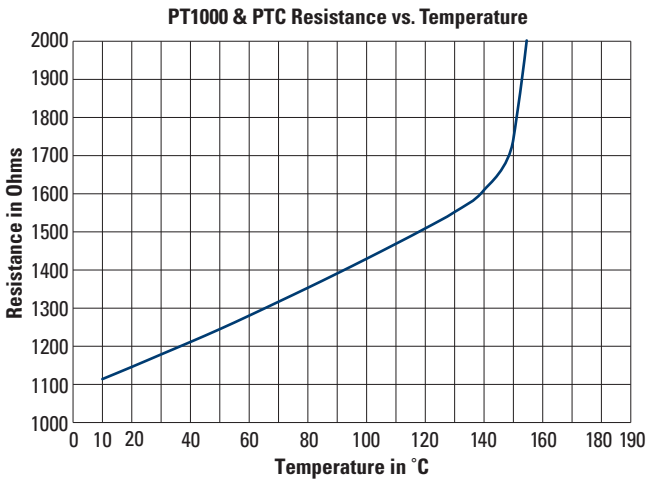
Option 2



Option 3



Option 0

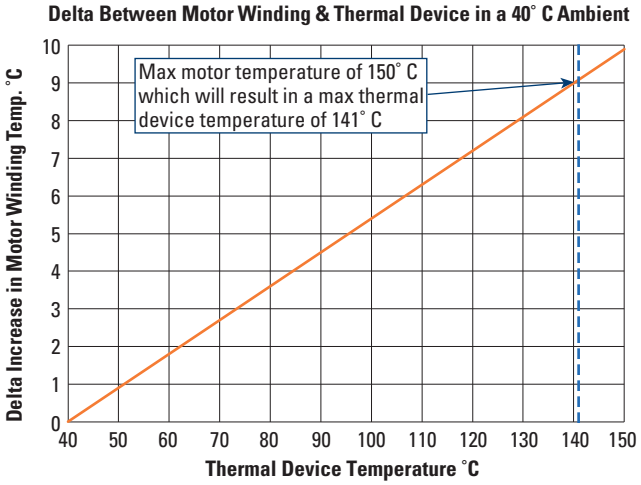


V. Delta Between Motor Winding and Thermal Device

When using a drive other than the Kollmorgen AKD you will need to account for the difference (Delta) in temperature between the value reported by the thermal sensor and the actual motor winding temperature. This is necessary to insure proper operation and protection of the motor.
The provided graph shows the delta between the reported device temperature on the x axis and the motor winding temperature on the y axis and should be used to adjust the response of the system for the difference between the thermal sensors reported temperature and the actual motor winding temperature.

Examples:

At 60°C on thermal device temperature the winding temperature will be 1.8°C higher (61.8°C).
At 130°C on thermal device temperature the winding temperature will be 8.1°C higher (138.1°C).

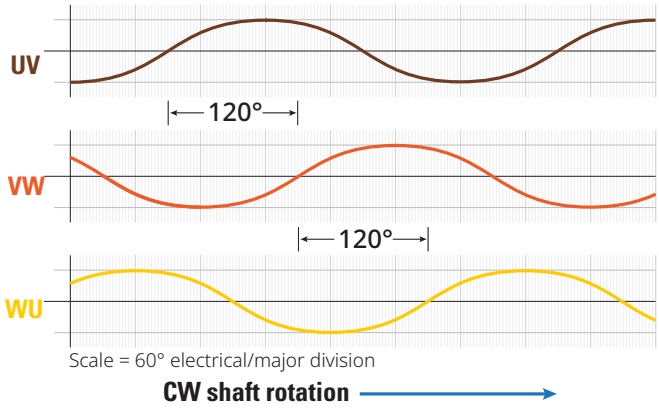


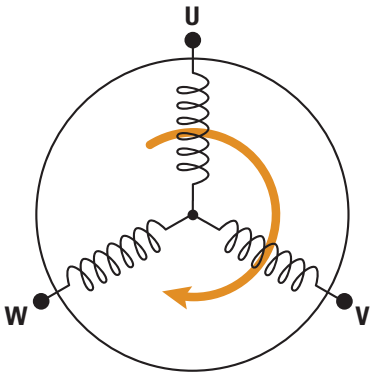
VI. Motor Phasing Diagram

When the motor is rotated clockwise (CW) as viewed from front shaft end, the following BEMF voltage waveforms result:

- Voltage phase-UV leads Voltage phase-VW by 120-degrees
- Voltage phase-VW leads Voltage phase-WU by 120-degrees
- Voltage phase-WU leads Voltage phase-UV by 120-degrees

BEMF Waveforms





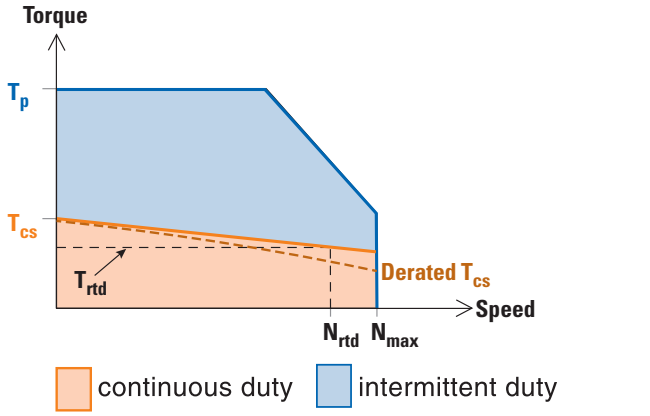
VII. Servo Motor Performance Curve Overview

How to Build a Servo Drive and Motor System

Performance data provided in this document is designed to help you select the optimum brushless servo motor.

Drive and Motor Performance Curves

The performance characteristics of a brushless servo system (motor/drives combination) are described by a torque/speed operating envelope. As shown above, the shaded areas of the curve indicate the continuous duty and intermittent duty zones of the system.



Continuous Duty Zone

The continuous duty zone is bordered by the continuous torque line up to the intersection with the intermittent duty line. The continuous torque line is set by either the motor's maximum rated temperature, or the drives' rated continuous current output, whichever is less. The system voltage limit line is set by the voltage rating of the drives, the line voltage supplied, and the motor winding. The system can operate on a continuous basis anywhere within this area, assuming the ambient temperature is 40°C or less.

Intermittent Duty Zone

The intermittent duty zone is bordered by the peak torque line and the system voltage limit line. The peak torque line is set by either the drives' peak current rating, which the drive can produce for a limited time, or the maximum rated peak current for the motor, whichever is less. Refer to the Performance Data pages for each frame size. Note: Higher torque levels may be achievable at higher power levels.

Definitions

T_p	Peak torque
T_{cs}	Continuous torque
T_{rtd}	Continuous rated torque (torque at rated power)
Derated T_{cs}	Maximum continuous torque with derating motor options (feedback type, shaft seal and brake)
N_{max}	Maximum speed
N_{rtd}	Rated speed (speed at rated power)

Performance Derating

Feedback, brake, and shaft seal options reduce, or derate, the continuous motor torque as shown by the Derated T_{cs} curve above. Kollmorgen documented performance data and curves, unless specified otherwise, are generated based on motors using resolver feedback, no brake and no shaft seal. Derate is taken into account when using the Kollmorgen Performance Curve Genorator, or Motioneering Application.

Derate curves are prodived to help determine the continuous torque of a motor with other combinations of feedback, shaft seal, and brake when referencing documented performance data and curves.

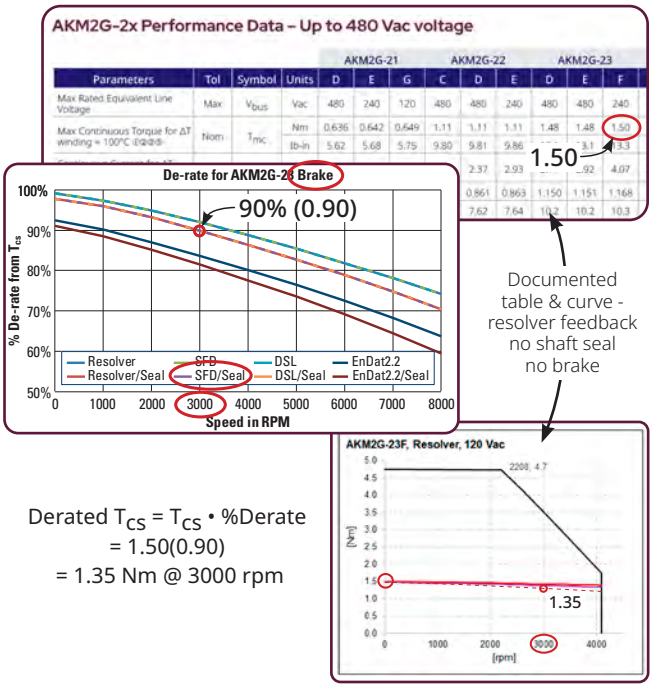
Consult Kollmorgen Customer Support for more details. The system voltage limit line is set by the voltage rating of the drive, the line voltage applied and the motor winding. Operation in the intermittent zone must be limited to a duty cycle that will produce an RMS system torque falling within the continuous duty area. The RMS torque value is a function of the magnitude of the intermittent torque and the percentage of the time spent at that torque.

Derate Calculations

Derate is calculated by multiplying the continuous torque value (T_{CS}) by the percent derate for the appropriate feedback/seal option, either with or without brake at the desired speed point. Also, use the correct derate graph for the motor based on whether it will have a brake or no brake. Operating intermittently and/or at less than rated temperatures will reduce the derate. Kollmorgen Customer Support is available to discuss the specifics of your application and optimum sizing.

Derate curves shown for each motor variation assume continuous operation at the selected speed and at maximum rated temperature.

Example:
For an AKM2G-23F motor with SFD feedback, shaft seal and brake, operating at 3000 RPM the continuous torque (T_{CS}) is reduced to 90% of it's value without the derating options. Multiply the motor torque value (T_{CS}) by 0 .90 for the derated torque (Derated T_{CS}) at 3000 RPM. For ease of graph interpretation, using a Derate that is a rounded approximation is acceptable. For exact values, refer to Kollmorgen's online Motioneering Application, or Performance Curve Generator.

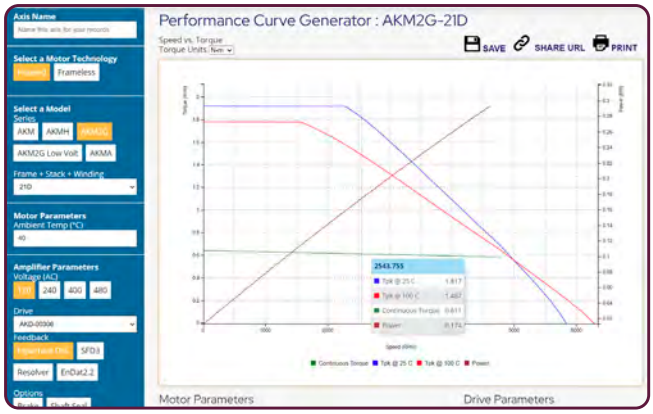


Derated $T_{CS} = T_{CS} \cdot \%Derate$
$= 1.50(0.90)$
$= 1.35$ Nm @ 3000 rpm

Generating Performance Curves

Kollmorgen offers two options, the Performance Curve Generator and Motioneering Sizing Application, for the AKM family of servo motors as well as TBM, TBM2G, and KBM frameless motors. These applications have any derating factored into the generated curves.

Kollmorgen Performance Curve Generator

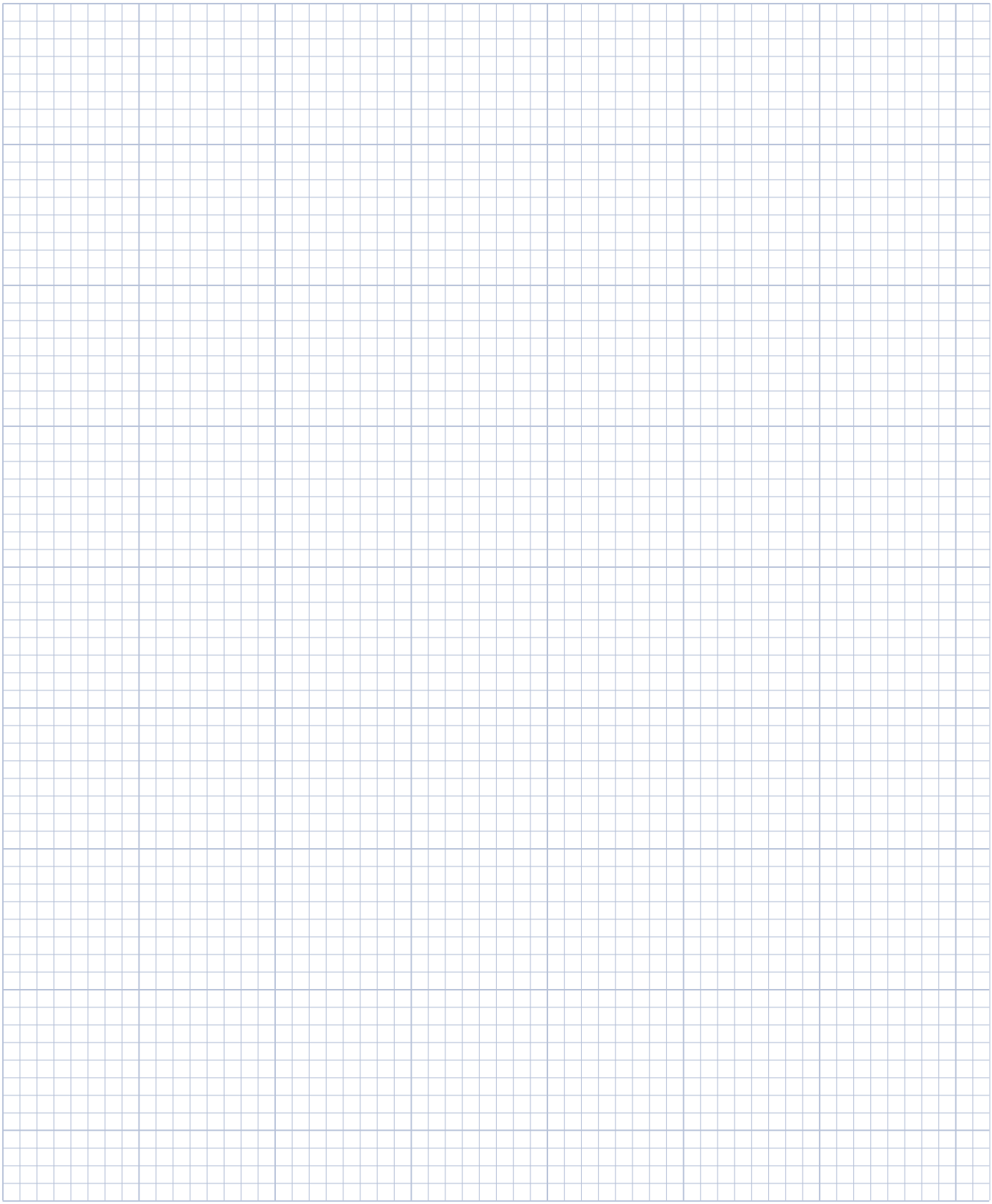


https://www.kollmorgen.com/en-us/service-and-support/technical/performance-curve-generator

Motioneering Application Curve Generator

https://www.kollmorgen.com/en-us/service-and-support/technical/motioneering-online

Notes



0.125 inch divisions

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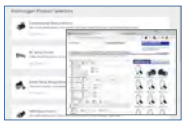
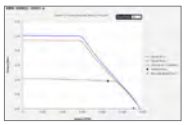


Product Selector

Quickly choose the ideal products for your application needs.

Motioneering®

Size your motion system based on application requirements and motion profiles.



Performance Curve Generator

Optimize housed and frameless motor windings based on power and environmental factors.

3D Models

Visualize products in 3D and download CAD files for use in your design.

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Interactively choose the most efficient stepper solution for your application.

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About Kollmorgen

Kollmorgen, a Regal Rexnord brand, has more than 100 years of motion experience, proven in the industry's highest-performing, most reliable motors, drives, linear actuators, AGV (Automated Guided Vehicle) control solutions, and automation control platforms. We deliver breakthrough solutions that combine exceptional performance, reliability and ease of use, giving machine builders an irrefutable marketplace advantage.

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