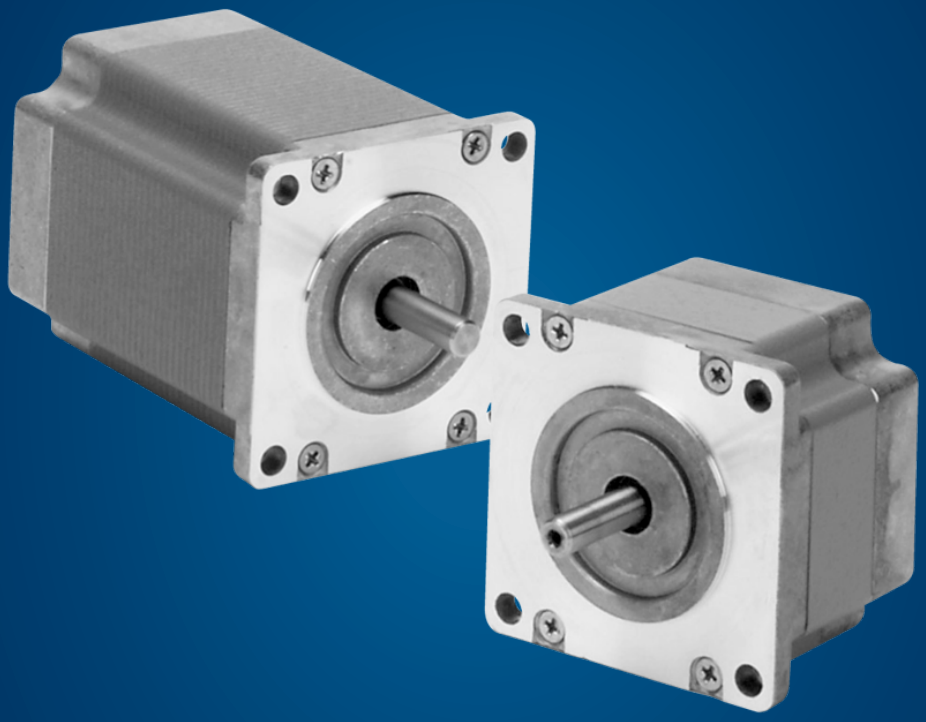
T2 Series Stepper Motor

Selection Guide



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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.

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How To Use This Selection Guide:

This guide covers the technical information required to select and order T2 Series steppper motors. Select the proper motor using one of the following procedures:

» If you're already familiar with these motors and the available options, refer to the Model Nomenclature on pg. 7 to verify the part number and corresponding motor options prior to order.

» If you're not familiar with T2 motors and available options: first refer to the General Specifications, pg. 5. To further evaluate individual winding specifications refer to the Drawings and Performance Data. After all the technical parameters and options are determined, construct a part number using the Model Nomenclature (pg. 7).

Where To Order:

Kollmorgen utilizes an experienced channel of Authorized High-Tech Distributors (AHTDs) to assist our customers with applications, sizing and selection, ordering, and technical support. Visit our Distributor Locator to find locally available distributors. www.kollmorgen.com/enus/where-to-buy/

Kollmorgen Customer Service Representatives are also available by phone or e-mail and can assist in selecting and contacting local distributors.

» North America: 1-540-633-3545, support@kollmorgen.com

» Europe/Middle East/Africa: +49 (0) 2102 9394 0, think@kollmorgen.com

» Asia: +86-400 661 2802, sales.china@kollmorgen.com

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T2 Series Stepper Motors

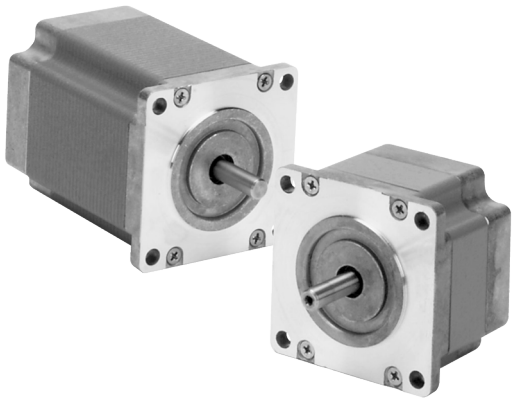
Kollmorgen T2 Series stepper motors provide high torque in a NEMA 23 frame size (60 mm).

With holding torques to 421 oz-in (3.0 N-m), these steppers deliver the most torque of any Size 23 motor. They are available with open leads or a terminal box, and offer an excellent alternative to pneumatic, hydraulic and servo motor systems.

Features

- 0.56 to 3.0 N-m (80 to 421 oz-in) holding torque accommodates most high torque application requirements
- 0.014 to 0.049 N-m (2 to 7 oz-in) detent torque leaves more power for moving the load
- Speeds up to 3000 RPM meet the velocity demands of most high torque application

General Specifications



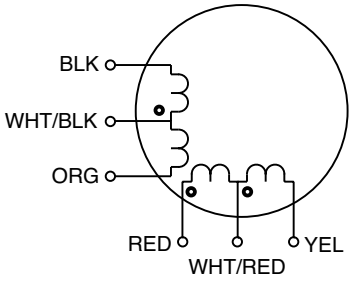
» NEMA Size 23
» High Torque at moderate speeds
» Inch standard mounting
» UL, CE compliant
» Unipolar or Bipolar windings
» Standard Features: Shaft Flats, Rear Shaft, Flying Leads or Motor-Mounted Connectors, Encoder Mounting Provisions, Incremental Encoders
» Co-Engineered Options: Shaft Modifications, Special Windings, Lead Lengths, Connectors

Parameter	T2
NEMA frame size	23
Windings	Unipolar and Bipolar
Full Steps per Revolution	200
Step Angle (degrees)	1.8
Step Accuracy % (of one full step, no load)	+/- 2
Operating Temperature	-20° C to +40° C
Insulation Class	Class B, 130° C
Insulation Voltage (Vdc)	340
Insulation Resistance	100 Megohms

T2 Series Stepper Motors

T2 Series Stepper Motor Connection Information

6-Lead Configuration



6-Lead Unipolar Connection

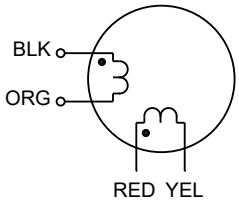
Driver Connection	Lead Color
A	Black (Blk)
B	Orange (Org)
C	Red
D	Yellow (Yel)
V+	Wht/Blk/Org
V+	Wht/Red/Yel

Unipolar Full Step Phase Sequence

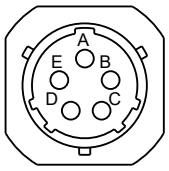
CCW ↓ ↑ CW

STEP	A	B	C	D
1	GND	0	GND	0
2	0	GND	GND	0
3	0	GND	0	GND
4	GND	0	0	GND
1	GND	0	GND	0

4-Lead Configuration



Optional MS Connector



4-Lead Bipolar Connection

Driver Connection	Lead Color	MS Connector
A	Black	A
$\overline{A}$	Orange	B
B	Red	C
$\overline{B}$	Yellow	D
Ground	Grn/Yel	E

Bipolar Full Step Phase Sequence

CCW ↓ ↑ CW

STEP	A	$\overline{A}$	B	$\overline{B}$
1	+	–	–	+
2	–	+	–	+
3	–	+	+	–
4	+	–	+	–
1	+	–	–	+

T2 Series Stepper Motor Nomenclature

T 2 3 N R H J – L N N – N – 00

T Series

Motor Frame Size
2 NEMA 23 (2.25 in. square

Rotor Stack Length
H Half stack
1 1 stack
2 2 stacks
3 3 stacks

Mounting Configuration
N NEMA 23
S Special, contact factory

Construction / Hookup
C MS connector
L Terminal box via 1/2 in. NPT pipe thread
M Terminal box via PG11 pipe thread
R Regular leadwire
S Special, contact factory

Winding / Leads
E 6 leads (Unipolar)[1]
H 4 leads (Parellel connected)
L 4 leads (Series connected)
S Special, contact factory

Winding Type
D, E, F, G, H, J, K
S Special, contact factory

Special Sequence
Insert 00 if all parts are standard
Any other numbers are factory assigned

Encoder Option
C2 Encoder 200 LPR w/line driver[3]
C4 Encoder 400 LPR w/line driver[3]
C5 Encoder 500 LPR w/line driver[3]
M4 Encoder mtg. provisions[3]
SS Special, contact factory

Shaft Modification
F Flat
N Smooth
S Special, contact factory

Shaft Configuration
D Rear shaft extension[2]
N No rear shaft extension
S Special, contact factory

Rotor Type
L Laminated

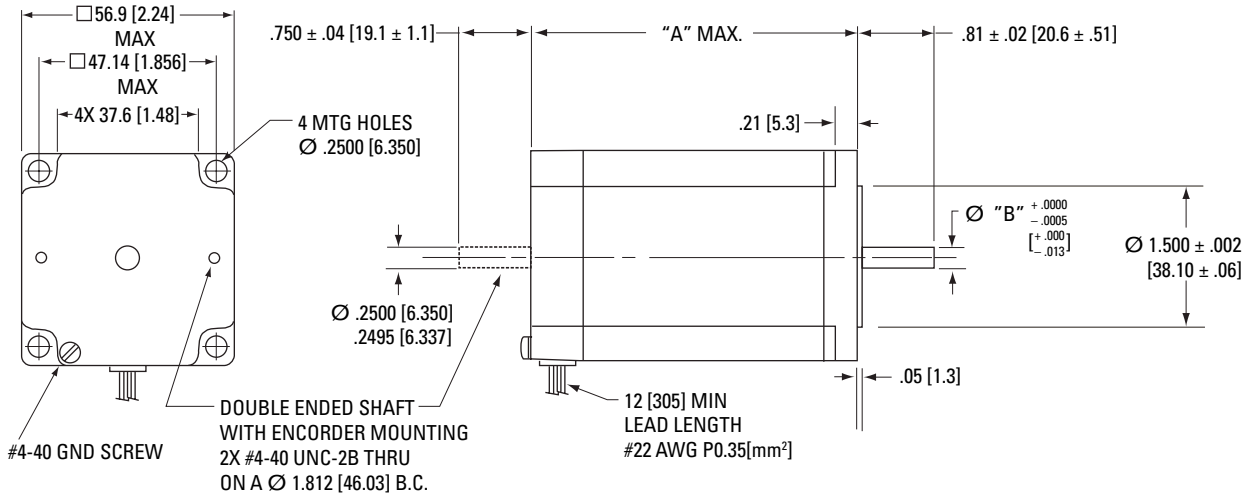
Notes:

1. N/A with "C" Construction / Hookup option
2. "R" Construction / Hookup only, required for motors with encoders
3. Requires "R" Construction / Hookup option and "D" Shaft Configuration option

T2 Series Stepper Motors

T2 Outline Drawings

Leadwire Hookup Models

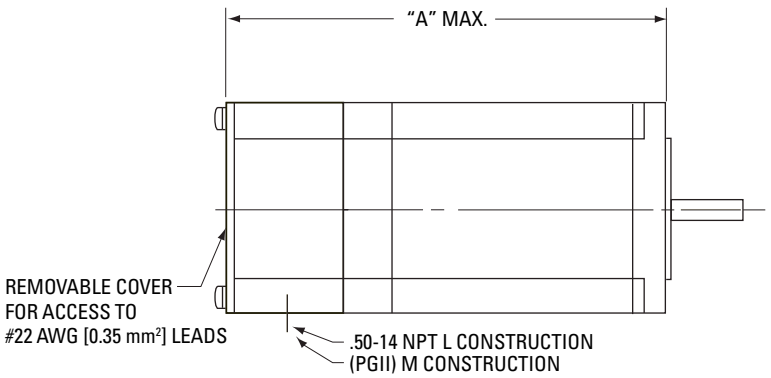


Model	"A" Max	"B" Max
T2H	1.64 (41.6)	0.2500 (6.35)
T21	2.21 (56.1)	
T22	3.06 (77.7)	
T23	4.06 (103.1)	0.3125 (7.94)

Dimensions in inches [mm]

Terminal Box Construction

Model	"A" Max
T2H	2.84 (72.1)
T21	3.41 (86.6)
T22	4.26 (108.2)
T23	5.26 (133.6)



Dimensions in inches [mm]

T2 Performance Data

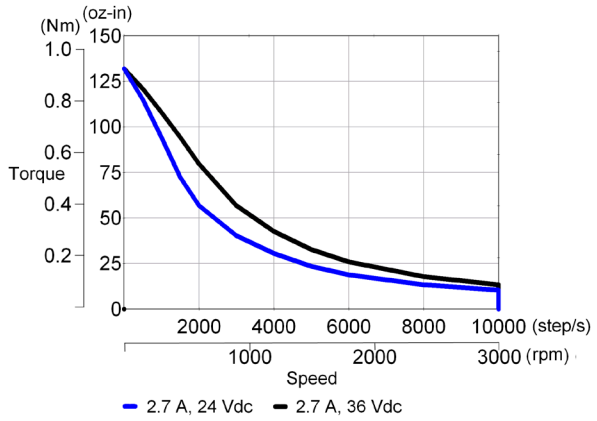
	Motor Model Number	Config.		Holding Torque (2 phases on)	Rated Current/ Phase	Phase Resistance	Phase Inductance	Thermal Resistance	Rotor Inertia	Weight	Shaft Loading*	
		Parallel	Series	oz-in (Nm) +/-10%	Amps DC	Ohms +/-10%	mH Typical	Mounted °C/Watt	oz-in-s^2 (kg-m^2 x 10^{-3})	lb (kg)	Radial Force lb (N)	Axial Force lb (N)
Short Stack	T2HxxHK	•		74 (0.52)	5.3	0.19	0.63	6.14	0.00154 (0.0109)	1.1 (0.50)	15 (67)	25 (111)
	T2HxxHJ	•			4.0	0.28	1.0					
	T2HxxLH		•		2.7	0.64	2.5					
	T2HxxLD		•		1.1	3.6	16					
1 Stack	T21xxHK	•		180 (1.27)	5.4	0.23	1.1	4.64	0.0034 (0.024)	1.5 (0.68)	15 (67)	25 (111)
	T21xxHJ	•			4.1	0.33	1.8					
	T21xxLC		•		0.4	42.9	209					
	T21xxLH		•		2.7	0.85	4.6					
	T21xxLE		•		1.4	3.0	16					
	T21xxLD		•		1.1	4.9	30					
2 Stack	T22xxHK	•		280 (1.98)	6.6	0.20	0.85	3.69	0.0056 (0.040)	2.2 (1.0)	15 (67)	25 (111)
	T22xxHJ	•			4.1	0.49	2.5					
	T22xxLC		•		0.46	41.4	209					
	T22xxLH		•		3.3	0.75	3.4					
	T22xxLG		•		2.5	1.3	7.1					
	T22xxLE		•		1.5	2.9	17					
3 Stack	T23xxHK	•		380 (2.68)	6.0	0.28	1.5	3.04	0.0084 (0.059)	3.3 (1.5)	15 (67)	25 (111)
	T23xxHJ	•			3.8	0.64	3.9					
	T23xxLC		•		0.67	23.5	136					
	T23xxLH		•		3.0	1.0	6.2					
	T23xxLF		•		1.8	2.8	17					
	T23xxLE		•		1.5	4.1	24					

Note: *Maximum shaft loading based on 20,000 hours of operation at 1500 rpm.

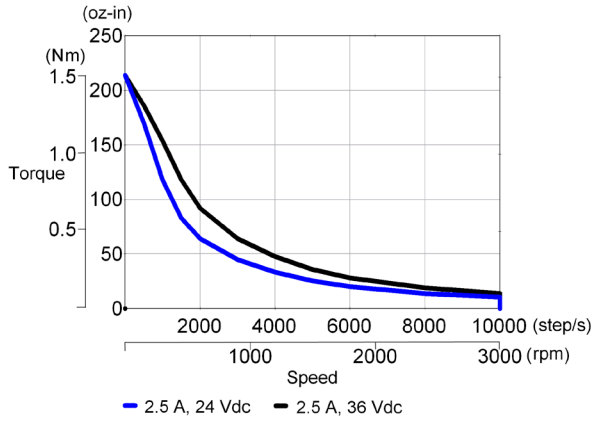
T2 Series Stepper Motors

T2 Performance Curves – DC Drive Models

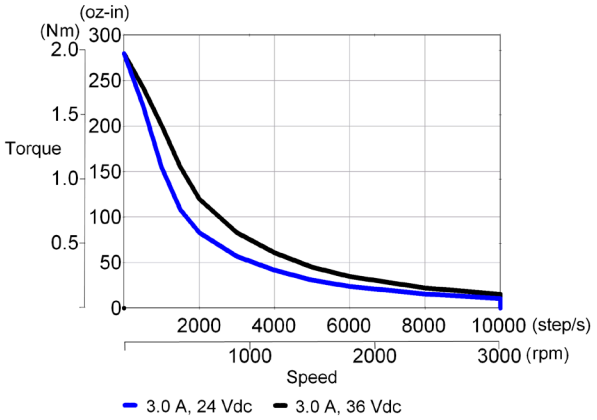
T21xxLH w/ P70530



T22xxLG w/ P70530

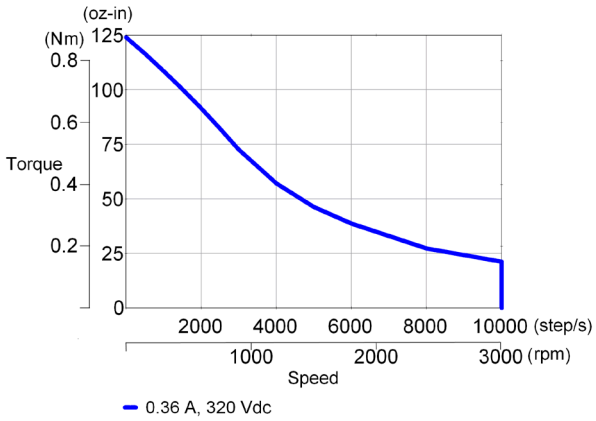


T23xxLH w/ P70530

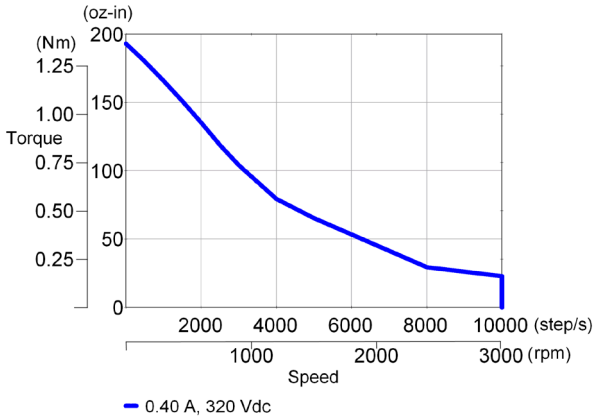


T2 Performance Curves – AC Drive Models

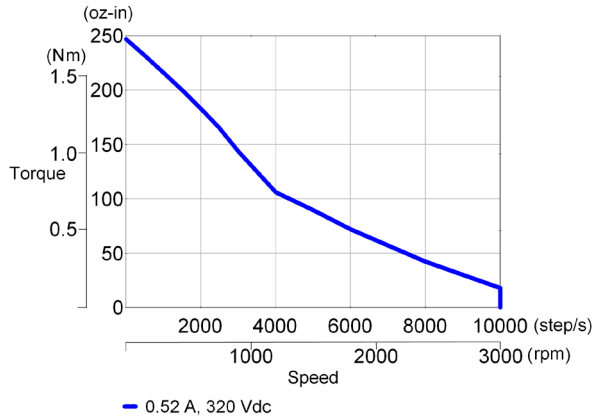
T21xxLC w/ P70360



T22xxLC w/ P70360



T23xxLC w/ P70360

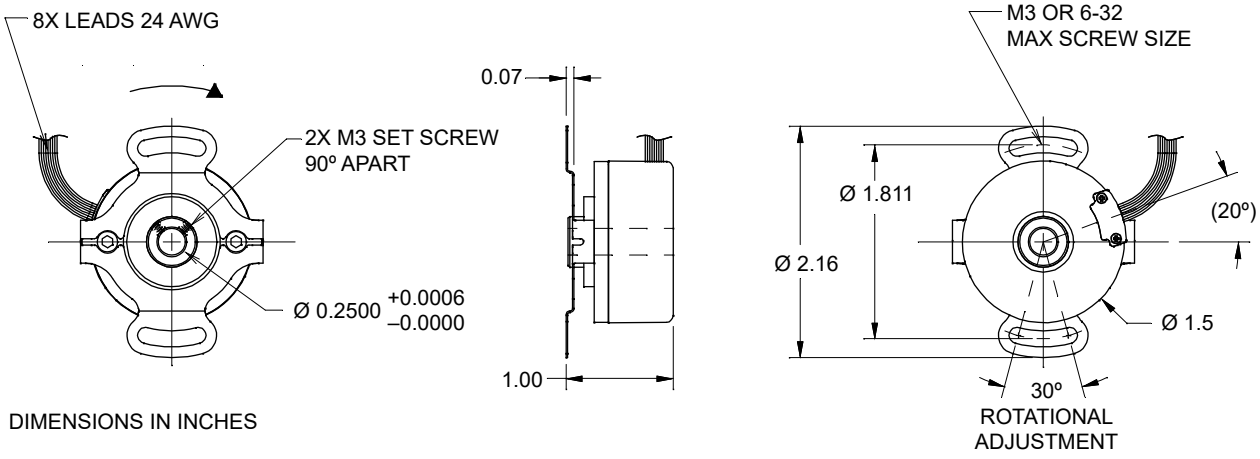


T2 Encoder Option

Enconder Specifications

Parameter	Code		
	C2	C4	C5
Type	Optical Incremental		
Supply Voltage	5 VDC ±10%		
Lines per Revolution	200	400	500
Output Format	Dual Channel Quadrature with Index (Z)		
Output Type	Differential Line Drive (with compliments)		
Output Frequency (kHz)	200		
Operating Temperature (°C)	-20 to 100		
Storage Temperature (°C)	-25 to 85		

Enconder Dimensional Drawings

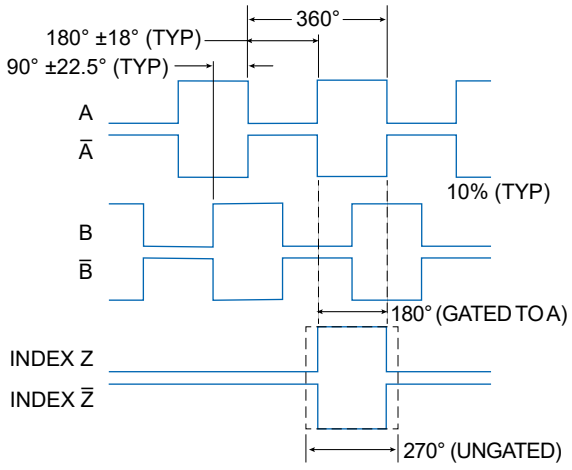


DIMENSIONS IN INCHES

Encoder Connection

Function	Color Code
COM	Black
+5 VDC	White
A	Brown
$\bar{A}$	Yellow
B	Red
$\bar{B}$	Green
Z (Index)	Orange
$\bar{Z}$ (Index)	Blue

C2, C4, C5 Encoder Phase Diagram



OUTPUT FORMAT FOR CCW ROTATION VIEWED FROM ENCODER END

More Expertise for a More Successful Machine

Our global engineering, service and support network provides deep knowledge of all the major industries that rely on advanced motion control and automation technology. We offer world-class engineering expertise, self-service design tools, personalized field service, and easy access to our design, application and manufacturing centers in strategic locations across the globe.

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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