Torque Motors

Additional Information

Torque Motors

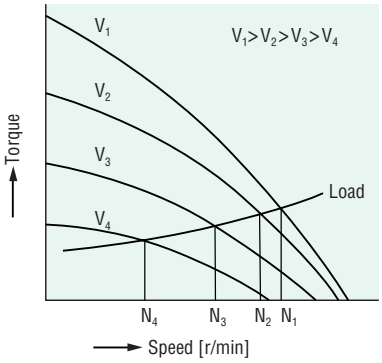
Torque motors are designed to provide high starting torque and sloping characteristics (torque is highest at zero speed and decreases steadily with increasing speed), and operate over a wide speed range. They also provide stable operation, especially in the low speed range or under a locked rotor condition.

Gearhead shown in the photograph is sold separately.

Features

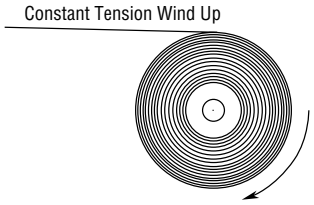
Speed can be varied over a wide range

The motor torque is approximately proportional to the square of the voltage, allowing easy speed control simply by changing the voltage of the power supply.



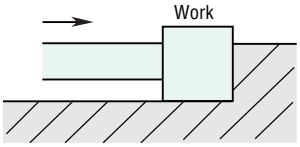
Suitable for winding applications

In an application where an object is released continuously at a constant speed and wound up with constant tension, the torque must be doubled and the speed must be halved if the diameter of the winding spool is doubled.



Locked rotor operation is available

Unlike induction motors or reversible motors, torque motors are designed to provide a stable torque even under stall conditions or at very low speeds (nearly stalling).
They are suitable for pushing applications that require static torque, or for loads that are usually under a locked rotor condition but are under stall conditions at the end of processes. The motors can operate continuously at 60 VAC or less. When used at voltages above 60 VAC, the motors are rated for limited duty. The motor has a 5-minute rating at 115 VAC.

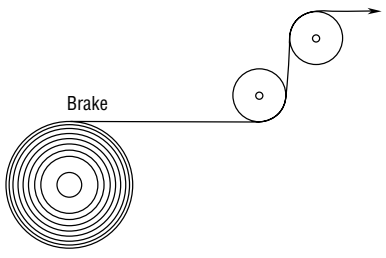


Note:

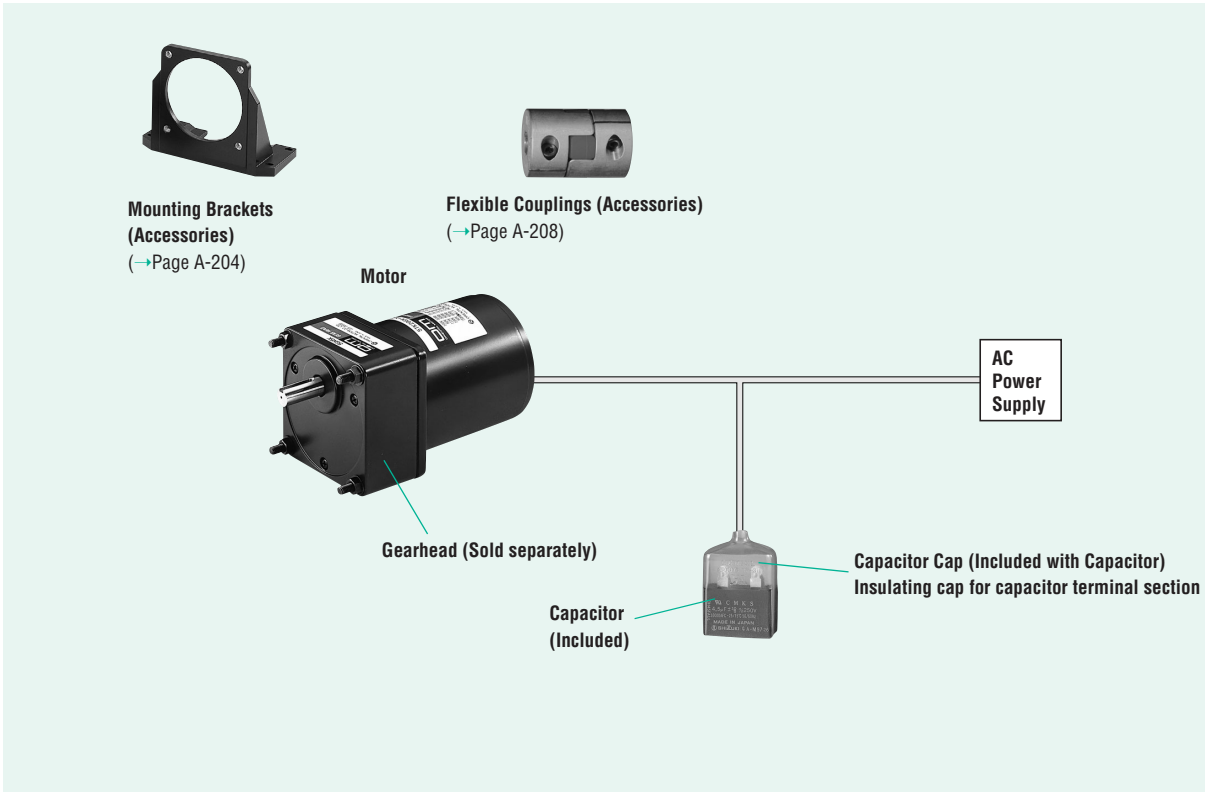
- When using a motor in a locked rotor condition, the output torque becomes very large. Do not exceed the permissible torque of the gearhead. Also, ensure that the work does not hit an object and stop, since this can cause damage to the gearhead due to the shock.

Use as a brake

By using the motor in the braking region of the speed-torque characteristics, it can serve as a brake. Constant tension operation can be achieved by applying a DC voltage.



System Configuration



The system configuration shown above is an example. Other configurations are available.

Product Number Code

4 T K 10 GN - A UL □

- **A**: Inch-Sized Output Shaft (Only Round Shaft Type)
- **UL**: UL Recognized and CSA, VDE Certified
- **Voltage**
  A: Single-Phase 115 VAC
- **Motor Shaft Type**
  GN: Pinion Shaft (for use with **GN**-type gearhead)
  A: Round Shaft
- **Output Power**
  (Example) **10**: 10 W
- **Motor Series**
  K: **K** Series
- **Motor Type**
  T: Torque Motor
- **Motor Frame Size**
  3: 2.76 in. sq. (70 mm sq.)
  4: 3.15 in. sq. (80 mm sq.)
  5: 3.54 in. sq. (90 mm sq.)

● **Gearhead Product Number Code** →Page A-16

Safety Standards and CE Marking

Standards	Certification Body	Standards File No.	CE Marking
UL1004 UL547	UL	E64197	Low Voltage Directives
CSA C22.2 No.100 CSA C22.2 No.77	CSA	LR47296	
EN60950	VDE	5877ÜG	

● **Details of Safey Standards**→Page G-2

How to Read Speed–Torque Characteristics Graph

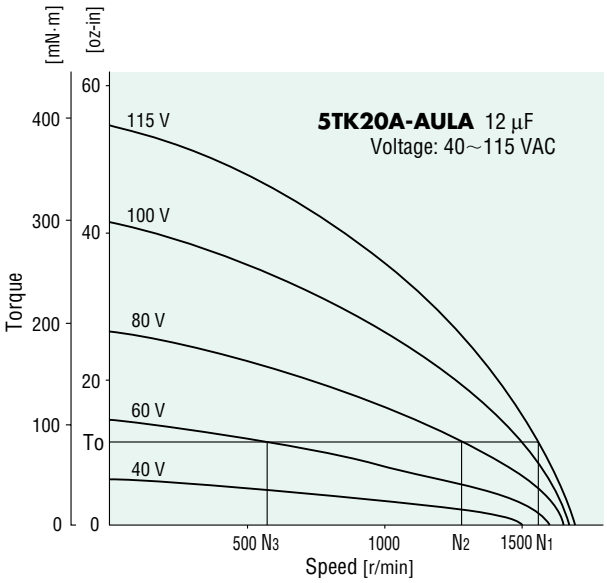
The torque generated by the torque motor changes approximately proportionally to the square of the voltage. When the voltage supplied to the motor is changed, speed-torque curves with a sloping characteristics (torque is highest at zero speed and decreases steadily with increasing speed) shifts to that of the corresponding voltage.

When the voltage is changed to 115 VAC, 80 VAC and 60 VAC while the load torque is T_0, the motor rotates at the speeds N_1, N_2 and N_3 respectively. Thus, the speed can be changed easily by varying the voltage.

When choosing a torque motor, first determine the required torque and speed. Then select a motor using the speed-torque characteristics curves to determine whether the motor should be operated under continuous duty or limited duty.

When used under locked rotor conditions, only the torque factor is considered.

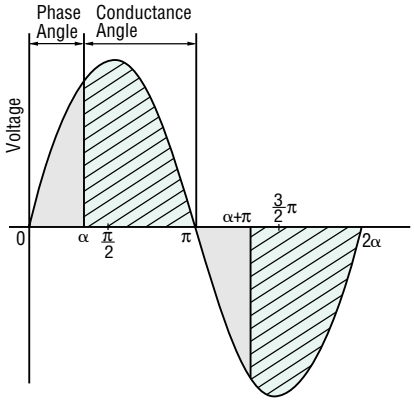
The temperature rise of the motor may cause a problem during continuous operation. In this case, choose a motor with an output power large enough for continuous operation and adjust the voltage to control the torque and speed.



Voltage Control of Torque Motors

The method most commonly used to control voltage is by phase control using a triac. As shown in the figure to the right, by changing the phase angle “alpha” at which the triac switches, the input voltage is controlled as represented by the phase angle areas of the graph.

- When adjusting the speed or the torque, an external voltage adjuster is necessary.



Phase Control

Specifications

Model		Rating at Locked Rotor	Voltage	Frequency	Starting Torque		Output Power		At max. output power					Capacitor
									Speed	Torque		Current	Input	
Pinion Shaft Type	Round Shaft Type		VAC	Hz	oz-in	mN·m	HP	W	r/min	oz-in	mN·m	A	W	µF
(TP) 3TK6GN-AUL	3TK6A-AULA	5 minutes	Single-phase 115	60	21	150	1/93	8	900	12.3	87	0.62	67	8.0
		Continuous	Single-phase 60		6.3	45	1/300	2.5		3.8	27	0.34	20	
(TP) 4TK10GN-AUL	4TK10A-AULA	5 minutes	Single-phase 115	60	27	195	1/62	12	900	18.4	130	0.66	70	8.0
		Continuous	Single-phase 60		7.1	50	1/270	2.8		4.4	31	0.32	19	
(TP) 5TK20GN-AUL	5TK20A-AULA	5 minutes	Single-phase 115	60	49	350	1/32	23	900	35	250	1.0	110	12.0
		Continuous	Single-phase 60		12.7	90	1/125	6		9.2	65	0.49	29	

(TP) Contains a built-in thermal protector. If a motor overheats for any reason, the thermal protector is opened and the motor stops. When the motor temperature drops, the thermal protector closes and the motor restarts. Be sure to turn the motor off before inspecting.

General Specifications

Item	Specifications
Insulation Resistance	100 MΩ or more when 500 VDC is applied between the windings and the frame after rated motor operation under normal ambient temperature and humidity.
Dielectric Strength	Sufficient to withstand 1.5 kV at 60 Hz applied between the windings and the frame for 1 minete after rated motor operation under normal ambient temperature and humidity.
Temperature Rise	135°F (75°C) or less measured by the resistance change method after rated motor operation.
Insulation Class	UL/CSA Standard Class A [221°F (105°C)], EN Standard Class E [248°F (120°C)].
Overheat Protection	Built-in thermal protector (Automatic return type) Operating temperature, open: 248°F±9°F (120°C±5°C) close: 170.6°F±27°F (77°C±15°C)
Ambient Temperature Range	14°F～104°F (−10°C～+40°C)(nonfreezing)
Ambient Humidity	85% maximum (noncondensing)
Degree of Protection	IP20

Gearheads (Sold Separately)

Parallel Shaft

Model	Gear Ratio
3GN□KA	**3～180**
3GN10XK (Decimal Gearhead)	
4GN□KA	**3～180**
4GN10XK (Decimal Gearhead)	
5GN□KA	**3～180**
5GN10XK (Decimal Gearhead)	

- Enter the gear ratio in the box (□) within the model name.

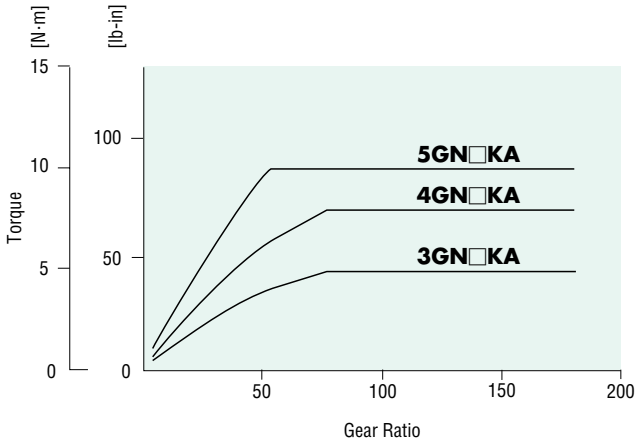
Gearmotor–Torque Table

The permissible torque when a gearhead and a decimal gearhead are directly connected can be calculated according to the following formula, using the speed and torque determined from the speed-torque characteristics.

Speed of gearhead output shaft N_G = Motor speed × 1/gearhead gear ratio
Output torque of gearhead T_G = Motor torque × Gearhead gear ratio × Gearhead efficiency

The output torque of the gearhead must be lower than the maximum permissible torque.

Maximum Permissible Torque of Gearheads



Gearhead Model	Gearhead Gear Ratio	Gearhead Efficiency
3GN□KA	**3, 3.6, 5, 6, 7.5, 9, 12.5, 15, 18**	81%
4GN□KA	**25, 30, 36**	73%
5GN□KA	**50, 60, 75, 90, 100, 120, 150, 180**	66%

- Gearheads and decimal gearheads are sold separately.
- Enter the gear ratio in the box (□) within the model name.

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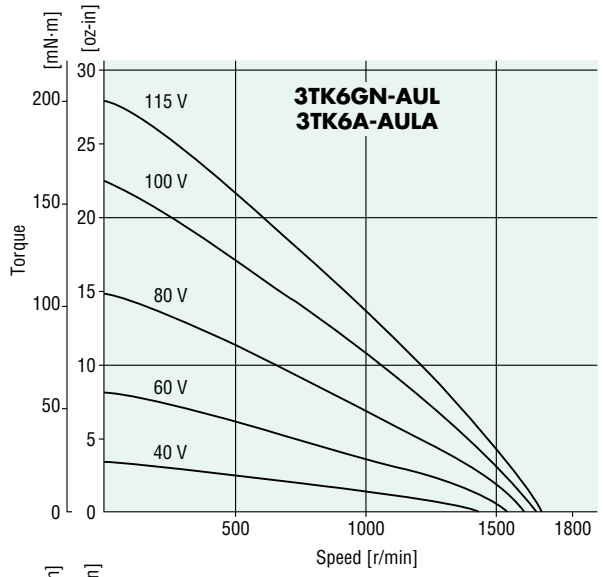
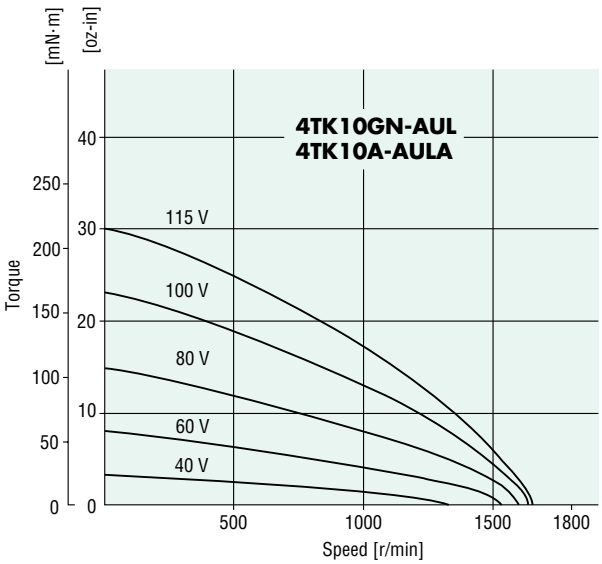
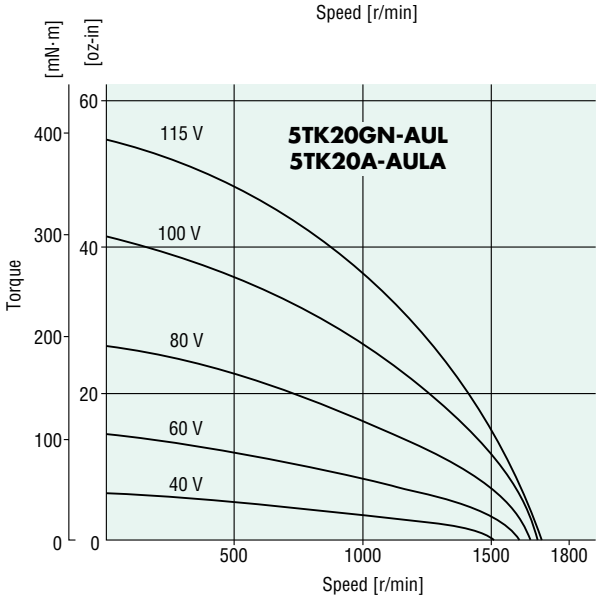
Speed – Torque Characteristics (Reference Values)





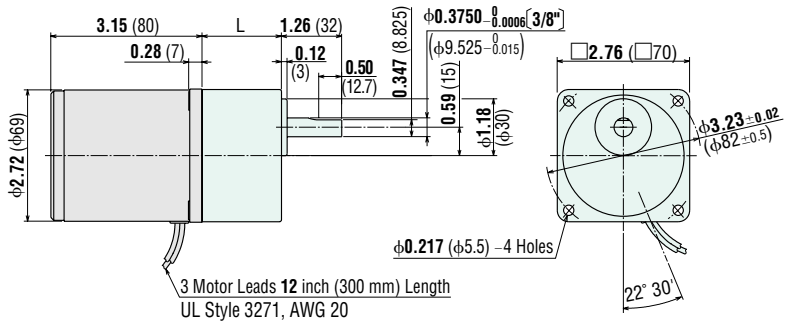


Dimensions Scale 1/4, Unit = **inch** (mm)

Motor
3TK6GN-AUL
Weight: 2.4 lb. (1.1 kg)

Gearhead
3GN□KA
Weight: 1.2 lb. (0.55 kg)

DXF A010AU (**3GN3KA**~**18KA**)
A010BU (**3GN25KA**~**180KA**)



3GN3KA~**18KA**: L = **1.26** (32)
3GN25KA~**180KA**: L = **1.65** (42)

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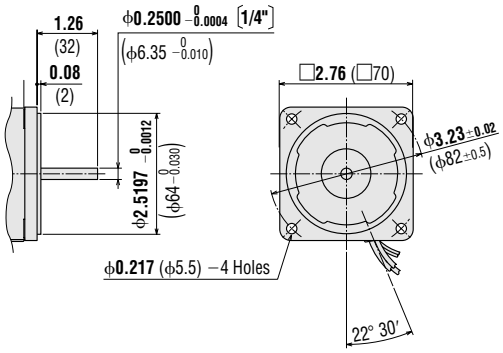
Round Shaft Type

3TK6A-AULA

Weight: 2.4 lb. (1.1 kg)

DXF A326U



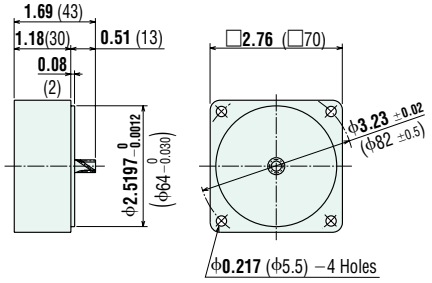
Decimal Gearhead

(For **3TK6GN-AUL**)

3GN10XK

Weight: 0.66 lb. (0.3 kg)

DXF A009

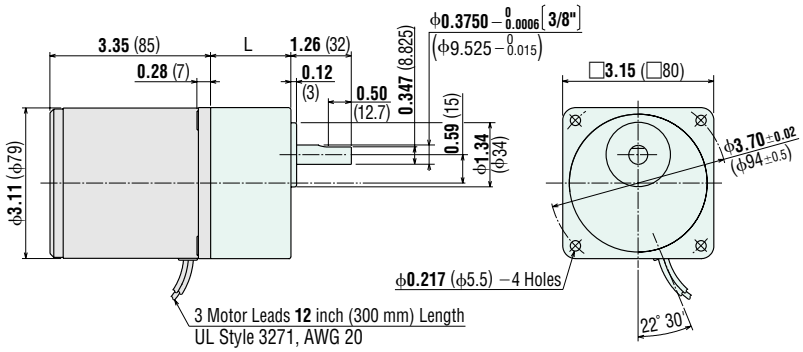


Motor / Gearhead

4TK10GN-AUL / **4GN□KA**

Weight: 3.3 lb. (1.5 kg) / Weight: 1.4 lb. (0.65 kg)

DXF A014AU (**4GN3KA~18KA**)
A014BU (**4GN25KA~180KA**)



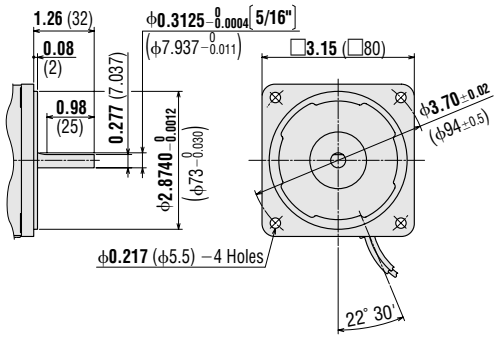
4GN3KA~18KA: L = **1.26** (32)
4GN25KA~180KA: L = **1.67** (42.5)

Round Shaft Type

4TK10A-AULA

Weight: 3.3 lb. (1.5 kg)

DXF A327U



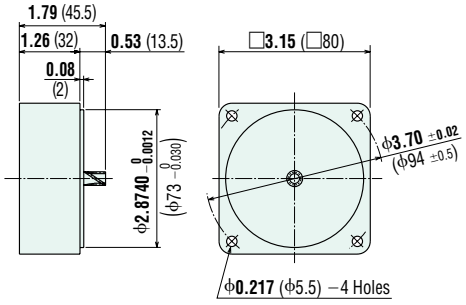
Decimal Gearhead

(For **4TK10GN-AUL**)

4GN10XK

Weight: 0.88 lb. (0.4 kg)

DXF A013



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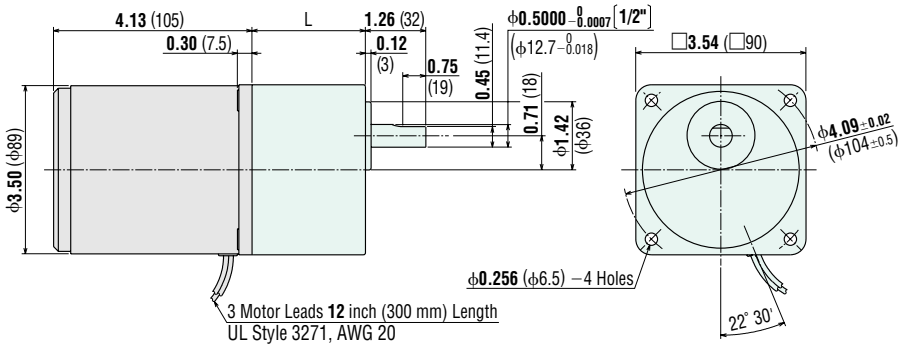
Motor / Gearhead

5TK20GN-AUL
Weight: 5.5 lb. (2.5 kg)

5GN□KA
Weight: 3.3 lb. (1.5 kg)

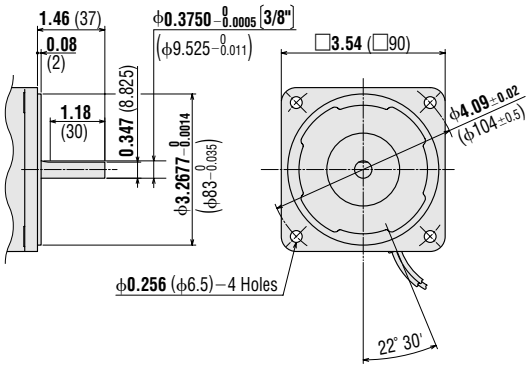
DXF A019AU (**5GN3KA**~**18KA**)
A019BU (**5GN25KA**~**180KA**)



5GN3KA~**18KA**: L = **1.65** (42)
5GN25KA~**180KA**: L = **2.36** (60)

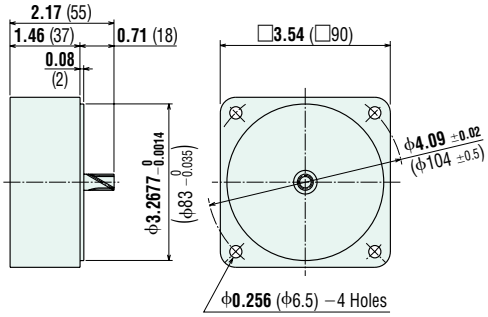
Round Shaft Type

5TK20A-AULA
Weight: 5.5 lb. (2.5 kg)
DXF A329U

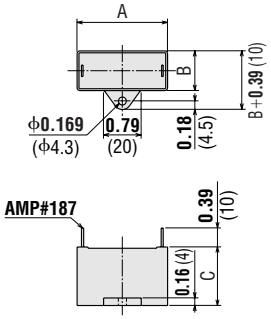


Decimal Gearhead

(For **5TK20GN-AUL**)
5GN10XK
Weight: 1.3 lb. (0.6 kg)
DXF A022



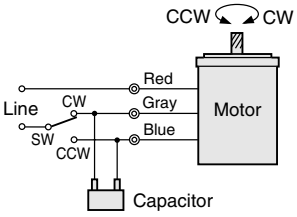
Capacitor (included with the motors)



Motor Model	Capacitor Model	Dimensions in. (mm) A	B	C	Weight oz. (g)
3TK6GN-AUL / **3TK6A-AULA**	CH80UL	1.50 (38)	0.83 (21)	1.22 (31)	1.2 (35)
4TK10GN-AUL / **4TK10A-AULA**	CH80UL	1.50 (38)	0.83 (21)	1.22 (31)	1.2 (35)
5TK20GN-AUL / **5TK20A-AULA**	CH120CUL	2.28 (58)	0.83 (21)	1.22 (31)	1.8 (50)

- If you need to order a capacitor with out a motor, add "–C" to the capacitor model name shown. A capacitor cap is included with the capacitor.

Connection Diagram

3TK6GN-AUL **4TK10GN-AUL** **5TK20GN-AUL**	

To rotate the motor in a clockwise (CW) direction, flip switch SW to CW.
To rotate it in a counterclockwise (CCW) direction, flip this switch to CCW.

The direction of motor rotation is as viewed from the front shaft end of the motor.

- The direction of motor rotation is as viewed from the shaft end of the motor.
- CW represents the clockwise direction, while CCW represents the counterclockwise direction.
- Connection diagrams are also valid for the equivalent round shaft motors.
- **How to connect a capacitor** →Page A-225