

## Brushless DC Motor Systems

# AXH Series

The **AXH** Series combines a compact, brushless DC speed control motor and 24 VDC board-level driver. These systems provide space savings and high power output, and are easy to use.

### Combination Type (Pre-assembled Gearmotors)

The combination type (pre-assembled gearmotors) come with the motor and its dedicated gearhead already assembled. This simplifies installation in equipment.

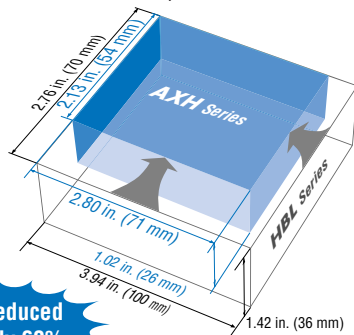
Motors and gearheads are also available separately so they can be on hand to make changes or repairs.

\* Except for 15W type

## Features

### ● Compact Board-Level Driver

The size of the **AXH** driver has been reduced by approximately 60% when compared to conventional DC brushless drivers. (Driver for 15W-50W)



Driver volume reduced by approximately 60%

### ● Compact, High Power Motors

The size of the **AXH** Motor has been reduced by approximately 55% when compared to conventional AC speed control motors [□3.15 in. (□80mm) size]. The motor has extremely high output power for its small size.

### ● Superior Speed Stability

The fluctuation is only  $\pm 1\%$  for load, voltage and temperature. These motors provide superior speed stability with minimal speed fluctuation.

## Safety Standards and CE Marking

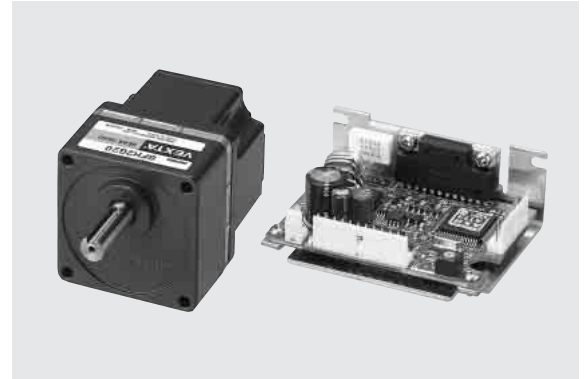
	Standards	Certification Body	Standards File No.	CE Marking
<b>AXH015</b> type	UL1950	UL	E208200	EMC Directives
<b>AXH230</b> type	CSA C22.2 No.950			
<b>AXH450</b> type				
<b>AXH5100</b> type	UL60950 CSA C22.2 No.60950	UL	E208200	

● When the system is approved under various safety standards, the model names on the motor and driver nameplates are the approved model names.

● **List of Motor and Driver Combinations** → Page B-68

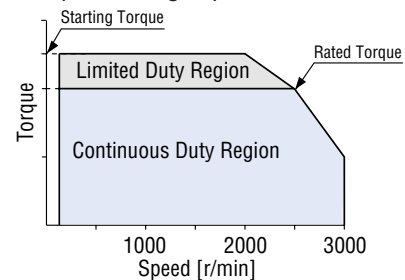
● **Details of Safety Standards** → Page G-2

● The EMC value changes according to the wiring and layout. Therefore, the final EMC level must be checked with the motor/driver incorporated in the equipment.



### ● Constant Torque over a Wide Speed Range

The speed can be set within the wide range of 100 r/min to 3000 r/min (30:1). The **AXH** Series maintains a constant torque from low speed to high speed.



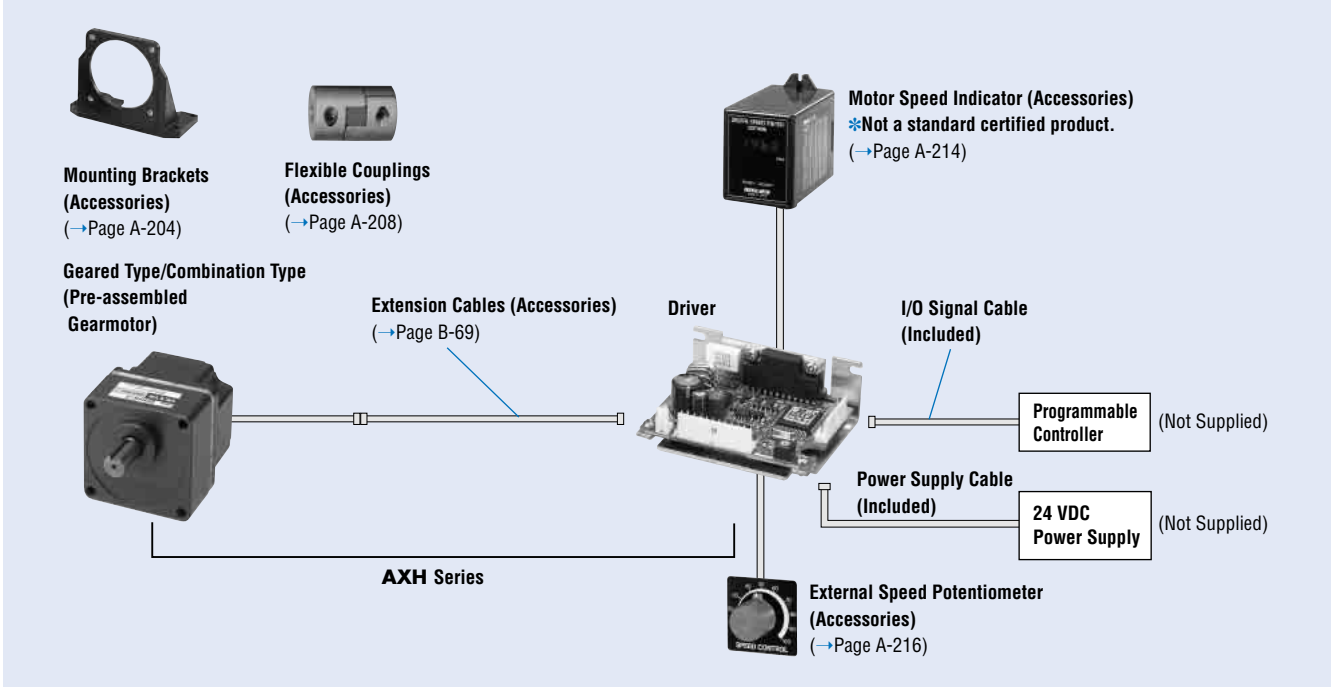
### ● Gearheads Provide High Torque

**AXH** geared type motors come pre-assembled with a gearhead. These gearheads provide torque up to 17.7 lb-in (2N·m) for the 15 W motors and up to 141 lb-in (16N·m) with the 50 W motors.

### ● Protective Functions

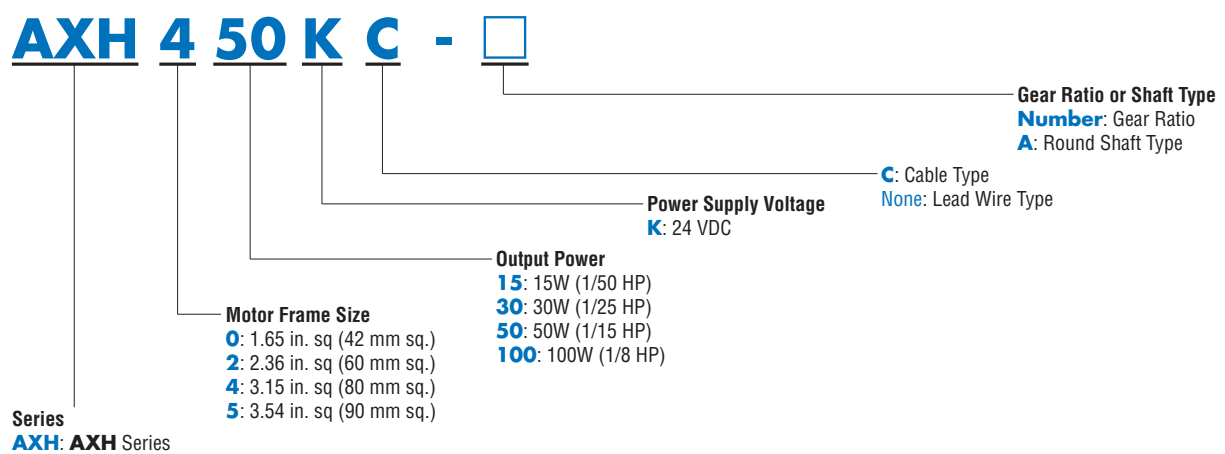
The **AXH** Series is equipped with protective functions to handle overload, overvoltage, undervoltage, overspeed and out-of-phase power. When one of these protective functions detects an abnormality, a LED blinks and motor comes to a stop.

## System Configuration



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

## Product Number Code



## Product Line

### Geared Type/Combination Type

Output Power HP    W	Model	Gear Ratio
1/50    15	AXH015K-□	5, 10, 15, 20, 30, 50, 100
1/25    30	AXH230KC-□	5, 10, 15, 20, 30, 50, 100, 200
1/15    50	AXH450KC-□	5, 10, 15, 20, 30, 50, 100, 200
1/8     100	AXH5100KC-□	5, 10, 15, 20, 30, 50, 100, 200

### Round Shaft Type

Output Power HP    W	Model
1/50    15	AXH015K-A
1/25    30	AXH230KC-A
1/15    50	AXH450KC-A
1/8     100	AXH5100KC-A

- AXH015K-□ are Geared Type and the others are combination type.
- Enter the gear ratio in the box (□) within the model name.

## Specifications

Model	Geared Type/Combination Type		AXH015K-□	AXH230KC-□	AXH450KC-□	AXH5100KC-□
	Round Shaft Type		AXH015K-A	AXH230KC-A	AXH450KC-A	AXH5100KC-A
Rated Output Power	HP (W)		1/50 (15)	1/25 (30)	1/15 (50)	1/8 (100)
Power Source	Voltage	24 VDC ±10%				
	Rated Input Current A		1.0	2.1	3.1	6.0
	Maximum Input Current A		2.0	3.5	5.0	9.0
Rated Torque	oz-in (N-m)		7.1 (0.05)	17 (0.12)	28 (0.20)	56 (0.40)
Starting Torque	oz-in (N-m)		10.6 (0.075)	21 (0.15)	34 (0.24)	71 (0.50)
Permissible Load Inertia J *	oz-in <sup>2</sup> (×10 <sup>-4</sup> kg-m <sup>2</sup> )		2.7 (0.5)	9.8 (1.8)	18.1 (3.3)	31 (5.6)
Maximum Speed	r/min	3000				
Rated Speed	r/min		3000		2500	
Variable Speed Range	r/min	100~3000 (30:1)				
Speed Regulation	Load	±1% Max. (0~rated torque, at rated speed)				
	Voltage	±1% Max. (Power supply voltage ±10%, at rated speed with no load)				
	Temperature	±1% Max. (32°F~122°F [0°C~+50°C] at rated speed with no load)				

\* The permissible load inertia specified above is only applicable for round shaft type. Permissible Load Inertia for Geared Type and Combination Type → Page B-61

• Enter the gear ratio in the box (□) with the model name.

• The values for each item is for the motor only.

## Common Specifications

Item	Specifications
Speed Control Method	Any one of the following methods. 1. By built-in potentiometer 2. By external potentiometer 3. By DC voltage (0~5 VDC)
Input Signals	C-MOS negative logic L: (ON) : 0~0.5 VDC H: (OFF) : 4~5 VDC
	START/STOP input L: START H: STOP
	Brake input L: RUN H: Instantaneous stop
	Direction of rotation input L: CW H: CCW
	Speed setting method L: Internal H: External
	Alarm reset L: Reset H: Normal
Output Signals	Open collector output External use conditions 26.4 VDC, 10 mA Max. Speed Signal Output (SPEED OUT) 30 P/R, Alarm Signal Output (ALARM OUT)
Protection Functions*1	When the following are activated, the alarm signal will be output and the motor will come to a natural stop. <ul style="list-style-type: none"> <li>• Overload Protection: Activated when a load exceeding the rated torque is applied to the motor for approximately 5 seconds or more.</li> <li>• Out-of-Phase Protection: Activated when the sensor wire inside the motor cable is disconnected.</li> <li>• Overvoltage Protection: Activated when the voltage applied to the driver exceeds 24 VDC by approximately 15% or more.</li> <li>• Undervoltage Protection: Activated when the voltage applied to the driver falls at least 25% below 24 VDC.</li> <li>• Over Speed Protection: Activated when the motor rotates at an abnormal speed above 3500 r/min.</li> </ul>
Motor Insulation Class*2	Class E [248°F (120°C)]
Rating	Continuous

\*1 With the **AXH** Series the motor speed cannot be controlled in applications where the motor shaft is turned by the load, as in lowering operations.

Also, the motor will stop naturally if the load exceeds the permissible load inertia or the overvoltage protection function is activated during load lowering operations.

\*2 Motor insulation is recognized as class A [221°F(105°C)] by UL and CSA standards.

## General Specifications

Item	Motor	Driver
Insulation Resistance	100 MΩ or more when 500 VDC megger is applied between the windings and the frame after continuous operation under normal ambient temperature and humidity.	100 MΩ or more when 500 VDC megger is applied between the power supply input and the frame after continuous operation under normal ambient temperature and humidity.
Dielectric Strength	Sufficient to withstand 0.5 kVAC at 50 Hz applied between the windings and the frame for 1 minute after continuous operation under normal ambient temperature and humidity.	Sufficient to withstand 0.5 kVAC at 50 Hz applied between the power supply input and the frame for 1 minute after continuous operation under normal ambient temperature and humidity.
Temperature Rise	90°F (50°C) or less measured by the thermocoupler method after the temperature of the coil has stabilized under normal operation at the rated voltage and frequency under normal ambient temperature and humidity, with a connected gearhead or equivalent heat radiation plate.*	—
Ambient Temperature	32°F~122°F (0°C~+50°C) (nonfreezing)	
Ambient Humidity	85% maximum (noncondensing)	
Atmosphere	No corrosive gases or dust	
Degree of Protection	15W Type: IP 40 30W~100W Type: IP65 (except for the mounting surface)	IP 00

\* Size of heat radiation plate (Material: Aluminum)

**AXH230KC-A**: 4.53 in. × 4.53 in. (115 mm × 115 mm), 0.20 in. (5 mm) thick

**AXH450KC-A**: 5.31 in. × 5.31 in. (135 mm × 135 mm), 0.20 in. (5 mm) thick

**AXH5100KC-A**: 7.87 in. × 7.87 in. (200 mm × 200 mm), 0.20 in. (5 mm) thick

## Gearmotor — Torque Table (Geared Type/Combination Type)

Unit = Upper values: lb-in/Lower values: N·m

Model	Speed Range * r/min	20~500 (20~600)	10~250 (10~300)	6.7~167 (6.7~200)	5~125 (5~150)	3.3~83 (3.3~100)	2~50 (2~60)	1~25 (1~30)	0.5~12.5
	Gear Ratio	5	10	15	20	30	50	100	200
<b>AXH015K-</b> <input type="checkbox"/>		2.0 0.23	3.9 0.45	6.0 0.68	7.6 0.86	11.5 1.3	17.7 2.0	17.7 2.0	—
<b>AXH230KC-</b> <input type="checkbox"/>		4.7 0.54	9.7 1.1	14.1 1.6	19.4 2.2	27 3.1	46 5.2	53 6.0	53 6.0
<b>AXH450KC-</b> <input type="checkbox"/>		7.9 0.9	15.9 1.8	23 2.7	31 3.6	46 5.2	76 8.6	141 16	141 16
<b>AXH5100KC-</b> <input type="checkbox"/>		15.9 1.8	31 3.6	47 5.4	63 7.2	91 10.3	152 17.2	260 30	260 30

- Enter the gear ratio in the box (□) within the model name.
- A colored background indicates gear shaft rotation in the same direction as the motor shaft; a white background indicates rotation in the opposite direction.
- \* Values inside parentheses ( ) are for the **AXH015K-** model.

## Permissible Overhung Load and Permissible Thrust Load

### Geared Type/Combination Type

Model	Gear Ratio	Permissible Overhung Load				Permissible Thrust Load	
		0.39 in. (10 mm) from shaft end		0.79 in. (20 mm) from shaft end		lb.	N
		lb.	N	lb.	N		
<b>AXH015K-</b> <input type="checkbox"/>	<b>5~100</b>	11.2	50	—	—	6.7	30
<b>AXH230KC-</b> <input type="checkbox"/>	<b>5</b>	22	100	33	150	9	40
	<b>10~20</b>	33	150	45	200		
	<b>30~200</b>	45	200	67	300		
<b>AXH450KC-</b> <input type="checkbox"/>	<b>5</b>	45	200	56	250	22	100
	<b>10~20</b>	67	300	78	350		
	<b>30~200</b>	101	450	123	550		
<b>AXH5100KC-</b> <input type="checkbox"/>	<b>5</b>	67	300	90	400	33	150
	<b>10~20</b>	90	400	112	500		
	<b>30~200</b>	112	500	146	650		

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

### Round Shaft Type

Model	Permissible Overhung Load			
	0.39 in. (10mm) from shaft end		0.79 in. (20 mm) from shaft end	
	lb.	N	lb.	N
<b>AXH015K-A</b>	11.2	50	—	—
<b>AXH230KC-A</b>	15.7	70	22	100
<b>AXH450KC-A</b>	27	120	31	140
<b>AXH5100KC-A</b>	36	160	38	170

- Permissible Thrust Load: Avoid thrust loads as much as possible. If thrust load is unavoidable, keep it to no more than half the motor weight.

## Permissible Load Inertia J for Geared Type/Combination Type

Unit = Upper values: oz-in<sup>2</sup>/Lower values: × 10<sup>-4</sup> kg·m<sup>2</sup>

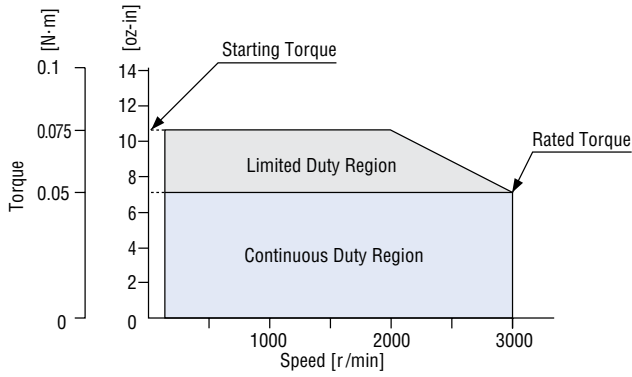
Model \ Gear Ratio	5	10	15	20	30	50	100	200
<b>AXH015K-</b> <input type="checkbox"/>	2.2 0.4	9.3 1.7	21 3.9	38 7.0	86 15.7	240 43.7	240 43.7	—
<b>AXH230KC-</b> <input type="checkbox"/>	8.5 1.55	34 6.2	77 14.0	136 24.8	310 55.8	850 155	850 155	850 155
<b>AXH450KC-</b> <input type="checkbox"/>	30 5.5	120 22	270 49.5	480 88	1080 198	3000 550	3000 550	3000 550
<b>AXH5100KC-</b> <input type="checkbox"/>	137 25	547 100	1230 225	2188 400	4923 900	13675 2500	13675 2500	13675 2500

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

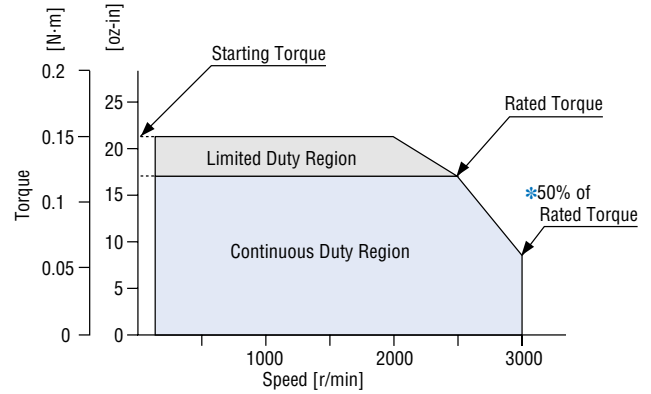
## Speed — Torque Characteristics

- For the geared type and combination type, the values are for the motor alone.
- Enter the gear ratio in the box (□) within the model name.

### AXH015K-□/AXH015K-A

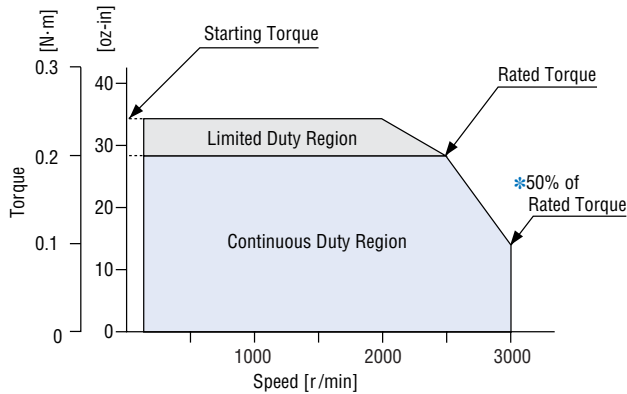


### AXH230K-□/AXH230K-A



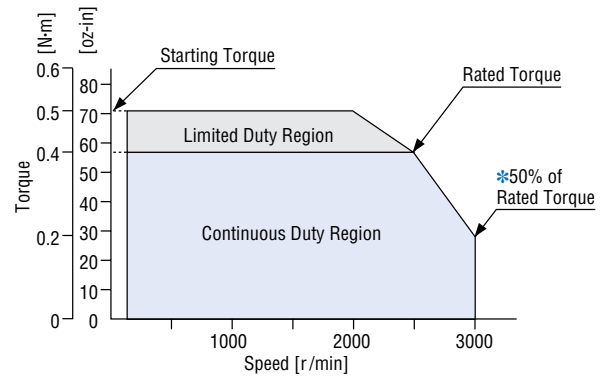
\* Values for 24 VDC with no extension cable

### AXH450K-□/AXH450K-A



\* Values for 24 VDC with no extension cable

### AXH5100K-□/AXH5100K-A



\* Values for 24 VDC with no extension cable

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

Mounting screws are included with the combination type. Dimensions for screws → Page B-133

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

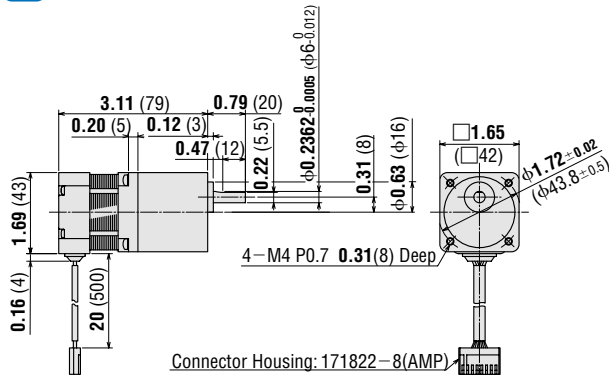
### Motor/Gearhead

#### AXH015K-□ (Geared Type)

Geared motor: AXHMO15K-□

Weight: 1.1 lb. (0.5 kg)

**DXF** A388



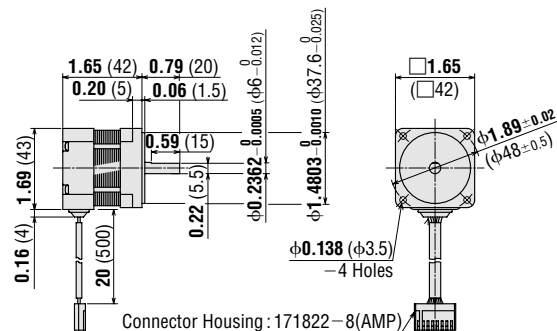
### Round Shaft Type

#### AXH015K-A

Motor: AXHMO15K-A

Weight: 0.55 lb. (0.25 kg)

**DXF** A389



● Motor/Gearhead

**AXH230KC-□ (Combination Type)**

Motor: AXHM230KC-GFH

Gearhead: GFH2G□

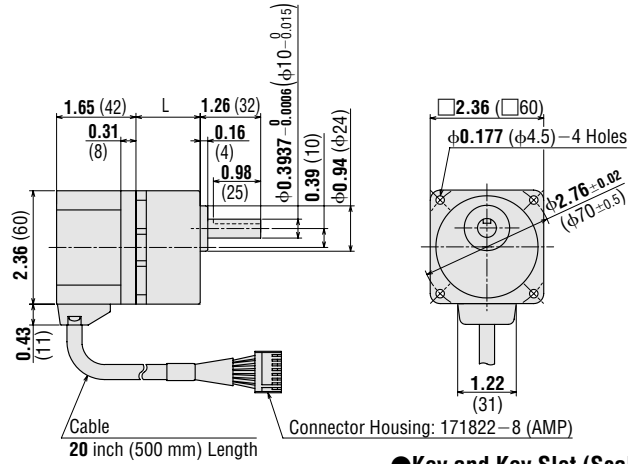
Weight (including gearhead): 2.2 lb. (1.0 kg)

**DXF** A294AU (GFH2G5~20)

A294BU (GFH2G30~100)

A294CU (GFH2G200)

Lead Wire Types are also available. Contact your Oriental Motor Representative for more information.



● Round Shaft Type

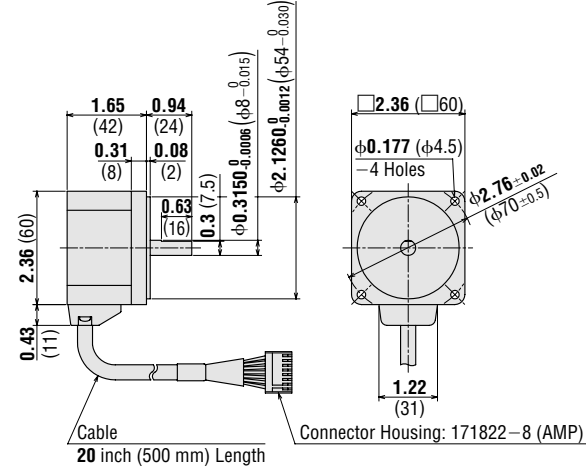
**AXH230KC-A**

Motor: AXHM230KC-A

Weight: 1.1 lb. (0.5 kg)

**DXF** A295U

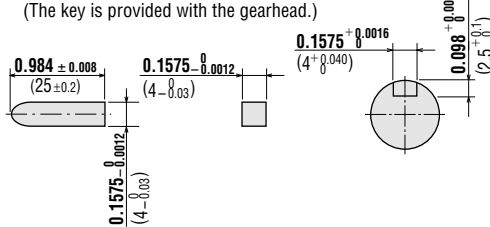
Lead Wire Types are also available. Contact your Oriental Motor Representative for more information.



● Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)

**AXH230KC-5~20:** L = 1.34 (34)  
**AXH230KC-30~100:** L = 1.50 (38)  
**AXH230KC-200:** L = 1.69 (43)



● Motor/Gearhead

**AXH450KC-□ (Combination Type)**

Motor: AXHM450KC-GFH

Gearhead: GFH4G□

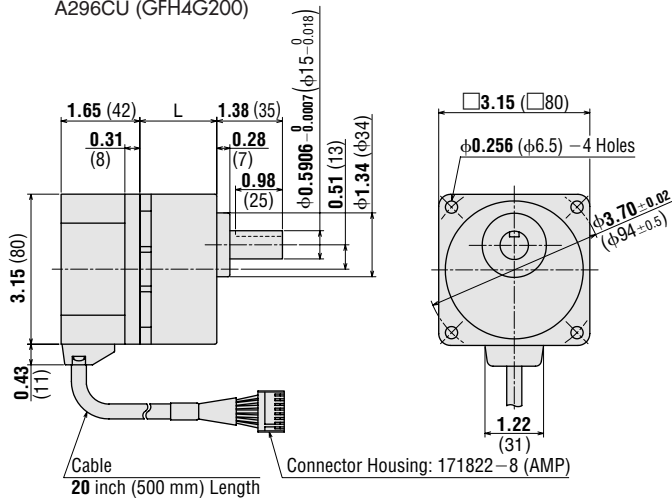
Weight (including gearhead): 4.0 lb. (1.8 kg)

**DXF** A296AU (GFH4G5~20)

A296BU (GFH4G30~100)

A296CU (GFH4G200)

Lead Wire Types are also available. Contact your Oriental Motor Representative for more information.



● Round Shaft Type

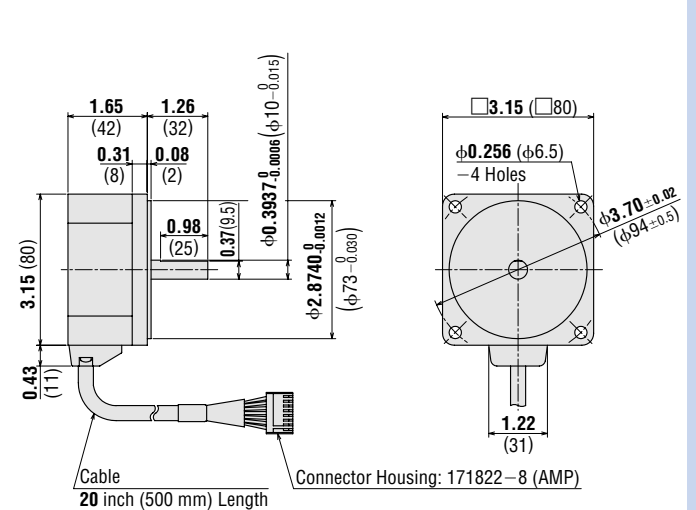
**AXH450KC-A**

Motor: AXHM450KC-A

Weight: 1.76 lb. (0.8 kg)

**DXF** A297U

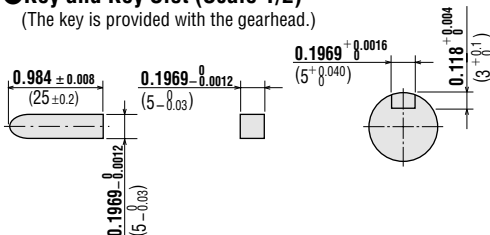
Lead Wire Types are also available. Contact your Oriental Motor Representative for more information.



● Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)

**AXH450KC-5~20:** L = 1.61 (41)  
**AXH450KC-30~100:** L = 1.81 (46)  
**AXH450KC-200:** L = 2.01 (51)



● Motor/Gearhead

**AXH5100KC-□ (Combination Type)**

Motor: AXHM5100KC-GFH

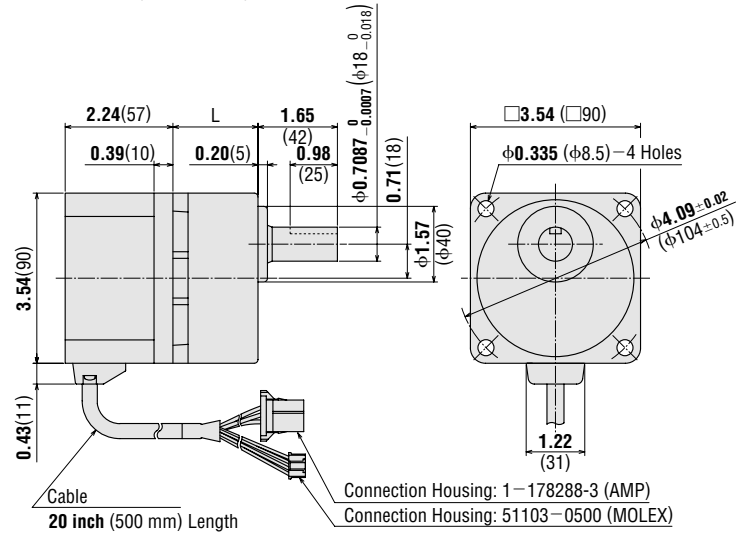
Gearhead: GFH5G□

Weight (including gearhead): 6.4 lb. (2.9 kg)

**DXF** A401AU (GFH5G5~20)

A401BU (GFH5G30~100)

A401CU (GFH5G200)



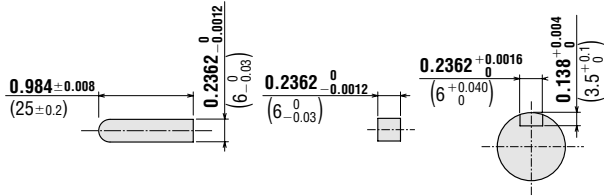
**AXH5100KC-5~20:** L = 1.77 (45)

**AXH5100KC-30~100:** L = 2.28 (58)

**AXH5100KC-200:** L = 2.52 (64)

● Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)



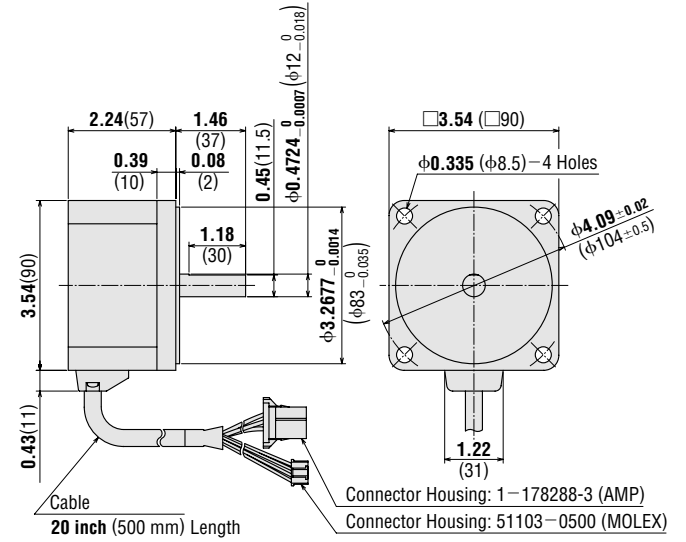
● Round Shaft Type

**AXH5100KC-A**

Motor: AXHM5100KC-A

Weight: 3.1 lb. (1.4 kg)

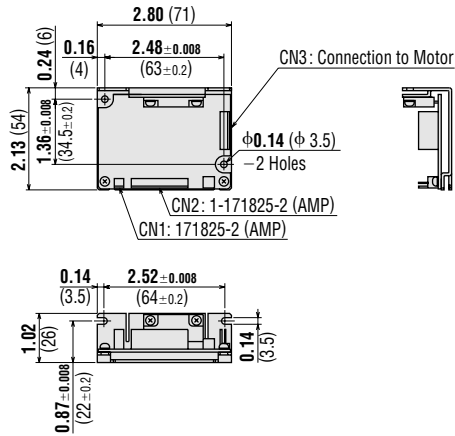
**DXF** A402U



● Driver

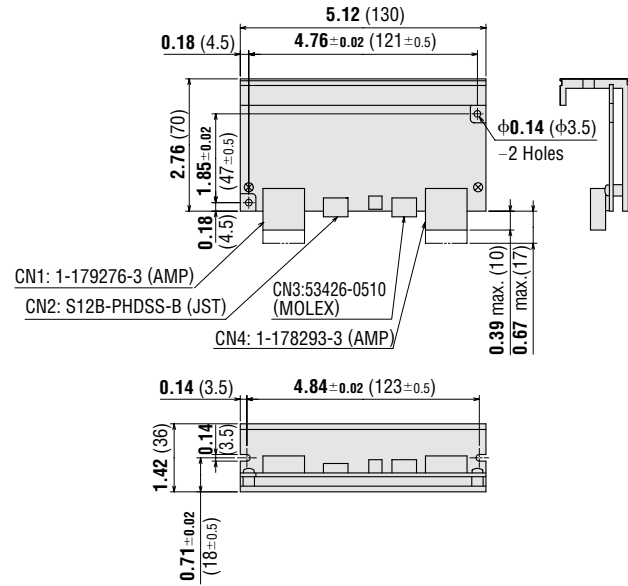
AXHD15K, AXHD30K, AXHD50K  
Weight: 0.22 lb. (0.1 kg)

DXF A298



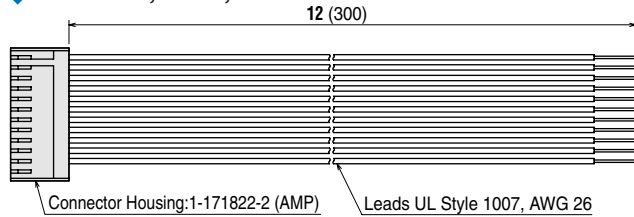
AXHD100K  
Weight: 0.66 lb. (0.3 kg)

DXF A403

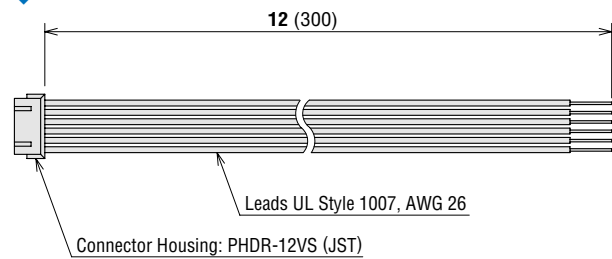


● Driver Input Signal Cable (Included)

◆ For 15 W, 30 W, 50 W

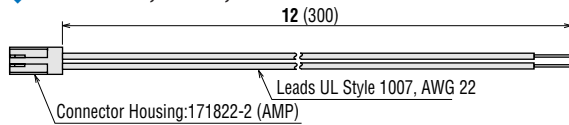


◆ For 100 W

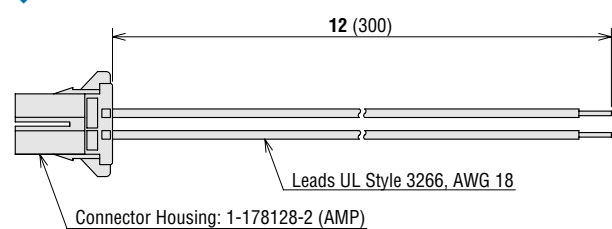


● Driver Power Supply Cable (Included)

◆ For 15 W, 30 W, 50 W



◆ For 100 W



■ List of Motor and Driver Combinations

● Geared Type/Combination Type

Output Power	Model	Motor Model	Gearhead Model	Driver Model
1/50 HP 15 W	<b>AXH015K</b> -□	AXHM015K-□*	—	AXHD15K
1/25 HP 30 W	<b>AXH230KC</b> -□	AXHM230KC-GFH	GFH2G□	AXHD30K
1/15 HP 50 W	<b>AXH450KC</b> -□	AXHM450KC-GFH	GFH4G□	AXHD50K
1/8 HP 100 W	<b>AXH5100KC</b> -□	AXHM5100KC-GFH	GFH5G□	AXHD100K

● Enter the gear ratio in the box (□) with in the model name.

\* Geared Motor Model

● Round Shaft Type

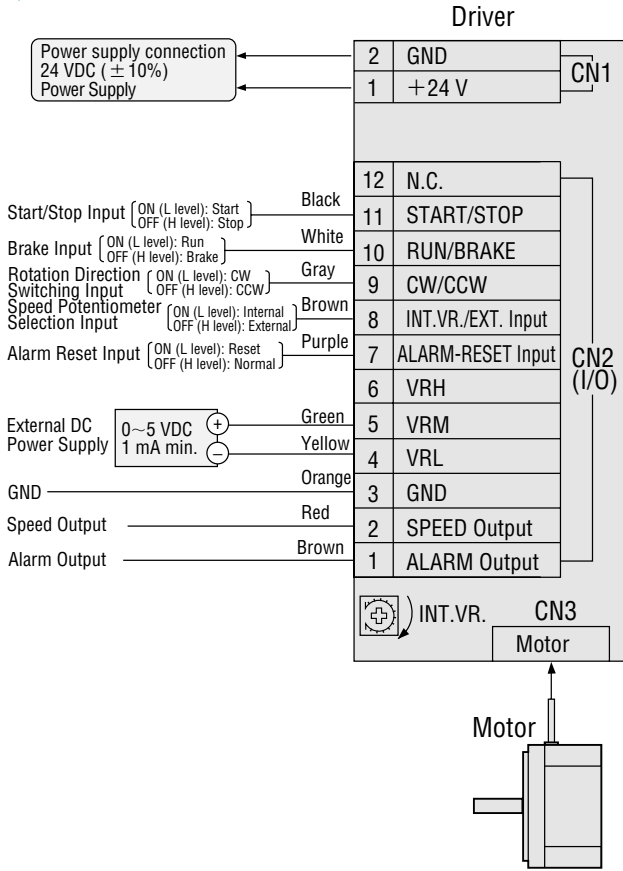
Output Power	Model	Motor Model	Driver Model
1/50 HP 15 W	<b>AXH015K-A</b>	AXHM015K-A	AXHD15K
1/25 HP 30 W	<b>AXH230KC-A</b>	AXHM230KC-A	AXHD30K
1/15 HP 50 W	<b>AXH450KC-A</b>	AXHM450KC-A	AXHD50K
1/8 HP 100 W	<b>AXH5100KC-A</b>	AXHM5100KC-A	AXHD100K



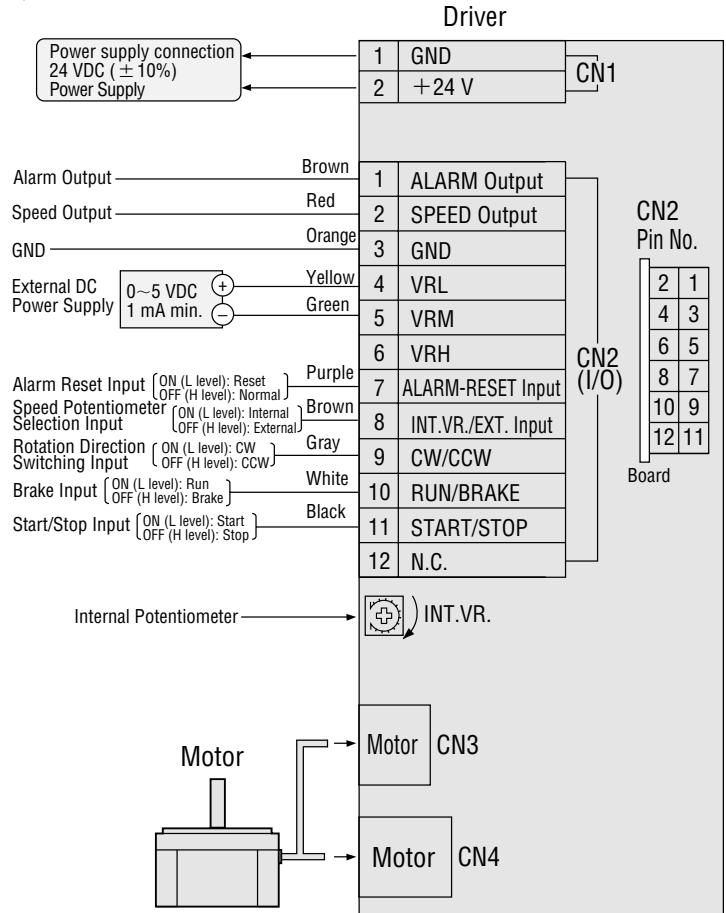
## ■ Connection and Operation

### ● Connection Diagrams

#### ◆ 15 W, 30 W, 50 W



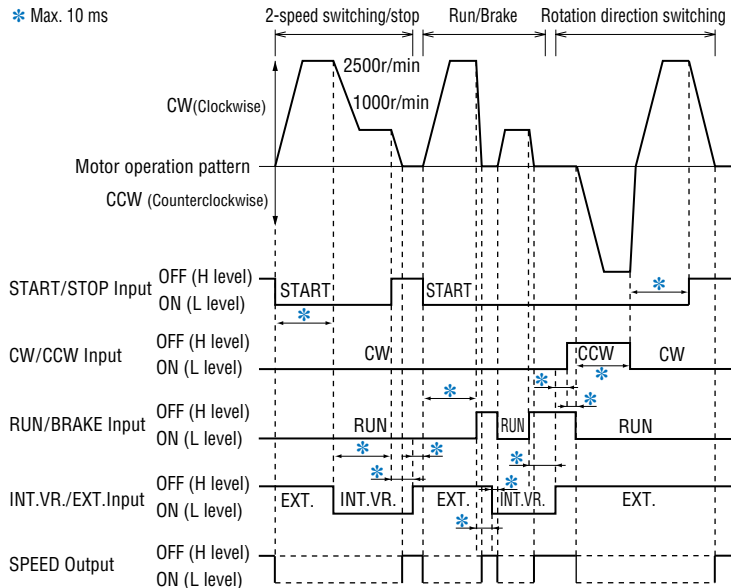
#### ◆ 100 W



- When the motor cable needs to be extended, use an optional extension cable [sold separately, 4.9 ft. (1.5 m)].  
**Extension Cable** → Page B-69

### ● Timing Chart

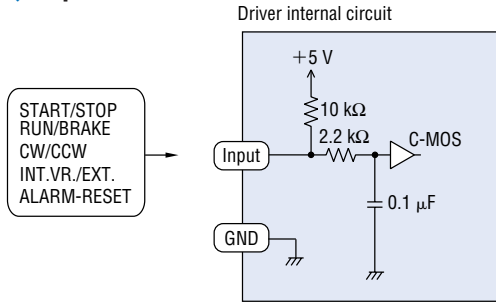
\* Max. 10 ms



- Run/stop, instantaneous stopping and rotation direction switching operations can all be controlled with the START/STOP, RUN/BRAKE and CW/CCW signals.
- If both the START/STOP signal and the RUN/BRAKE signal are set to ON (L level), the motor rotates. At this time, if the CW/CCW signal is set to ON (L level), then the motor rotates clockwise as seen from the motor shaft side; if the CW/CCW signal is set to OFF (H level), the motor rotates in the counterclockwise direction.
- If the RUN/BRAKE signal is set to OFF (H level) while the START/STOP signal is ON (L level), the motor stops instantaneously. If the START/STOP signal is set to OFF (H level) while the RUN/BRAKE signal is set to ON (L level), the motor stops naturally.
- Wait for 10 ms before switching the other input signals.
- Do not switch different input signals simultaneously. Wait for 10 ms before switching the other input signals.

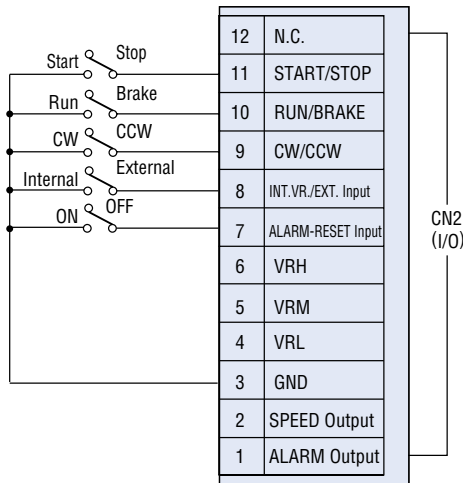
● Input Signal Circuit

◆ Input Circuit



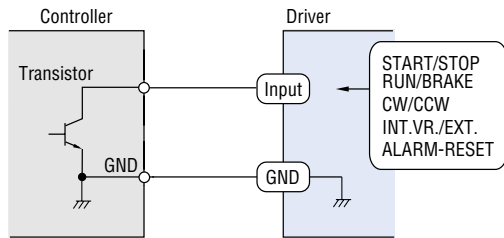
◆ Example of Input Circuit Connection  
 · Control by Small Capacity Relay, Switch, or Similar Device

Switch capacity: 24 VDC 10 mA

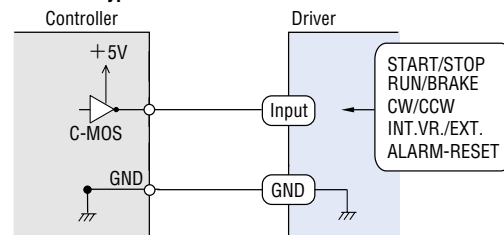


· Control by Controller

■ Transistor output type

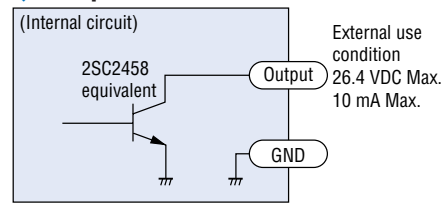


■ C-MOS type



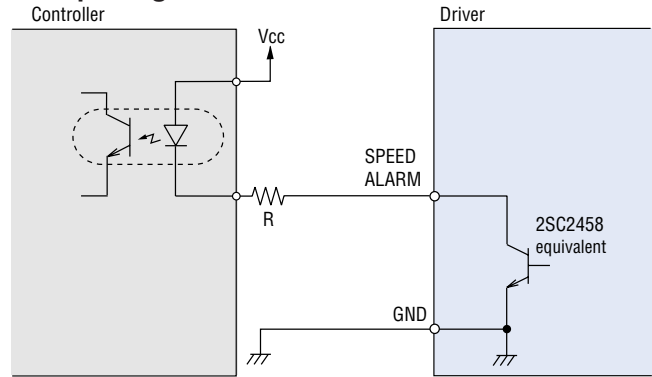
● Output Signal Circuit

◆ Output Circuit



◆ Example of Output Circuit Connection

· Output Signal Connections

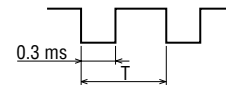


· SPEED Output

The system outputs pulse signals (with a width of 0.3 ms) at a rate of 30 pulses per rotation of the motor output shaft, synchronized with the motor drive. You can measure the SPEED output frequency and calculate the motor speed.

$$\text{Motor speed (r/min)} = \frac{\text{Speed output frequency [Hz]}}{30} \times 60 \text{ [r/min]}$$

$$\text{SPEED output frequency (Hz)} = \frac{1}{T}$$



· ALARM Output

The ALARM output is normally at the ON (L level) and switches to the OFF (H level) when there is an alarm.

· ALARM-RESET

When the motor is stopped, setting this signal to the ON (L level), then returning it to the OFF (H level) resets the alarm. Please return either the START/STOP input or the RUN/BRAKE input to the OFF (H level) before inputting the ALARM-RESET. The ALARM-RESET is not accepted if both these signals are at the ON (L level).

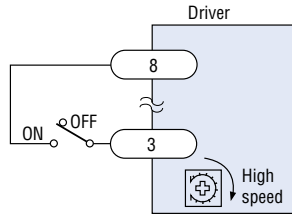
Notes:

- Output signal is open collector output, so an external power supply (Vcc) is required.
- Use a power supply of no more than 26.4 VDC and connect a limit resistance (R) so that the output current does not exceed 10 mA. When using neither the speed output function nor the alarm output function, this connection is not required.

● **Speed Setting Method**

◆ **Speed Control by Internal Potentiometer**

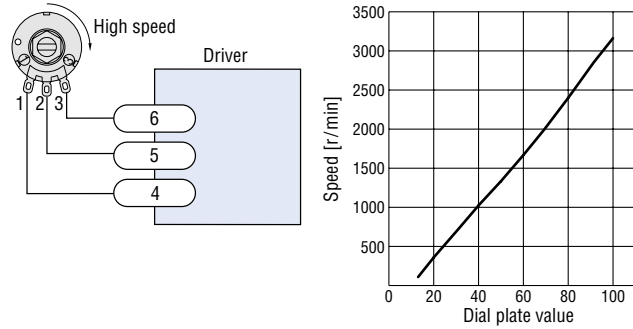
When INT.VR/EXT. input is set to the ON (L level), the speed can be set with the internal speed potentiometer. There is no need for this connection when the internal potentiometer is not used.



◆ **Speed Control by External Potentiometer**

When separating the motor speed setting from the driver, connect the optional external potentiometer as follows.

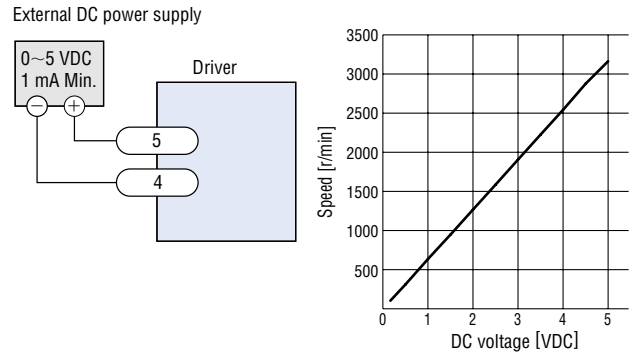
External speed potentiometer  
**PAVR-20KZ** (Sold separately)



External Potentiometer Scale – Speed Characteristics (Representative Values)

◆ **Speed Control by External DC Voltage**

When setting the motor speed with an external DC voltage, do so in the following manner.



DC Voltage – Speed Characteristics (Representative Values)

■ **Accessories (Sold Separately)**

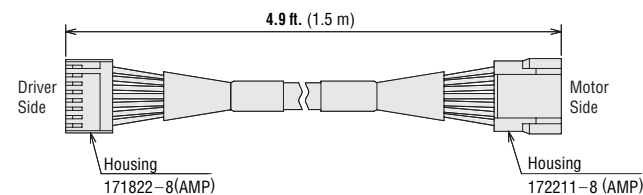
● **Extension Cable**

The maximum extended length is 6.6 ft. (2 m).

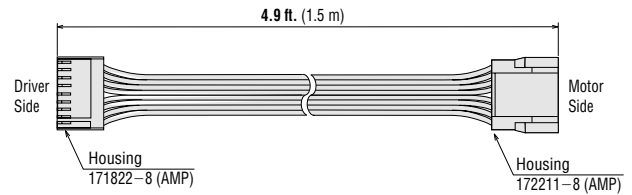
◆ **For 15 W, 30 W, 50 W**

Two types of cables are available. Covered lead wire type and ribbon cable type.

● **CC02AXH [4.9 ft. (1.5 m)]**



● **FC02HBL [4.9 ft. (1.5 m)]**



◆ **For 100 W**

● **CC02AXH2 [4.9 ft. (1.5 m)]**

