■Connection and Operation

●Names and Functions of Driver
◇15W (1/50HP) / 30W (1/25HP) / 50W (1/15HP)

◇100W (1/8HP)

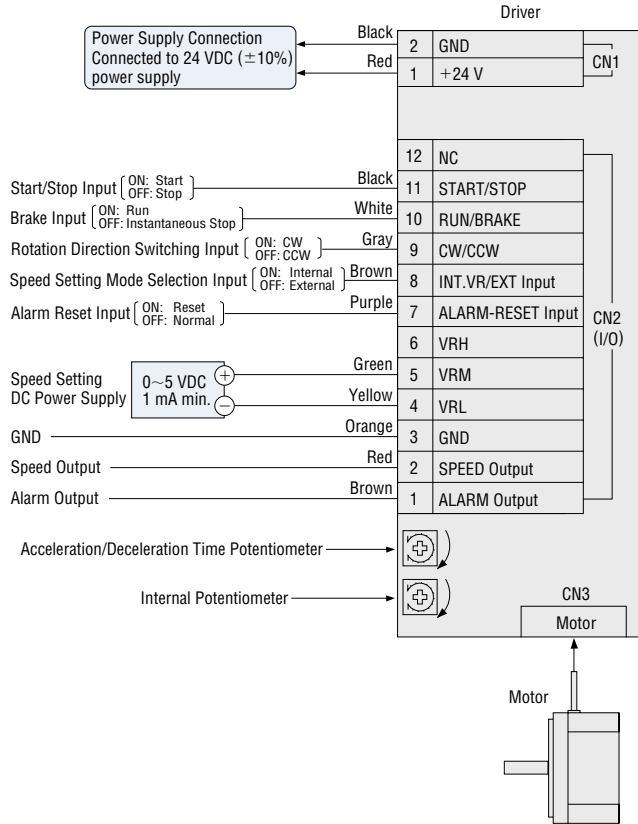Motor Connector

Power Supply Connector

2 1

Power Supply Connector 2 1 Motor Connector
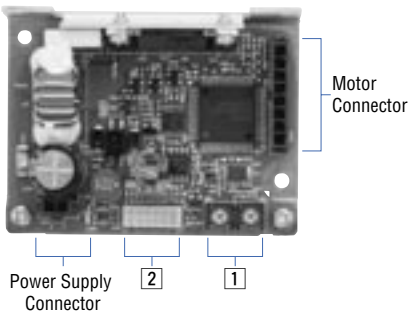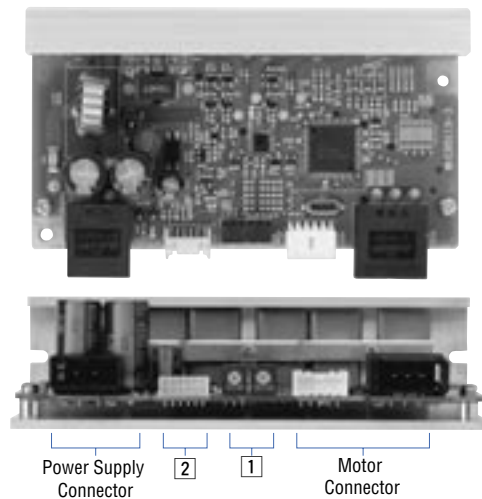
1 Speed Potentiometers

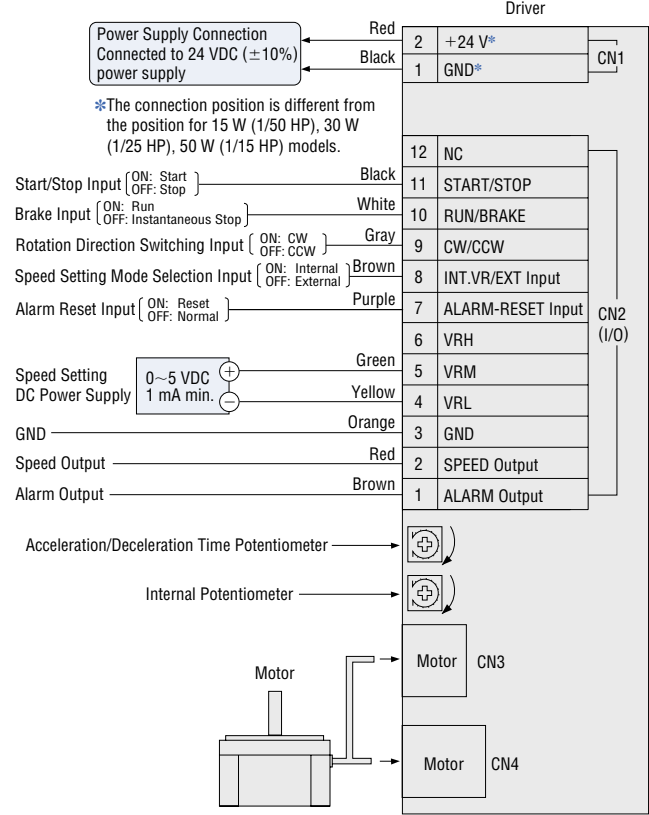| Display	Potentiometer Name	Function
VR1	Internal Potentiometer	Set and adjust the operating speed of the motor.
VR2	Acceleration/ Deceleration Time Potentiometer	Set a common acceleration/deceleration time in the range of 0.5 to 10 seconds.

2 Input and Output Signals

Display	Signal	Pin No.	Function
CN2	Output	1	ALARM Output
		2	SPEED Output
	I/O Signal Common	3	GND
	Analog Input	4	VRL Input
		5	VRM Input
		6	VRH Input
	Input	7	ALARM-RESET Input
		8	INT.VR/EXT Input
		9	CW/CCW Input
		10	RUN/BRAKE Input
		11	START/STOP Input
		12	NC

●Connection Diagrams

◇15W (1/50HP) / 30W (1/25HP) / 50W (1/15HP)

Driver

Power Supply Connection Connected to 24 VDC (±10%) power supply

Black	2	GND
Red	1	+24 V

CN1

	12	NC
Start/Stop Input [ON: Start / OFF: Stop] — Black	11	START/STOP
Brake Input [ON: Run / OFF: Instantaneous Stop] — White	10	RUN/BRAKE
Rotation Direction Switching Input [ON: CW / OFF: CCW] — Gray	9	CW/CCW
Speed Setting Mode Selection Input [ON: Internal / OFF: External] — Brown	8	INT.VR/EXT Input
Alarm Reset Input [ON: Reset / OFF: Normal] — Purple	7	ALARM-RESET Input
	6	VRH
Speed Setting DC Power Supply 0~5 VDC 1 mA min. — Green	5	VRM
Yellow	4	VRL
GND — Orange	3	GND
Speed Output — Red	2	SPEED Output
Alarm Output — Brown	1	ALARM Output

CN2 (I/O)

Acceleration/Deceleration Time Potentiometer

Internal Potentiometer

CN3 Motor

Motor

◇100W (1/8HP)

Driver

Power Supply Connection Connected to 24 VDC (±10%) power supply

Red	2	+24 V*
Black	1	GND*

CN1

*The connection position is different from the position for 15 W (1/50 HP), 30 W (1/25 HP), 50 W (1/15 HP) models.

	12	NC
Start/Stop Input [ON: Start / OFF: Stop] — Black	11	START/STOP
Brake Input [ON: Run / OFF: Instantaneous Stop] — White	10	RUN/BRAKE
Rotation Direction Switching Input [ON: CW / OFF: CCW] — Gray	9	CW/CCW
Speed Setting Mode Selection Input [ON: Internal / OFF: External] — Brown	8	INT.VR/EXT Input
Alarm Reset Input [ON: Reset / OFF: Normal] — Purple	7	ALARM-RESET Input
	6	VRH
Speed Setting DC Power Supply 0~5 VDC 1 mA min. — Green	5	VRM
Yellow	4	VRL
GND — Orange	3	GND
Speed Output — Red	2	SPEED Output
Alarm Output — Brown	1	ALARM Output

CN2 (I/O)

Acceleration/Deceleration Time Potentiometer

Internal Potentiometer

Motor

Motor CN3

Motor CN4

●Timing Chart

●All operations of run/stop, instantaneous stop and rotation direction switching operations can 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, the motor rotates. The motor will accelerate over the time set by the acceleration/deceleration time potentiometer. During this time, if the CW/CCW signal is set to ON, the motor rotates clockwise as viewed from the shaft end from the motor; if the CW/CCW signal is set to OFF, the motor rotates in the counterclockwise direction.

●If the RUN/BRAKE signal is set to OFF while the START/STOP signal is ON, the motor stops instantaneously. If the START/STOP signal is set to OFF while the RUN/BRAKE signal is ON, the motor will stop with deceleration time set by the acceleration/deceleration time potentiometer.

●The duration of each input signal must be 10 msec or longer.

●Do not operate (turn ON/OFF) two or more input signals simultaneously. There must be a minimum interval of 10 msec before another input signal can be operated, after a previous input signal has been operated.

*1 At least 10 ms
*2 The direction applies to the motor alone. The specific direction will vary depending on the gear ratio.
*3 The motor will start/stop over the time set by the acceleration/deceleration time potentiometer.

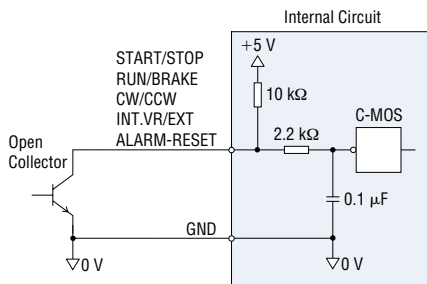## ●Input/Output Signal Circuits
◇Input Circuit
The driver's signal inputs use the C-MOS input method.
The signal status indicates a voltage level of 0 to 0.5 V when the signal is ON, or 4 to 5 V when it is OFF.
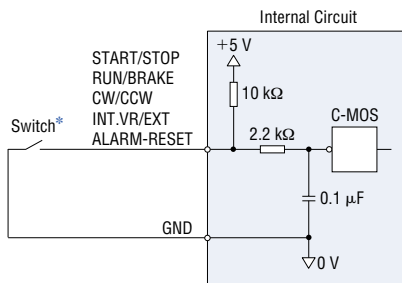
• 5V C-MOS output from controller
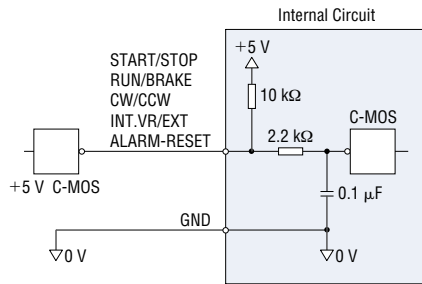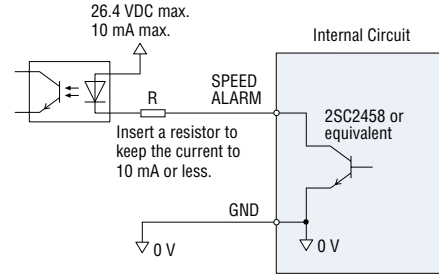

• Open collector output from controller

• Switch connection

∗Use a switch capable of opening/closing the current flow at 5 VDC, 1 mA maximum.

◇Output Circuit

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

$$\text{Motor Speed (r/min)} = \frac{\text{SPEED Output Frequency [Hz]}}{30} \times 60$$

$$\text{SPEED Output Frequency (Hz)} = \frac{1}{T}$$

◇ALARM Output
The ALARM output is normally ON and goes OFF when there is an alarm.

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

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 resistor (R) such 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
◇Internal Potentiometer

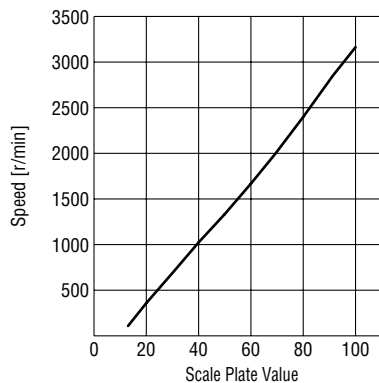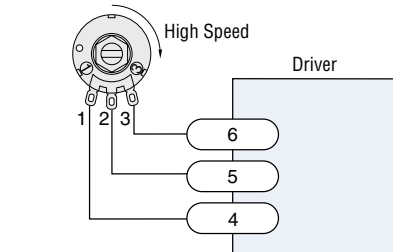When INT.VR/EXT input is set to ON, the speed can be set with the internal potentiometer.

There is no need for this connection when the internal potentiometer is not used.

Driver

8

ON   OFF

3

High
Speed
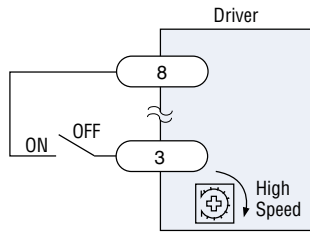
◇External Potentiometer (Sold Separately)

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

External Potentiometer **PAVR-20KZ** (Sold Separately)

High Speed

Driver

1 2 3

6

5

4

External Potentiometer Scale－Speed Characteristics
(Representative Values)

X-axis: Scale Plate Value (0, 20, 40, 60, 80, 100)
Y-axis: Speed [r/min] (500, 1000, 1500, 2000, 2500, 3000, 3500)

◇External DC Voltage

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

External DC Power Supply

0～5 VDC
1 mA min.

Driver

5

4

External DC Voltage－Speed Characteristics
(Representative Values)

X-axis: DC Voltage [VDC] (0, 1, 2, 3, 4, 5)
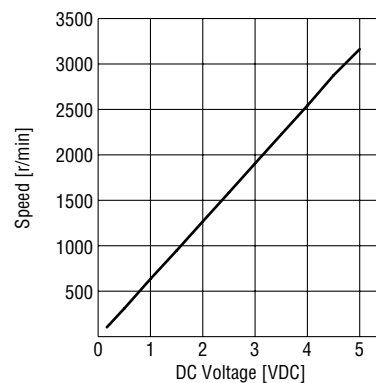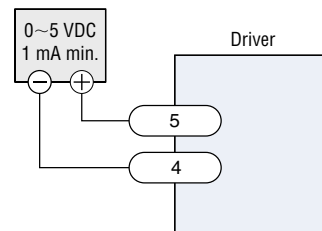Y-axis: Speed [r/min] (500, 1000, 1500, 2000, 2500, 3000, 3500)

Note:
●The speed in the graph represents the speed of a motor alone. The gearhead output shaft speed of the combination type or geared type is calculated by dividing the graph speed by the gear ratio.

Note:
●The speed in the graph represents the speed of a motor alone. The gearhead output shaft speed of the combination type or geared type is calculated by dividing the graph speed by the gear ratio.

●Multi-Motor Control

Two or more sets of motor and driver can be operated at the same speed by using a DC power supply or an external potentiometer.

◇When External DC Power Supply is Used

●Use a DC power supply with current capacity is equal to or greater than the value obtained by the following expression.

Current capacity (N is the number of drivers) I=1×N (mA)
Example: When two drivers are used, current capacity should be at least
2 mA.

●The lines for other input/output signals should be connected to each driver individually.
●Motor speed differences can be adjusted by connecting a resistor of 1.5 kΩ, 1/4 W to the M terminal of the first driver, and a 5 kΩ, 1/4 W variable resistor (VRn) to the M terminals of the other drivers.
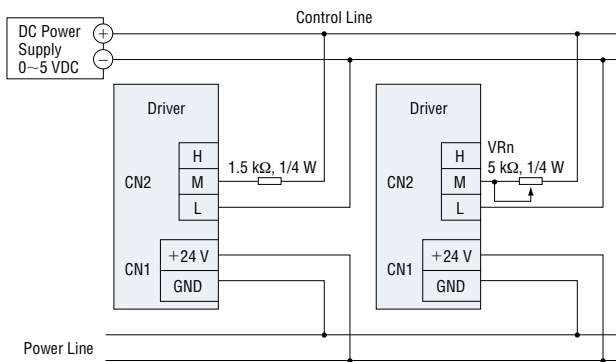
◇When External Potentiometer is Used

As shown below, make the power line and the speed control line common to set the speed at VRx.
●The required resistance of the external potentiometer is calculated by the following expression.

Resistance value (N is the number of drivers) VRx=20/N (kΩ), N/4 (W)
Example: When two drivers are used, the resistance is 10 kΩ, 1/2 W.

●Connect the other input/output lines to each driver individually.
●Motor speed differences can be adjusted by connecting a resistor of 1.5 kΩ, 1/4 W to the M terminal of the first driver, and a 5 kΩ, 1/4 W variable resistor (VRn) to the M terminals of the other drivers.
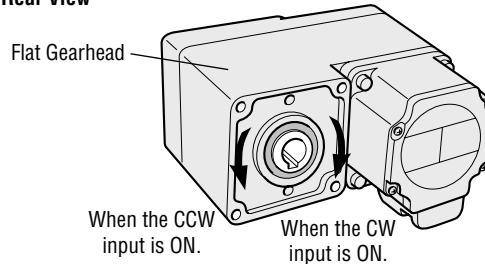●No more than five motors should be operated simultaneously when using the external potentiometer.
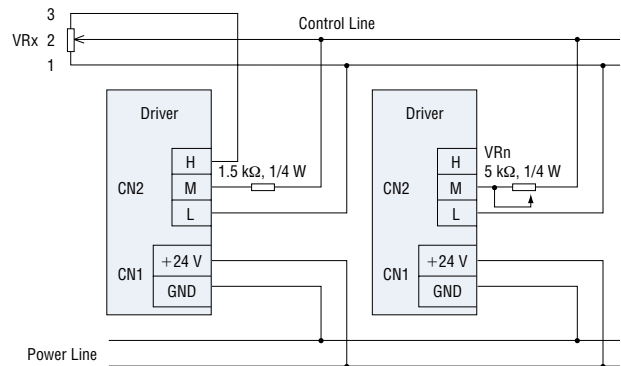
■Rotation Direction of the Hollow Shaft Flat Gearhead

The hollow shaft flat gearhead of the combination type rotates in the direction as shown below, with respect to the direction input from the driver.

Front View
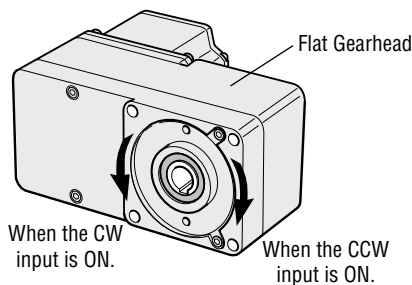
Rear View

# ■Installation of the Hollow Shaft Flat Gearhead

●Installing the Load Shaft

● Install the load shaft to the hollow output shaft by aligning the center of the hollow shaft with that of the load shaft.
● The hollow output shaft has a key slot. Machine a matching key slot on the load shaft and use the supplied key to affix the two shafts across the slots.
● The recommended tolerance of the load shaft is h7.
● If the motor is intended to receive large impacts due to frequent instantaneous stops or carry a large overhung load, use a stepped load shaft.

Notes:
● When installing the load shaft to the hollow output shaft, be careful not to damage the hollow output shaft or bearing.
● To prevent seizure, apply a coat of molybdenum disulfide grease on the exterior surface of the load shaft and interior surface of the hollow output shaft.
● Do not attempt to modify or machine the hollow output shaft. Doing so may damage the bearing and cause the hollow shaft flat gearhead to break.
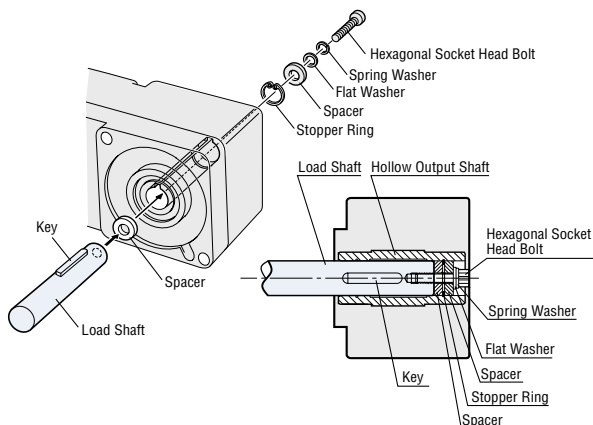
◇Stepped Load Shaft

Install a hexagonal socket head bolt over a stopper ring, spacer, flat washer and spring washer, and tighten the bolt to affix the load shaft.
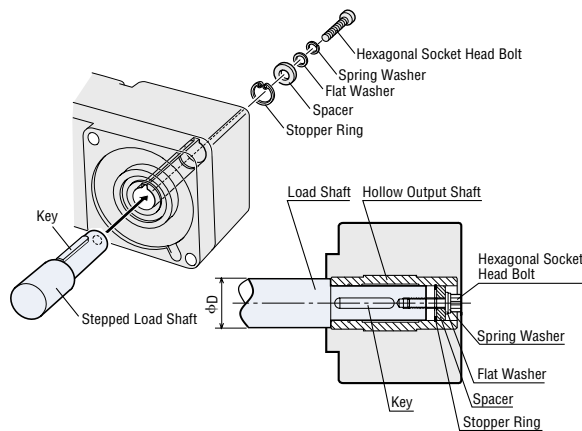
◇Straight Load Shaft

Install a hexagonal socket head bolt over a stopper ring, spacer, flat washer and spring washer, with a spacer also inserted underneath the load shaft, and tighten the bolt to affix the load shaft.

●Recommended Load Shaft Installation Dimensions
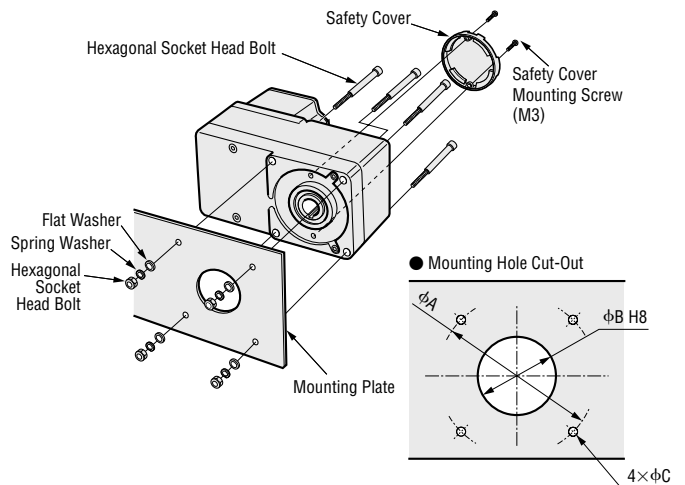
Unit = Upper value: mm/Lower value: inch

Model	BLH230	BLH450	BLH5100
Inner Diameter of Hollow Shaft (H8)	$\phi 12^{+0.027}_{0}$ $\phi 0.4724^{+0.0011}_{0}$	$\phi 15^{+0.027}_{0}$ $\phi 0.5906^{+0.0011}_{0}$	$\phi 20^{+0.033}_{0}$ $\phi 0.7874^{+0.0013}_{0}$
Recommended Tolerance of Load Shaft (h7)	$\phi 12^{0}_{-0.018}$ $\phi 0.4724^{0}_{-0.0007}$	$\phi 15^{0}_{-0.018}$ $\phi 0.5906^{0}_{-0.0007}$	$\phi 20^{0}_{-0.021}$ $\phi 0.7874^{0}_{-0.0008}$
Nominal Diameter of Stopper Ring	$\phi 12$, C-shaped $\phi 0.47$	$\phi 15$, C-shaped $\phi 0.59$	$\phi 20$, C-shaped $\phi 0.79$
Applicable Bolt	M4	M5	M6
Spacer Thickness✳	3 0.12	4 0.16	5 0.20
Outer Diameter of Step Part ϕD	20 0.79	25 0.98	30 1.18

✳Determine the spacer thickness in conformance with the table. If the spacer is thicker than the specified dimension, the bolt will project from the surface and interfere with the safety cover.
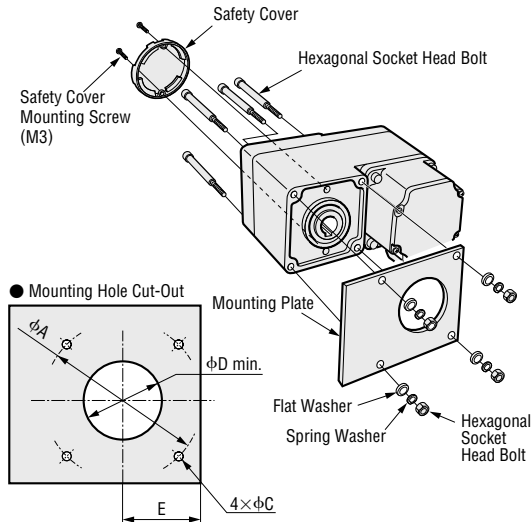
●Installing the Hollow Shaft
◇Installing from the Front Face

The output shaft boss (h8) can be used to align the shaft.

◇Installing from the Rear Face

Safety Cover
Hexagonal Socket Head Bolt
Safety Cover Mounting Screw (M3)

● Mounting Hole Cut-Out

Mounting Plate
Flat Washer
Spring Washer
Hexagonal Socket Head Bolt

φA
φD min.
E
4×φC

● Mounting Hole Dimensions

Unit = Upper value: mm/Lower value: inch

Model	BLH230	BLH450	BLH5100
Nominal Bolt Size	M5	M6	M8
φA	70 2.76	94 3.70	104 4.09
φB H8	$34^{+0.039}_{0}$ $1.34^{+0.0015}_{0}$	$38^{+0.039}_{0}$ $1.50^{+0.0015}_{0}$	$50^{+0.039}_{0}$ $1.97^{+0.0015}_{0}$
φC	5.5 0.217	6.5 0.256	8.5 0.335
φD	25 0.98	30 1.18	35 1.38
E	29 1.14	39 1.54	44 1.73

Note:

●When installing the hollow shaft flat gearhead from the rear face, provide dimension E to prevent the mounting plate from contacting the motor.

■List of Motor and Driver Combinations

●Geared Type

The geared type has an integrated motor and gearhead. The combination of motor and gearhead cannot be changed.

Output Power	Package Model	Geared Motor Model	Driver Model
15 W (1/50 HP)	**BLH015K-☐**	BLHM015K-☐	BLHD15K

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

●Combination Type–Parallel Shaft Gearhead

The combination type comes with the motor and parallel shaft gearhead already assembled.

Output Power	Package Model	Motor Model	Gearhead Model	Driver Model
30 W (1/25 HP)	**BLH230KC-☐**	BLHM230KC-GFS	GFS2G☐	BLHD30K
50 W (1/15 HP)	**BLH450KC-☐**	BLHM450KC-GFS	GFS4G☐	BLHD50K
100 W (1/8 HP)	**BLH5100KC-☐**	BLHM5100KC-GFS	GFS5G☐	BLHD100K

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

●Combination Type–Hollow Shaft Flat Gearhead

The combination type comes with the motor and hollow shaft flat gearhead already assembled.

Output Power	Package Model	Motor Model	Gearhead Model	Driver Model
30 W (1/25 HP)	**BLH230KC-☐FR**	BLHM230KC-GFS	GFS2G☐FR	BLHD30K
50 W (1/15 HP)	**BLH450KC-☐FR**	BLHM450KC-GFS	GFS4G☐FR	BLHD50K
100 W (1/8 HP)	**BLH5100KC-☐FR**	BLHM5100KC-GFS	GFS5G☐FR	BLHD100K

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

●Round Shaft Type

Output Power	Package Model	Motor Model	Driver Model
15 W (1/50 HP)	**BLH015K-A**	BLHM015K-A	BLHD15K
30 W (1/25 HP)	**BLH230KC-A**	BLHM230KC-A	BLHD30K
50 W (1/15 HP)	**BLH450KC-A**	BLHM450KC-A	BLHD50K
100 W (1/8 HP)	**BLH5100KC-A**	BLHM5100KC-A	BLHD100K

●Pinion Shaft Type

Output Power	Package Model	Motor Model	Driver Model
30 W (1/25 HP)	**BLH230KC-GFS**	BLHM230KC-GFS	BLHD30K
50 W (1/15 HP)	**BLH450KC-GFS**	BLHM450KC-GFS	BLHD50K
100 W (1/8 HP)	**BLH5100KC-GFS**	BLHM5100KC-GFS	BLHD100K