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# Brushless Motors AC Speed Control Motors



# Brushless Motors/AC Speed Control Motors

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	DC Input	<b>BLU</b> Series ..... D-114	BLU
		<b>BLH</b> Series ..... D-132	BLH
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This catalog contains information necessary for informed product selection. Additional product details and information not outlined in this catalog can be found in each product's individual operating manual. Operating manuals can be downloaded from our website or obtained by contacting technical support or your nearest Oriental Motor sales office.

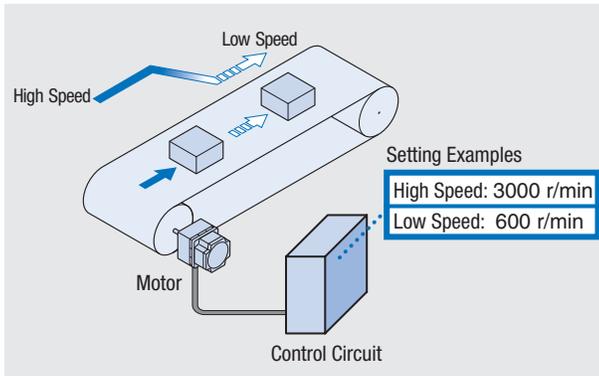
# Overview of Brushless Motors and AC Speed Control Motors

Brushless Motors and AC Speed Control Motors are motors that allow for the speed to be changed. There are two types of Oriental Motor speed control motors including brushless motors and AC speed control motors.

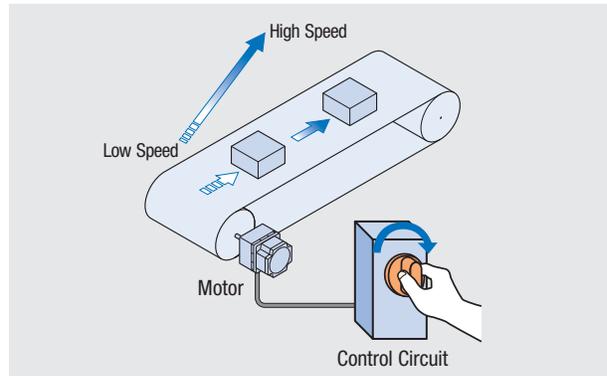
## Overview and Features

### ● Motors that Allow for Speed Changes

By combining a control circuit with the motor, speed changes can be performed. These motors are optimal for switching between high speed and low speed operation and for arbitrary adjustment of speed.



Setting multiple speeds and switching speeds



Arbitrarily adjusting the speed

### ● Product Line

The speed control motors are divided into two groups of products.

#### Brushless Motors



To understand the structure and features of speed control motors in detail

Overview of Brushless Motors  
→ Page D-4

To select the optimal model for the purpose and application

Speed Control Motors Selection Guide  
→ Page D-9

To compare the specifications and functions of each model

Product Line of Brushless Motors  
→ Page D-12

#### AC Speed Control Motors



Overview of AC Speed Control Motors  
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Product Line of AC Speed Control Motors  
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## Product Line-up of Brushless Motors and AC Speed Control Motors

We have grouped two speed control motor product lines based on function and characteristic differences. Use these as a reference for selecting the product group. Refer to the overview page for characteristics and other details.

Brushless Motors and AC Speed Control Motors Selection Guide [Page D-9](#)

Characteristics

### Brushless Motors



**BLU Series**

AC Input
20 W (1/38 HP)/ 40 W (1/19 HP)/ 90 W (1/8 HP)



**BLH Series**

DC Input
15 W (1/50 HP)/30 W (1/25 HP)/ 50 W (1/15 HP)/100 W (1/8 HP)



**BLE Series**

AC Input
30 W (1/25 HP)/ 60 W (1/12 HP)/ 120 W (1/6 HP)



**BLV Series**

DC Input
200 W (1/4 HP)/ 400 W (1/2 HP)



**BLF Series**

AC Input
30 W (1/25 HP)/ 60 W (1/12 HP)/ 120 W (1/6 HP)/ 200 W (1/4 HP)/ 400 W (1/2 HP)

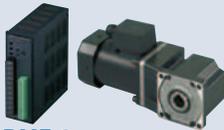


**BX Series**

AC Input
30 W (1/25 HP)/ 60 W (1/12 HP)/ 120 W (1/6 HP)/ 200 W (1/4 HP)/ 400 W (1/2 HP)

Mounted encoder  
● Position control/torque limiting (when using a control module)

### AC Speed Control Motors



**BHF Series**

200 W (1/4 HP)



**FE100/FE200**

6 W (1/125 HP)~200 W (1/4 HP)



**US Series**

6 W (1/125 HP)~90 W (1/8 HP)



**ES01/ES02**

6 W (1/125 HP)~60 W (1/12 HP)

Function

Product Group	Brushless Motors		AC Speed Control Motors									
Page	▶ Page D-11		▶ Page D-153									
Overview	These products include permanent magnets in the motor's rotor and a built-in hall IC in the stator for speed detection. Speed is controlled through a driver by using feedback signals from the motor. <a href="#">Overview details ▶ Page D-4</a>		● <b>BHF Series, FE100/FE200</b> These products are used in combination with three-phase induction motors. Speed is controlled by controlling the frequency and voltage. <a href="#">Overview details ▶ Page D-6</a>									
Series	<table border="1"> <tr> <th>AC Input</th> <th>DC Input</th> </tr> <tr> <td><b>BX Series</b> <b>BLF Series</b> <b>BLE Series</b> <b>BLU Series</b></td> <td><b>BLH Series</b> <b>BLV Series</b></td> </tr> </table>	AC Input	DC Input	<b>BX Series</b> <b>BLF Series</b> <b>BLE Series</b> <b>BLU Series</b>	<b>BLH Series</b> <b>BLV Series</b>	<table border="1"> <tr> <th>AC Input</th> </tr> <tr> <td><b>BHF Series</b> <b>FE100/FE200*</b></td> </tr> </table>	AC Input	<b>BHF Series</b> <b>FE100/FE200*</b>	<table border="1"> <tr> <th>AC Input</th> </tr> <tr> <td><b>ES01/ES02*</b> <b>US Series</b></td> </tr> </table>	AC Input	<b>ES01/ES02*</b> <b>US Series</b>	<a href="#">Overview details ▶ Page D-7</a>
AC Input	DC Input											
<b>BX Series</b> <b>BLF Series</b> <b>BLE Series</b> <b>BLU Series</b>	<b>BLH Series</b> <b>BLV Series</b>											
AC Input												
<b>BHF Series</b> <b>FE100/FE200*</b>												
AC Input												
<b>ES01/ES02*</b> <b>US Series</b>												

\*Motor sold separately

# Brushless Motors

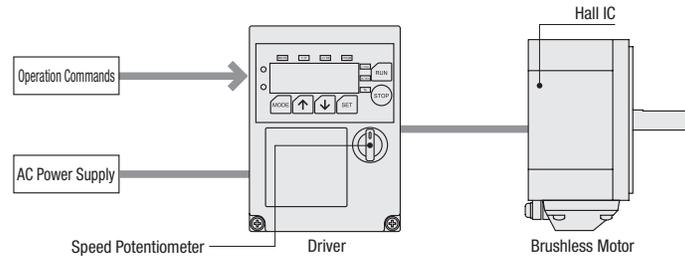
## Overview of Brushless Motors

With brushless motors, there is no brush and commutator, which is an advantage of Brushless Motors.

DC Brush motors rotate by means of a brush and commutator, so maintenance for these parts must be performed regularly. However, brushless motors rotate using signals detected by a hall IC (magnetic sensor), which means they are maintenance-free.

### System Configuration

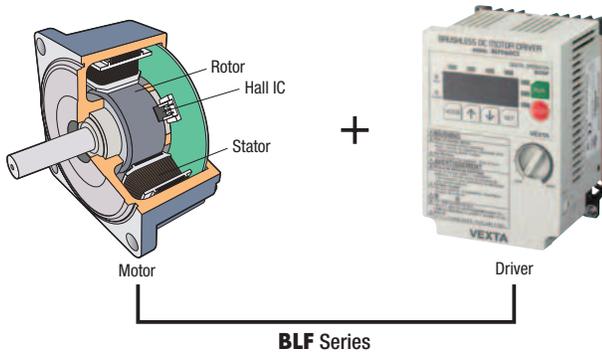
Driving is performed by a motor equipped with a built-in hall IC for detecting speed that is combined with a driver (control circuit). The motor speed is set using a speed potentiometer, external DC voltage or a control module.



### Structure

Brushless motors use permanent magnets in the rotor of three-phase motors. In addition, on the inside of the stator, there is a built-in hall IC (magnetic sensor) that detects magnetic field changes with the permanent magnets.

The feedback signals from the hall IC of the motor are compared with the setting speed by the driver and the motor speed is adjusted.

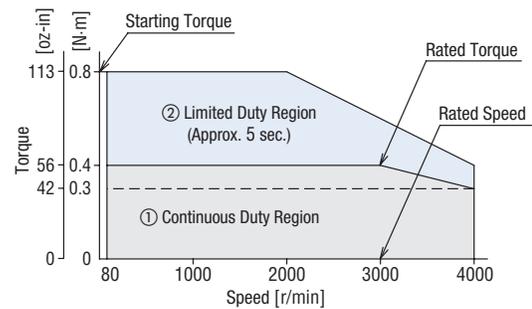


### Speed – Torque Characteristics

Brushless motors can operate continuously with a constant torque from low speed to rated speed. In addition, if within the rated torque, these motors rotate at a stable speed even when the load size changes.

With brushless motors, there is a continuous duty region (①) where continuous duty is possible and a limited duty region (②). The limited duty region can be used for acceleration torque when starting an inertial load.

If operation continues for five seconds or more in this region, the overload protective function activates and the motor is stopped.

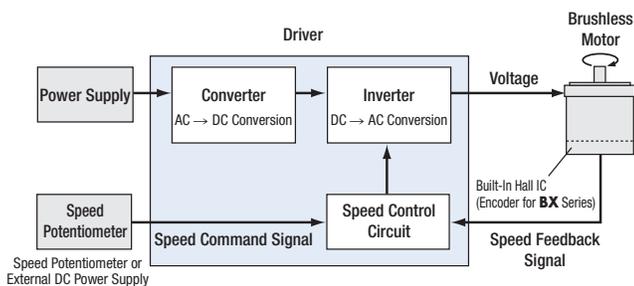


BLF Series 120 W (1/6 HP)

### Control Block Diagram

The speed feedback signal from the built-in hall IC in the motor is compared with the speed command signal set with a speed potentiometer or other devices in the driver.

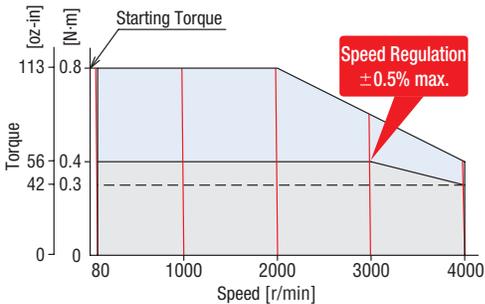
The comparison result is sent to the inverter. The inverter adjusts the voltage applied to the motor and controls the motor speed.



## Features of Brushless Motors

### ● Excellent Speed Stability

Brushless motors compare the setting speed with the speed feedback signals from the motor at all times and adjust the motor's applied voltage. For this reason, even if the load changes, stable rotation is performed from low speed to high speed. With inverter-controlled (V/F control) three-phase induction motors, feedback control is not performed, so the speed will drop significantly when the load increases. Brushless motors are recommended for applications where speed stability is important.



**BLF Series 120 W (1/6 HP)**

Speed regulation (load) for each model is as shown below. The level to which the speed changes when the load changes from 0 to rated torque is shown.

Series Name	Speed Regulation with Respect to the Load	
	Speed Regulation	Condition
<b>BX</b> Series	±0.05%	0~Rated Torque At rated speed
<b>BLF</b> Series	±0.2%	
<b>BLE</b> Series	±0.5%	
<b>BLU</b> Series	±0.5%	
<b>BLH</b> Series	±0.5%	
<b>BLV</b> Series	±0.5%	

### ● Wide Speed Control Range

Brushless motors have a wider speed control range than AC speed control motors and inverters.

Unlike AC speed control motors, the torque at low speed is not limited, so brushless motors are suited to applications that require a constant torque from low speed to high speed.

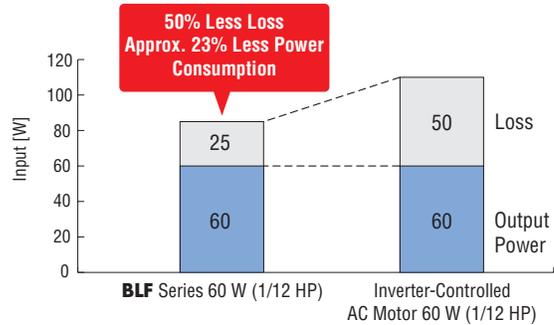
Product Group	Speed Control Range*	Speed Ratio
Brushless Motors (For <b>BLF</b> Series)	80~4000 r/min	50:1
Inverter-Controlled Three-Phase Induction Motors	200~2400 r/min	12:1
AC Speed Control Motors	50 Hz: 90~1400 r/min	15:1
	60 Hz: 90~1600 r/min	17:1

\*The speed control range varies depending on the model.

### ● Contributes to Energy Savings

Brushless motors, which incorporate permanent magnets in the rotor, generate little secondary loss from the rotor. This allows for power consumption to be reduced by approximately 23% compared with inverter-controlled three-phase induction motors\*. This contributes to energy savings.

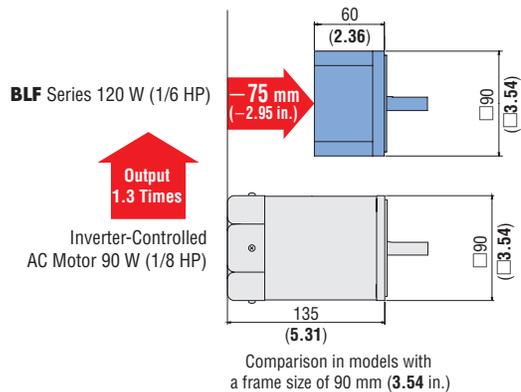
\*When output power is 60 W (1/12 HP)



### ● Compact yet Powerful

Brushless motors have slim bodies and provide high power due to permanent magnets being used in the rotor. For example, the overall length is 75 mm (2.95 in.) shorter and the output power is 1.3 times higher than that of three-phase induction motors with a frame size of 90 mm (3.54 in.).

Using brushless motors can contribute to downsizing.



### ● Protective Functions and Alarm Output

These motors are equipped with various protective functions including the overload protective function and overvoltage protective function. An alarm is output if a protective function activates.

### ● Conforms to Major Safety Standards



Each brushless DC motor series consists of models conforming to the UL, CSA and EN Standards and that also affix the CE Marking.

# AC Speed Control Motors

## Overview of BHF Series and FE100/FE200

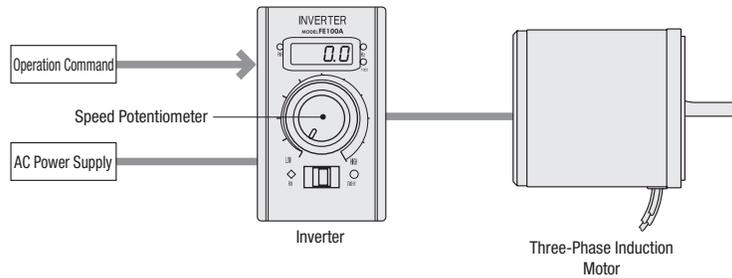
Inverters are control circuits that control the power supply frequency and voltage applied to three-phase induction motors in order to control speed. By setting the optimal settings for a motor from Oriental Motor, its torque is guaranteed when an inverter is combined with a motor from Oriental Motor.

### System Configuration

Driving is performed with an inverter combined with a constant speed three-phase induction motor.

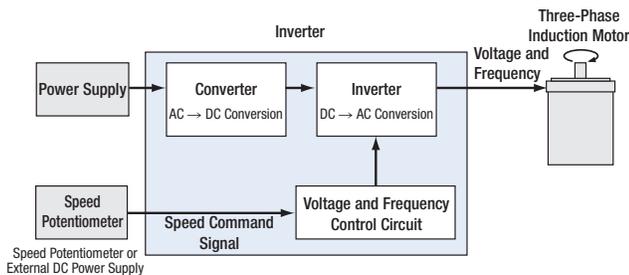
The motor does not contain speed detection or feedback functions.

The motor speed is set by using a speed potentiometer or external DC voltage.



### Control Block Diagram

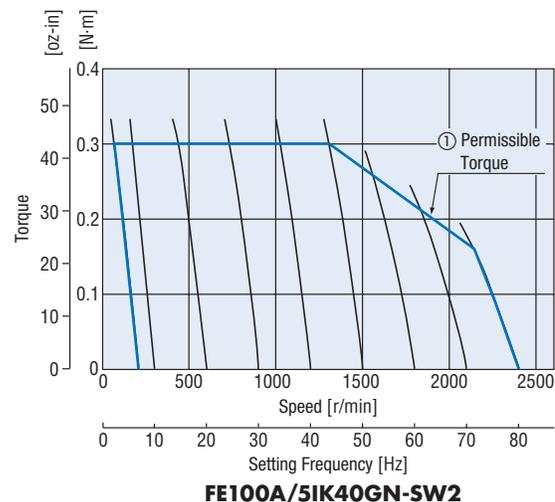
The inverter changes the voltage and frequency supplied to the motor in accordance with the speed command set with the speed potentiometer or other device in order to control the speed.



### Speed – Torque Characteristics

Since inverters do not perform speed feedback control, if the load torque changes in relation to the setting speed, the speed will also change.

Motors can be used continuously in the range below the permissible torque line (①) limited by the motor temperature rise.



## Features of BHF Series and FE100/FE200

### Requires No Parameter Setting

Optimal settings are established in accordance with each of the output characteristics of Oriental Motor three-phase induction motors. For this reason, immediate use without any difficult parameter settings, is possible.

### Maximized Motor Performance

Motor performance can be maximized over a wide speed control range from low speed to high speed.

In addition, torque during continuous use is guaranteed.

### Easy Speed Control for Three-Phase Motor

Now, it is easy to change the speed of a three-phase motor by using components designed for simplicity and guaranteed performance.

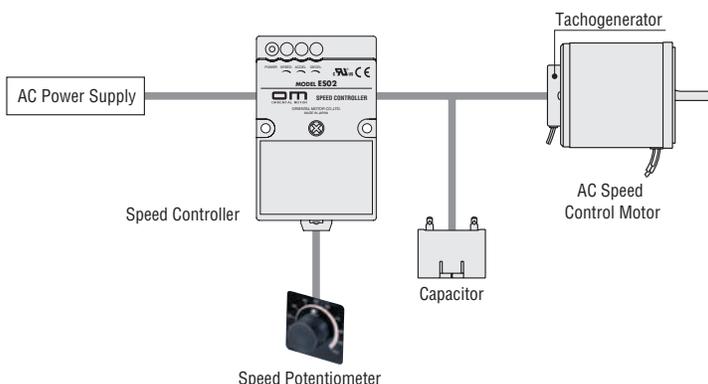
## Overview of ES01/ES02 and US Series

AC speed control motors are motors that include an induction motor or reversible motor equipped with a tachogenerator (AC generator) for speed detection. By combining these motors with a dedicated control circuit (speed controller), speed changes can be performed. A broad lineup of AC motors that can easily be used for speed control is available.

### System Configuration

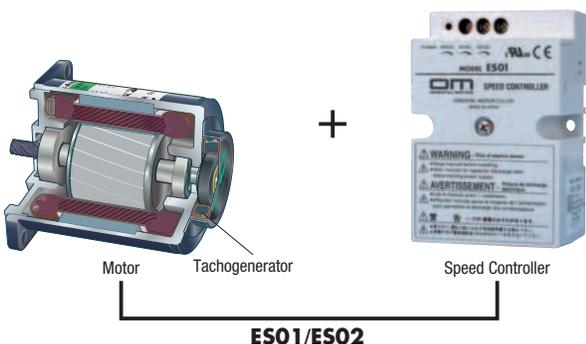
Driving is performed by a motor equipped with a tachogenerator (AC generator) for speed detection combined with a speed controller (control circuit).

The motor speed is set using a speed potentiometer or external DC voltage.



### Structure

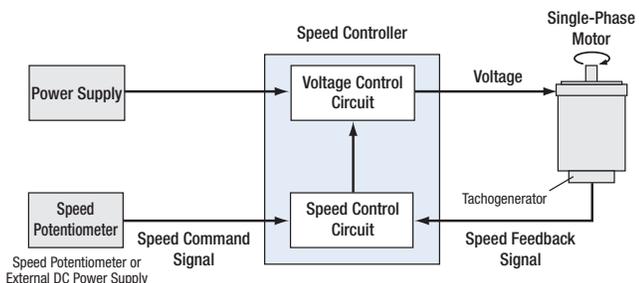
AC speed control motors are equipped with a tachogenerator (AC generator) on the back of the motor. The feedback signals from the tachogenerator are compared with the setting speed with the speed controller and the motor speed is adjusted.



### Control Block Diagram

The speed feedback signals from the tachogenerator assembled in the motor are compared with the speed command signal set with a speed potentiometer or other device in the speed controller.

The comparison result is sent to the voltage control circuit. The voltage control circuit adjusts the voltage applied to the motor and controls the motor speed.

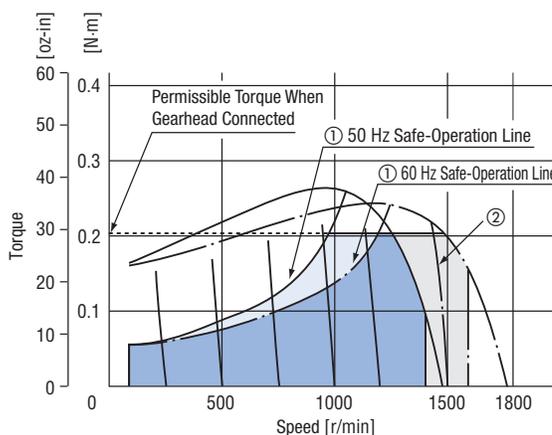


### Speed – Torque Characteristics

With AC speed control motors, rated operation\* is possible if operation is in the range below the safe-operation line (①) shown in the figure below.

If the load torque changes in relation to the speed set, the motor speed will also change. The speed change related to each setting speed is shown with the vertical lines (②) in the characteristics diagram.

\*Induction motors have a continuous rating and reversible motors have a 30 minute rating.

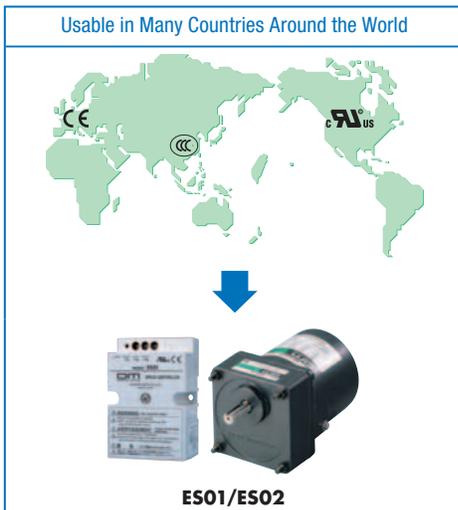
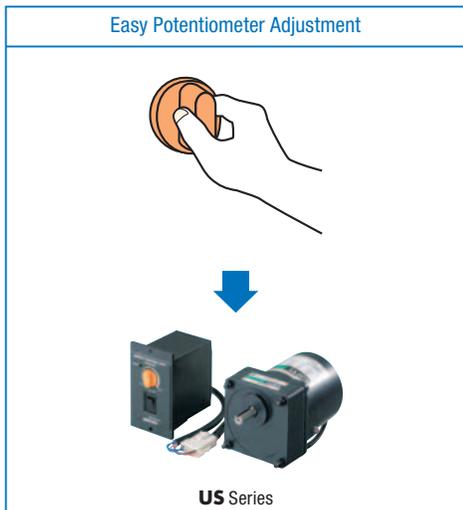


AC Speed Control Motors 25 W (1/30 HP)

## Features of US Series and ES01/ES02

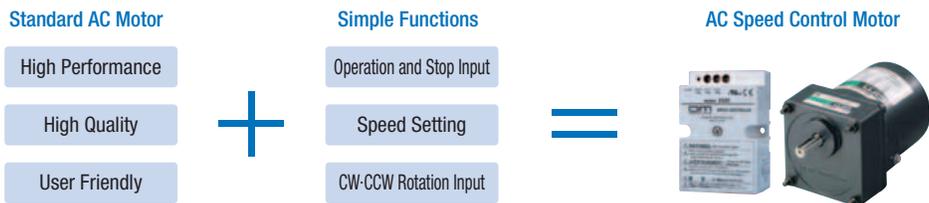
### ● Extensive Lineup

With the **US Series**, speed can easily be changed just by connecting to a power supply and performing adjustment with a potentiometer. In addition, the **US Series** and **ES01/ES02** feature an extensive motor lineup for use with various applications, conform to safety standards and support power supply voltages used in many countries around the world.



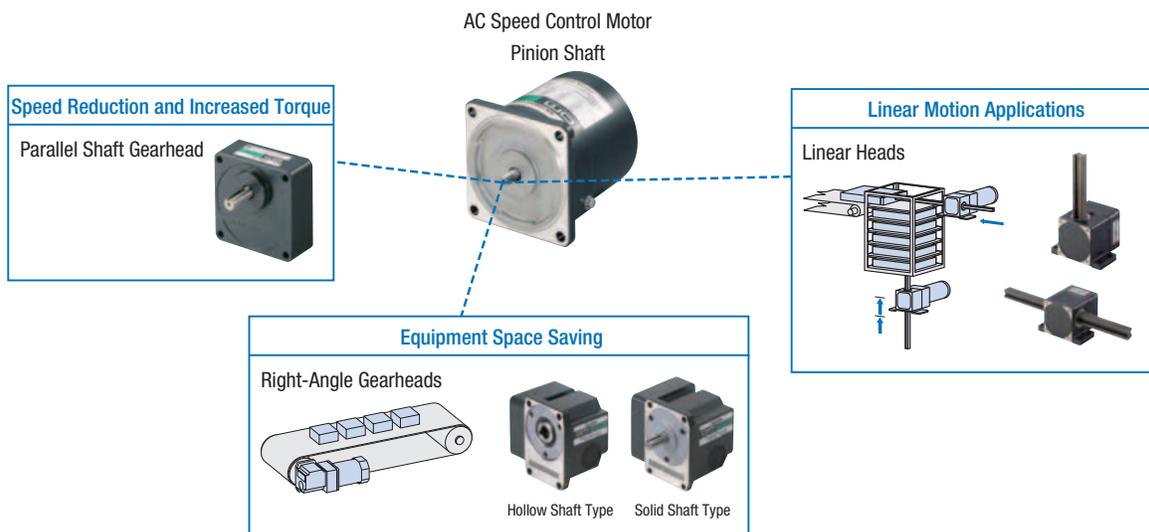
### ● Simple and Easy to Use Functions

Standard AC motors have won extensive loyalty for many years for their performance and quality as well as ease of use. AC speed control motors retain performance, quality, ease of use and are equipped with the functions necessary for speed control.



### ● Various Combinations are Available

A pinion shaft type motor can be combined with a right-angle gearhead or linear head in addition to a parallel shaft gearhead. When space saving is desired, it is convenient to use right-angle gearheads, and when linear motion is required, linear heads are suitable. Through various combinations, speed control is possible in a wide variety of applications.



## Brushless Motors and AC Speed Control Motors Selection Guide

The speed control range and performance varies and depend on the model.

This section explains the main selection points to consider in order to select an optimal model based on the characteristics and functions required in accordance with the purpose and application.

### Selection by Speed Control Range and Speed Regulation

The speed control ranges and speed regulation shown below apply to the motor only.

Gearheads are available for each model, enabling you to use them for speed reduction. For details, refer to the page where each product is listed.

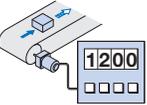
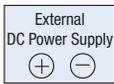
Series Name	Page	Speed Control Range (r/min)					Speed Ratio	Speed Regulation with Respect to Load		
		0	1000	2000	3000	4000		Condition		
Brushless Motors	<b>BX Series</b>	D-18	30 (3)*~3000 r/min					100:1 (1000:1)*	±0.05%	
	<b>BLF Series</b>	D-60	80~4000 r/min					50:1	±0.2%	
	<b>BLE Series</b>	D-84	100 (80)*~4000 r/min					40:1 (50:1)*	±0.5% (±0.2%)*	
	<b>BLU Series</b>	D-114	100~2000 r/min					20:1	±0.5%	
	<b>BLH Series</b>	D-132	100~3000 r/min					30:1	±0.5%	
	<b>BLV Series</b>	D-148	100 (80)*~4000 r/min					40:1 (50:1)*	±0.5% (±0.2%)*	
AC Speed Control Motors	<b>BHF Series</b>	D-160	100~2400 r/min					24:1	±3%	
	<b>FE100/FE200</b>	D-178	200~2400 r/min					12:1	-10% (Reference Value)	
	<b>ES01/ES02</b>	D-192	50 Hz: 90~1400 r/min					50 Hz: 15:1 60 Hz: 17:1	-5% (Reference Value)	
	<b>US Series</b>	D-222	60 Hz: 90~1600 r/min							

\*Specifications values for when digital setting is performed using a control module (sold separately).

### Selection by Output Power and Frame Size

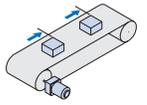
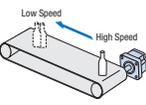
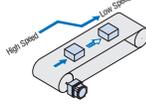
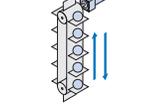
Series Name	Page	Output Power								
		Frame Size 42 mm (1.65 in.)	Frame Size 60 mm (2.36 in.)	Frame Size 70 mm (2.76 in.)	Frame Size 80 mm (3.15 in.)	Frame Size 90 mm (3.54 in.)		Frame Size 104 mm (4.09 in.)		
Brushless Motors	<b>BX Series</b>	D-18		30 W (1/25 HP)		60 W (1/12 HP)	120 W (1/6 HP)		200 W (1/4 HP)	400 W (1/2 HP)
	<b>BLF Series</b>	D-60		30 W (1/25 HP)		60 W (1/12 HP)	120 W (1/6 HP)		200 W (1/4 HP)	400 W (1/2 HP)
	<b>BLE Series</b>	D-84		30 W (1/25 HP)		60 W (1/12 HP)	120 W (1/6 HP)			
	<b>BLU Series</b>	D-114		20 W (1/38 HP)		40 W (1/19 HP)	90 W (1/8 HP)			
	<b>BLH Series</b>	D-132	15 W (1/50 HP)	30 W (1/25 HP)		50 W (1/15 HP)	100 W (1/8 HP)			
	<b>BLV Series</b>	D-148							200 W (1/4 HP)	400 W (1/2 HP)
AC Speed Control Motors	<b>BHF Series</b>	D-160							200 W (1/4 HP)	
	<b>FE100/FE200</b>	D-178		6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)	200 W (1/4 HP)
	<b>ES01/ES02</b>	D-192		6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)		
	<b>US Series</b>	D-222		6 W (1/125 HP)	15 W (1/50 HP)	25 W (1/30 HP)	40 W (1/19 HP)	60 W (1/12 HP)	90 W (1/8 HP)	

Selection by Speed Setting Methods

Series Name	Page	Speed Setting Methods					
		Potentiometer setting			Digital Setting	External DC Voltage	
		Internal Speed Potentiometer	External Speed Potentiometer	Built-in Potentiometer			
							
Brushless Motors	<b>BX Series</b>	D-18	●	●		●*	●
	<b>BLF Series</b>	D-60		●	●	●	●
	<b>BLE Series</b>	D-84	●	●		●*	●
	<b>BLU Series</b>	D-114			●		
	<b>BLH Series</b>	D-132	●	●			●
	<b>BLV Series</b>	D-148	●	●		●*	●
AC Speed Control Motors	<b>BHF Series</b>	D-160	●	●			●
	<b>FE100/FE200</b>	D-178			●		●
	<b>ES01/ES02</b>	D-192	●	●			
	<b>US Series</b>	D-222			●		

\*Possible when a control module (sold separately) is used.

Selection Based on Functions

Series Name	Page	Function Comparison						
		For displaying the speed	For stopping the motor quickly	For softening shock during starting and stopping	For operation at multiple speeds	To change motor speed in vertical operation	To use alarm output	
		Digital Speed Indicator	Instantaneous Stop	Acceleration and Deceleration Operation	Multi-Speed Operation	Load Holding/Gravitational Operation	Alarm Output	
								
Brushless Motors	<b>BX Series</b>	D-18	●*1	●	●	2 Speeds (8 speeds*1)	● Electromagnetic Brake Type	●
	<b>BLF Series</b>	D-60	●	●	●	8 Speeds		●
	<b>BLE Series</b>	D-84	●*2	●	●	2 Speeds (8 speeds*1)	● Electromagnetic Brake Type	●
	<b>BLU Series</b>	D-114	<b>SDM496</b>	●	●			●
	<b>BLH Series</b>	D-132	<b>SDM496</b>	●	●	2 Speeds (Internal/External switching)		●
	<b>BLV Series</b>	D-148	●*2	●	●	2 Speeds (8 speeds*1)	● Electromagnetic Brake Type	●
AC Speed Control Motors	<b>BHF Series</b>	D-160	<b>SDM496</b>	●*3	●	2 Speeds (Internal/External switching)	● Electromagnetic Brake Type	●
	<b>FE100/FE200</b>	D-178	●	●*3	●			●
	<b>ES01/ES02</b>	D-192	<b>SDM496</b>	●	●	2 Speeds (Internal/External switching)		
	<b>US Series</b>	D-222	<b>SDM496</b>					

\*1 Possible when a control module (sold separately) is used.

\*2 Possible when a control module (sold separately) or a speed indicator (sold separately) is used.

\*3 Although the instantaneous stop function is not available, the deceleration time can be set to as short as 0.1 seconds.

**SDM496**: Possible when a speed indicator (**SDM496**, sold separately) is used.