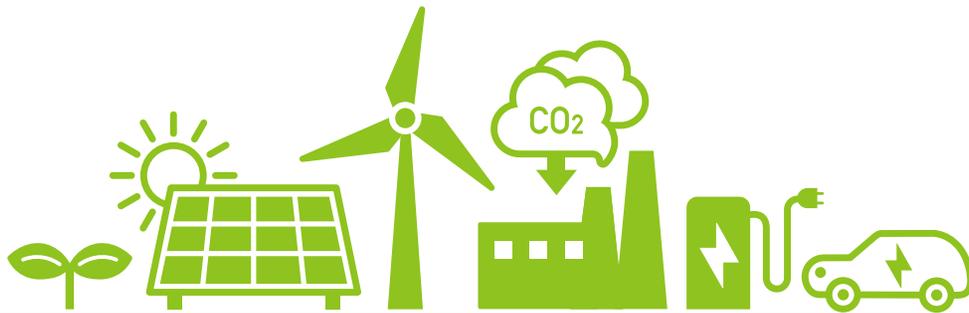


# Guide to Carbon Neutrality: Getting Started

Environmental considerations related to automation are attracting more attention  
as major nations announce carbon neutrality policies.

Here are Oriental Motor products and services with hints about how to start  
efforts to achieve carbon neutrality.



# Starting with Energy Saving Motors

## Reducing CO<sub>2</sub> Emissions with Brushless Motors

Using an energy saving motor in transport, agitation, winding, and other forms of speed regulation can reduce CO<sub>2</sub> emissions by lowering the power consumption. Brushless motors are small, high-efficiency speed control motors with an on-board sensor and a dedicated circuit (driver) that performs feedback control.

### The Effects of Using a Brushless Motor

Annual Power Consumption (Compared at 60 W output)

	Power Consumption (kWh/year)	CO <sub>2</sub> Emissions [kg/year (lb/year)]	Electricity Costs (USD/year)
AC Motors	439.2	228 (503)	53.64
<b>Brushless Motor</b>	<b>273.6</b>	<b>142 (313)</b>	<b>33.41</b>

• Calculated at 12 hours of drive time per day, 300 operating days per year, a power-CO<sub>2</sub> emissions conversion coefficient of 0.519 kg-CO<sub>2</sub>/kWh (1.144 lb-CO<sub>2</sub>/kWh), and electric utility rate of 0.12 USD/kWh

[AC Motor] Output 60 W, single-phase 200 V, 60 Hz  
[Brushless Motor] **BMU** Series, output 60 W

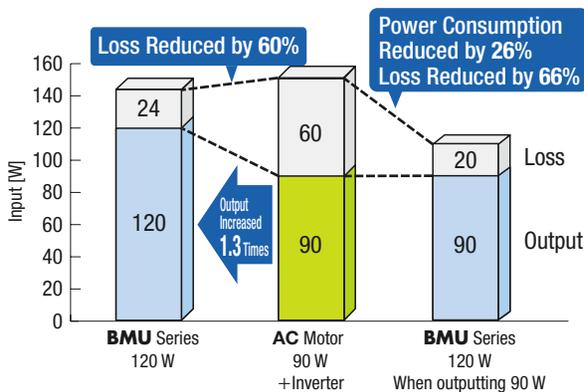


**Power Consumption** Reduced by **165 kWh/year**

**CO<sub>2</sub> Emissions** Reduced by **86 kg/year (190 lb/year), or 37%**

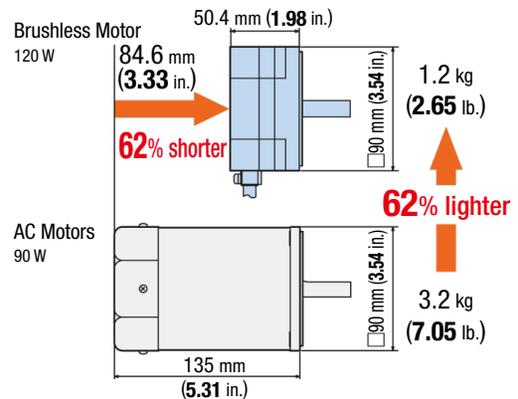
### High Efficiency

Brushless motors with a built-in permanent magnet are more efficient than three-phase (induction motor) inverter control.



### Fewer Natural Resources

Brushless motors are slim and high-power. This contributes to downsizing and a reduction in natural resources.



Easy-to-Use  
**BMU** Series (AC Input)



Advanced Performance  
**BLE2** Series (AC Input)



Compact Board Type Driver  
**BLH** Series (DC Input)



Battery Operated  
**BLV** Series R-Type (DC Input)

# Starting with Control Cabinets

## Reduced Power Consumption with Low-Power Consumption Axial Flow Fans

Cooling fans offer adequate ventilation and air flow for the forced-air cooling of control cabinet heat sources. The **EMU** Series of EC fan achieves reduced power consumption through the use of a built-in brushless motor. With a long expected life of 60,000 hours, approximately 2.2 times longer than the conventional product, this also means fewer natural resources are consumed.

### The Effects of Using the EMU Series

Annual Power Consumption (Compared at a frame size of 120 mm)

	Power Consumption (kWh/year)	CO <sub>2</sub> Emissions [kg/year (lb/year)]	Electricity Costs (USD/year)
Conventional Product	49.9	22.6 (49.8)	7.88
<b>EMU Series</b>	<b>16.9</b>	<b>7.6 (16.8)</b>	<b>2.66</b>

• Calculated at 16 hours of drive time per day, 240 operating days per year, a power-CO<sub>2</sub> emissions conversion coefficient of 0.453 kg-CO<sub>2</sub>/kWh (1.00 lb-CO<sub>2</sub>/kWh), and electric utility rate of 0.16 USD/kWh

• Comparison of **EMU1238** and **MU1238A-11B**



EC Fan  
**EMU Series**

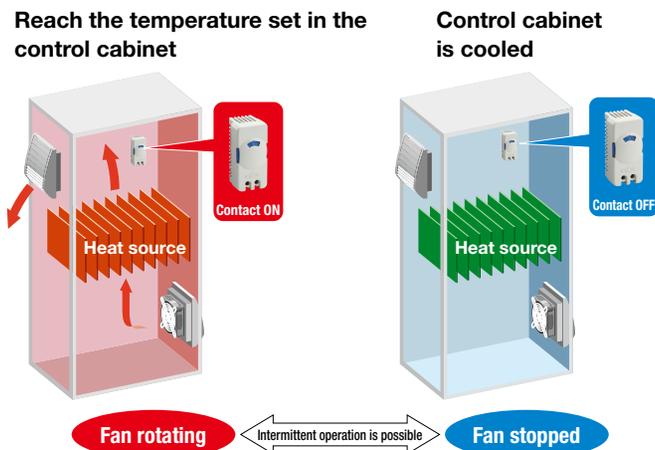
**Power Consumption** Reduced by **33 kWh/year**

**CO<sub>2</sub> Emissions** Reduced by **15 kg/year (33 lb/year)**, or approximately **66%**

## Use of a Thermostat to Cool Only When Necessary

By combining the cooling fan that is already in the control cabinet with a thermostat, cooling becomes more efficient. This will stop the cooling fan when the enclosure is already cool, reducing the power consumption from the fan.

### The Effects of Using a Thermostat



Annual Power Consumption (Compared at a frame size of 120 mm)

	Power Consumption (kWh/year)	CO <sub>2</sub> Emissions [kg/year (lb/year)]	Electricity Costs (USD/year)
Cooling fan on its own	51.8	23.5 (55.8)	8.18
<b>When using a thermostat</b>	<b>22.8</b>	<b>10.3 (22.7)</b>	<b>3.60</b>

• Calculated at 16 hours of drive time per day, 240 operating days per year, a power-CO<sub>2</sub> emissions conversion coefficient of 0.453 kg-CO<sub>2</sub>/kWh (1.00 lb-CO<sub>2</sub>/kWh), and electric utility rate of 0.16 USD/kWh



Fan Thermostat  
**AM2-XA1**

#### <Application Example>

- Potentiometer setting (operating temperature of thermostat) 40°C
- Cooling fan **MU1428S-11** × 1 (140 mm–28 mm thick cooling fan)
- Control cabinet size W:470×H:470×D:160 mm (18.5×18.5×6.30 in.)
- Heat generation of heat source 200 W

**Power Consumption** Reduced by **29 kWh/year**

**CO<sub>2</sub> Emissions** Reduced by **13 kg/year (28.7 lb/year)**, or approximately **44%**

# New Equipment Design Considerations

## The Electrification of Air Cylinders

Oriental Motor has the *αSTEP* product line, featuring the **AZ** Series offering linear & rotary actuators that support the electrification and improved efficiency of air cylinder applications. The **AZ** Series not only performs speed control with high positioning accuracy, but can also control the motor's generated torque to meet the desired value (push-motion operation, etc.).

### The **AZ** Series that Supports a Variety of Mechanisms and Operations

Compact Electric Cylinders  
**DR Series**



Compact Electric Cylinders  
**DRS2 Series**



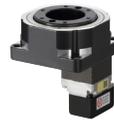
Electric Cylinders  
**EAC Series**



Rack-and-pinion Systems  
**L Series**



Hollow Rotary Actuators  
**DG2 Series**



Electric Grippers  
**EH Series**



### Standardized Control of Various Operations

There is a full product line of drivers that are compatible with the various factory automation (FA) networks. Linear & rotary actuators with an on-board **AZ** series controller allow for control driver standardization and collective monitoring in equipment with network-compatible products.



EtherNet/IP

PROFINET

SSCNET III/H  
SERVO SYSTEM CONTROLLER NETWORK

Modbus(RTU)

MECHATROLINK

CC-Link

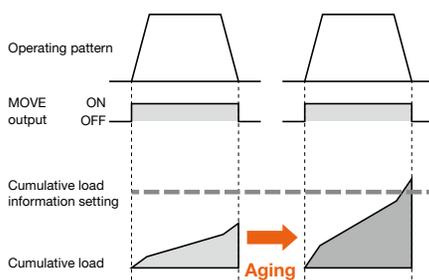
EtherCAT

### Increased Operating Ratio and Monitoring

The use of monitoring and information functions in network-compatible products increases the operating ratio of the equipment. This reduces the amount of wasted electricity caused by unexpected equipment stoppages, and also decreases a plant's total power consumption.

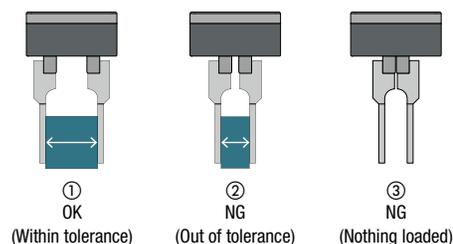
#### Example) Cumulative load monitoring

With the **AZ** Series, the cumulative load monitor allows the load factor of the motor to be grasped in terms of area and detected as a value. This is convenient when long-term changes in load due to deterioration over time or other factors need to be understood.



#### Example) Using a monitor for two simultaneous operations

Air cylinders need a sensor to determine the size of the load. The **EH** Series with on-board **AZ** Series uses the motor's encoder information to both identify and determine dimensions at the same time.



# Compact and Lightweight Equipment

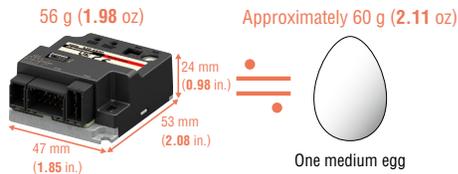
Oriental Motor has a wide range of products that can help make equipment and robots smaller and lighter. More compact, lighter equipment means lower motor output, resulting in less power consumption.

## Achieving Compact and Lightweight Equipment with the Latest Drivers



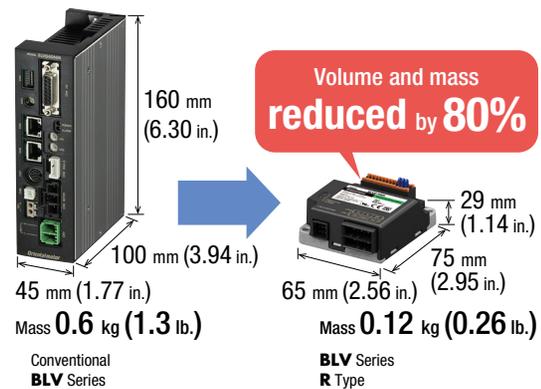
Built-in Battery-free Absolute Sensor  
**AlphaSTEP AZ Series mini Driver**  
 Modular Automation-compatible Product

The **AZ** Series not only performs speed control with high positioning accuracy, but can also control the motor's generated torque to a desired value (push-motion operation, etc.). The **AZ** Series **mini** drivers have a compact design to allow mounting in tight spaces, and can be directly installed onto equipment with two screws.




Brushless Motor  
**BLV Series R Type**  
 Modular Automation-compatible Products

The **BLV** Series of brushless motors have excellent speed control. Both the motor and driver are now much smaller and lighter in the **R** type. It fits into limited spaces within equipment. Power consumption can also be monitored.



## Modular Automation Compatible Products

Modular automation compatible products are a group of products with the shared concepts of being small, lightweight, and battery-operated. They are optimal for self-propelled equipment and mobile facilities, and can help achieve flexible automation lines and mobile automation, which are seeing a growing demand.

### Modular Automation Compatible Products have the Necessary Elements for Achieving Flexible Automation Equipment

- Automatically transport items without the use of a fixed conveyor.
- Configure a production line with modularized compact & lightweight equipment.
- Broaden the movement range without the need to run AC power supply lines.

The necessary elements  
**Battery Operated/DC Input**  
**Lightweight & Compact**

Oriental Motor  
**Modular Automation Compatible Products** may have the solution.



Usage Example

# Product Use Considerations

## Reduced Power Consumption with a High-torque Stepper Motor

Effectively using a high-torque motor can reduce power consumption by allowing for a smaller motor to be used or reducing the energy / current needed to perform the work. After revising the magnetic design and structure design of the **PKP** Series of stepper motors, it produces a significant amount of torque over that of conventional products of the same size. In addition, torque can be increased in the high-speed range by using bi-polar wound motors that efficiently use the full motor windings.



Stepper Motors  
**PKP Series (2-phase/5-phase)**

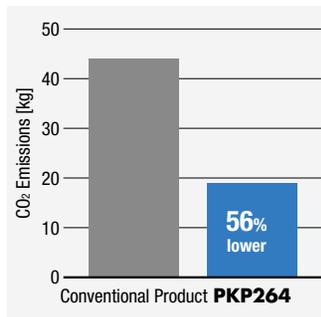
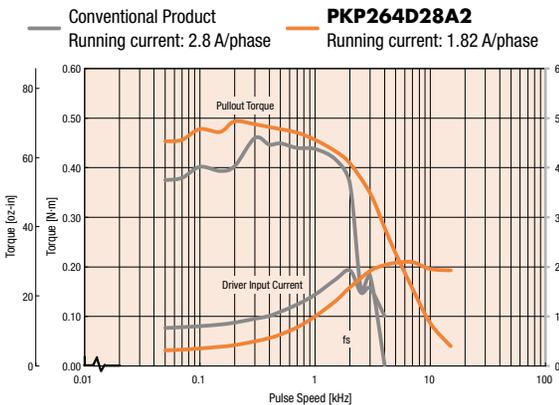
There are also drivers that can maximize the performance of the **PKP** Series.

Bipolar Driver for 2-phase Stepper Motor  
Driver for 5-phase Stepper Motor  
**CVD Series**

### The Effects of Using the PKP Series

#### Comparison of Speed-Torque Characteristics and CO<sub>2</sub> Emissions

The high torque of the **PKP** Series can be utilized to achieve a running current with the same torque as a conventional product to reduce CO<sub>2</sub> emissions.



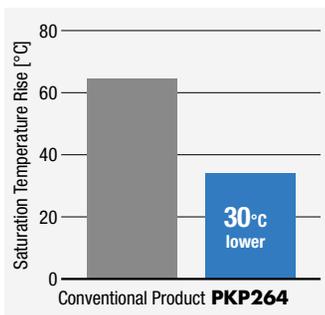
Speed	0.1 kHz (30 r/min)
Load Torque	No load
Operating time	24 hours a day, 365 days a year
Operation conditions	50% operating, 50% standby
Power Supply Voltage	24 VDC
CO <sub>2</sub> Coefficient	0.519 kg-CO <sub>2</sub> /kWh (1.144 lb-CO <sub>2</sub> /kWh)

• Comparison of **PK264D28A** and **PKP264D28A2**

**CO<sub>2</sub> Emissions** Up to **56% lower**

#### Comparison of Motor Temperature Rise

Temperature rise in the motor can be suppressed by lowering the running current in the **PKP** Series. This increases the life of the motor.



	Saturation Temperature Rise [°C (°F)]
Conventional Product	64.6 (148.3)
<b>PKP264D28A2</b>	<b>34.2 (93.6)</b>

**Temperature Rise** **30°C (55°F) lower**

# Choosing the Optimal Product

## Select the best motor when aiming for carbon neutrality by using Oriental Motor's Sizing and Selection Services

Using a motor that is over-specification can consume more power than necessary. Oriental Motor provides various sizing and selection services that can cut down the time and labor needed to select the right motor.

### Online Motor Sizing Tool

Oriental Motor offers a free online motor sizing tool. Simply type in your specifications including load, inertia and other required specification and the tool will calculate your required motor specifications. From this, select the desired motor. If you like the experts at Oriental Motor to confirm, review or complete the motor size and motor recommendation, email us your specification or results from the sizing tool.

#### 1. Select the Application Type

#### 2. Use the Calculate button to Provide Sizing Results

(Results can be downloaded and saved for future reference)

#### 3. Select Motor (or) Email your results to our Sizing Team

(Visit our Product Series Pages on our website to determine the motor type and part number or email your specifications to us and let us size a motor for you.)

The screenshot shows the Oriental Motor website's online motor sizing tool. The header includes the Oriental Motor logo and navigation links for Products, Motor Sizing, Downloads, Applications, and Technology. A search bar is present with options for 'Exact Match' and 'Keyword Search'. Below the search bar, there are links for various motor types: Stepper Motors, Servo Motors, AC Motors & Gear Motors, Brushless DC Motors, Linear Actuators, Rotary Actuators, Network Products, and Cooling Fans. A banner for 'FREE SHIPPING FOR ONLINE ORDERS' is displayed. The main content area is titled 'Motor Sizing Tools' and includes a description of the tool's purpose and contact information. A 'Select an Application' section features a grid of application types with corresponding illustrations: Ball / Lead Screw, Index Table, Belt Actuator, Belt Conveyor, Arm, Rotary Device, Door / Gate, and AGV - Automatic Guided Vehicle. On the right side, there is a 'We're Here to Help' section with a contact icon, a 'Contact Us' button, and business hours information: Monday to Friday, 8:30am EST to 5:00pm PST. Sales & Customer Service is available at 1-800-418-7903, and Technical Support is available at 1-800-GO-VEXTA (468-3982).

### Let us Help you Size the Proper Motor for you

Our Technical Support team is available from 7:30 am cst to 5:00 pst to assist you with selecting the proper motor to help you reduce your energy needs and become more carbon neutral. Simply ask our team for assistance in your Carbon Neutrality goals.

#### Technical Support

Tel: (800) 468-3982 / 8:30 A.M. to 5:00 P.M., P.S.T. (M-F)  
7:30 A.M. to 5:00 P.M., C.S.T. (M-F)

E-mail: [techsupport@orientalmotor.com](mailto:techsupport@orientalmotor.com)

Obtain Specifications, Online Training  
and Purchase Products at:  
[www.orientalmotor.com](http://www.orientalmotor.com)

# Optimal Products to Select From



## Brushless Motor BMU Series

Compact, high power and a high efficiency brushless motor and controller equipped with a digital display panel and settings dial for simple operation. Easy wiring by connecting the motor and driver.

- Output 30~400 W



## Brushless Motor BLV Series R Type

### Modular Automation Compatible Product

Capable of low speed operation from 1r/min, offering smooth motion, both the motor and driver are now much smaller and lighter. This contributes to the development of more compact battery-operated devices. Compatible with Modbus (RTU) and CANopen communication.

- Output: 100 W, 200 W
- Input type: 24~48 VDC



## EC Fans EMU Series

Reduced power consumption through the use of a built-in brushless motor. With support for a wide voltage range, the fans can use single-phase 100-240 VAC (50/60 Hz).

- Frame sizes 92 mm, 120 mm



## Built-in Battery-free Absolute Sensor

### $\alpha$ STEP AZ Series mini Driver

### Modular Automation Compatible Product

Featuring RS-485 communication, the **AZ** Series mini driver is smaller and lighter than traditional box-type drivers. The mini driver can also be battery-operated and drives our full line of **AZ** Series motors and linear or rotary actuators.

- Input type: 24~48 VDC



## Compact Electric Cylinders DR Series

These compact electric cylinders with a frame size of either 20 mm or 28 mm have an integrated  $\alpha$ STEP and ball screw to achieve linear motion.



## Stepper Motors PKP Series

A broad range of frame size are offered for the **PKP** series, from 20 mm to 85 mm. Select the motor that best meets the design specifications.

Specifications are subject to change without notice. This catalog was published in May, 2022.

## ORIENTAL MOTOR U.S.A. CORP.

### Western Sales and Customer Service Center

Tel: (310) 715-3301 Fax: (310) 225-2594

#### Los Angeles

Tel: (310) 715-3301

#### San Jose

Tel: (408) 392-9735

### Midwest Sales and Customer Service Center

Tel: (847) 871-5900 Fax: (847) 472-2623

#### Chicago

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Tel: (781) 848-2426 Fax: (781) 848-2617

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Tel: (973) 359-1100

### Technical Support

Tel: (800) 468-3982 / 8:30 A.M. to 5:00 P.M., P.S.T. (M-F)  
7:30 A.M. to 5:00 P.M., C.S.T. (M-F)

E-mail: [techsupport@orientalmotor.com](mailto:techsupport@orientalmotor.com)

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[www.orientalmotor.com](http://www.orientalmotor.com)