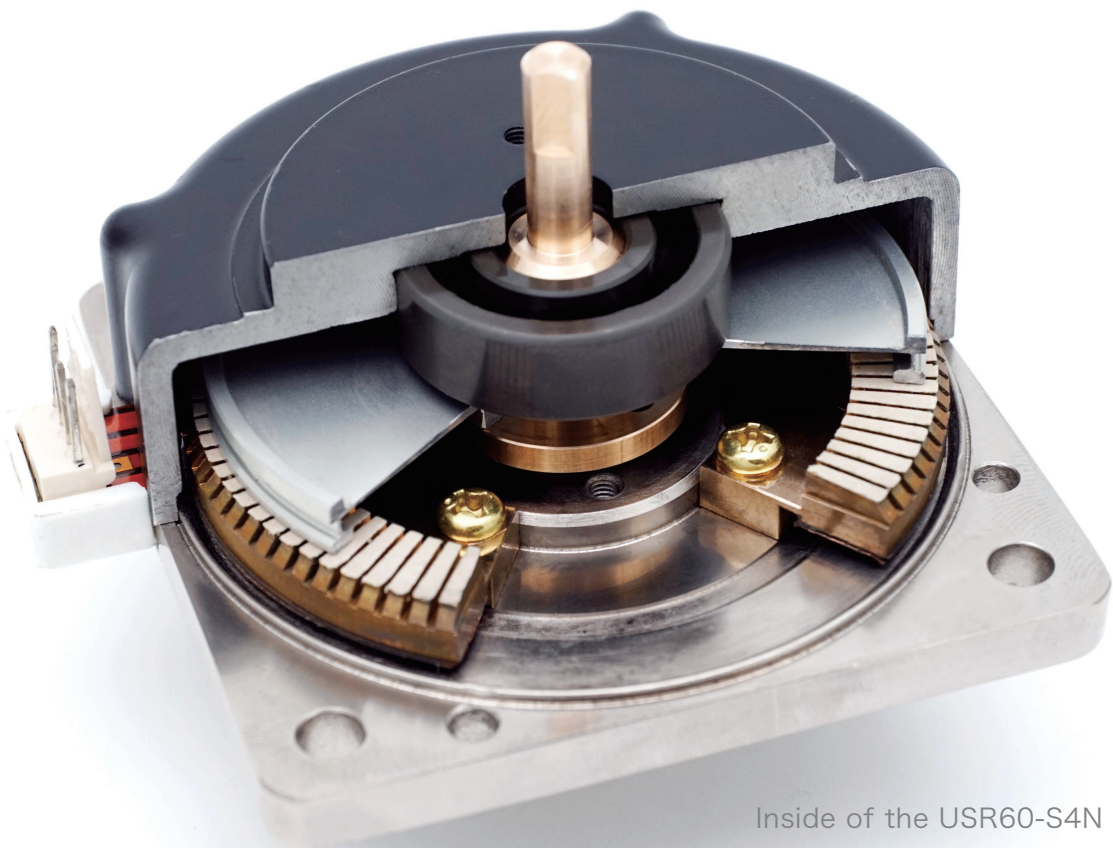


# Ultrasonic Motor

超音波モータ

## General Catalog



Inside of the USR60-S4N



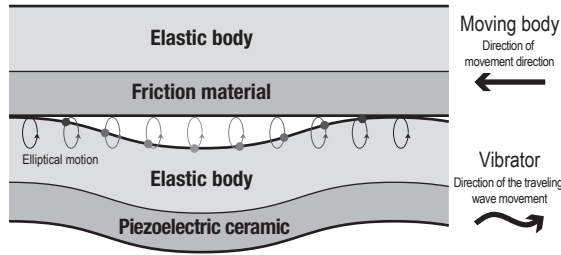
**SHINSEI Corporation**

## About Ultrasonic Motor

### What Is Ultrasonic Motor?

The ultrasonic motor does not use electromagnetic action, which is the driving principle of electromagnetic motor. It transforms back-and-forth motion from elastic vibration on the ultrasonic band of the oscillating body into one-way motion with frictional force. It is the actuator that transports the moving body.

### Traveling Wave Direction Ultrasonic Motor



An oscillating body (stator) is structured by pasting together piezoelectric ceramic with an elastic body, such as metal. It is set up by pressure contact moving body (rotor) on the oscillating body using spring or similar method. At that time, wear-proof friction material is structured on the surface of the oscillating or moving body to reduce wear.

Two sets of drive electrodes are formed on the piezoelectric ceramic and when prescribed phase-difference AC voltage is applied, the traveling wave of flexural vibration is driven on an oscillating body, and points on oscillating body surface travels in an elliptical orbit movement. The moving body comes into contact only at the wave crest of the traveling wave, and travels in the opposite direction of the traveling wave due to friction drive.

### Characteristics of Ultrasonic Motor

① <b>Low speed, high torque</b>	High torque is obtained at a low speed allowing for direct drive of the motor.
② <b>Self-holding</b>	Maintains high holding power even with the power off, requiring no electromagnetic brake to maintain position.
③ <b>High responsivity, High controllability</b>	Possesses high responsivity and high controllability due to small moment of inertia of rotor and controlling power due to motor friction.
④ <b>Non-magnetic</b>	Not affected by magnets because frictional force is the driving principle, the equipment can be safely used in a high magnetic field environment of higher than 3[T].
⑤ <b>Downsizing and Lightening</b>	Small and light because of its simple structure.
⑥ <b>Quietness</b>	Compared to combination of general electromagnetic motor with decelerator, equipment operates with minimal noise of about 20[dB].

### Example of Practical Use and Application of Ultrasonic Motor

The ultrasonic motor is used for the following applications making use of its features.

	Responsivity	Coarse and fine movement	Hollowness	Low noise	Holding power	High torque	Non-magnetic
① Camera platforms, gimbals	○	○	○				
② Stage rotating mechanism		○			○		○
③ Robot arm finger				△	△	△	
④ Main body and peripheral equipment for MRI magnetic resonance imaging devices							○
⑤ Hands for surgical robots in MRI' s				△	△	△	△
⑥ Surgical microscopes				○	○		
⑦ Paleomagnetic measurement devices							○
⑧ Electronic microscope							○

## Precautions



### Precautions for Use

- ① **Avoid putting excessive load or inertial load on the motor as much as possible.**  
Excess or inertial load may shorten motor life due to stator and rotor abrasion.
- ② **Do not place thrust load on the output shaft of the motor.**  
Doing so may cause property degradation of the motor.
- ③ **Do not place rotation force above the holding torque from outside when motor is stopped.**  
Doing so may damage the motor.
- ④ **The motor output shaft has a g6 dimensional tolerance.**  
Avoid fitting with indentation or driving into a counter hole.
- ⑤ **Ensure sufficient heat dissipation to hold motor case temperature to below 55 °C.**
- ⑥ **When using or storing the motor, ensure that humidity around the device is below 45%.**
- ⑦ **Motor is adjusted in the set of driver and cable.**  
Readjust driver when changing combination or cable length.
- ⑧ **Use driver power source with sufficient power capacity.**

### The Field Ultrasonic Motor is Less Compatible

The ultrasonic motor has many advantages over the electromagnetic motor. Taking advantage of its merits, it is being used for many purposes. High holding power is a merit when using the brake; however, it is a demerit when using during free state with power off. To ensure appropriate use of the ultrasonic motor, below are examples of conditions under which the ultrasonic motor may show poor performance.

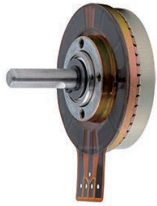
- |   |  |
|---|--|
| ① <b>Use under environments with high humidity oil corrosive gas dust</b> | In environments with humidity over 45 [%] may cause blocking.  |
| ② <b>Extended continuous operation under adiabatic state</b>              | Efficiency of the ultrasonic motor is approximately 30 [%]. The remainder will turn into heat; and therefore, cooling is required for extended continuous operation.   |
| ③ <b>Use requiring extended hours of endurance</b>                        | The ultrasonic motor rotates under the principle of friction drive; and therefore, durability is shorter than an electromagnetic motor due to abrasion and damage to drive part.   |
| ④ <b>Frequent start-stop motion under high inertial load state</b>        | This will cause intense wear of lining material causing a shortening of the working life.  |
| ⑤ <b>Use requiring ultra-precision rotation</b>                           | The ultrasonic motor operates under the pressure contact state of stator and rotor which generates minute uneven rotation.<br>Uneven rotation when speed is controlled by encoder will be 0.1 [%] at 150 [rpm] high-speed rotation and 0.5 [%] at 15 [rpm] low-speed rotation. |

※ **Note — Control at open loop**

The ultrasonic motor operating principle is different from stepping motor. Therefore, accurate position control and speed control cannot be performed with open loop control. Performing feedback control with rotary encoder, etc. is recommended for accurate control.

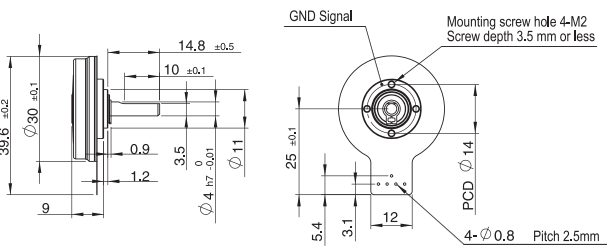
# USR30 Series Motor

## USR30-B3

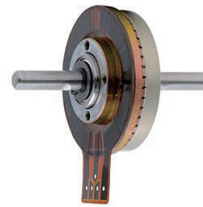


Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.3W
Maximum Output	2.5W (by Maximum Load)
Rated Speed	250rpm
Maximum Speed	300rpm
Rated Torque	0.05N·m (0.51Kg·cm)
Maximum Torque	0.1N·m (1.02Kg·cm)
Holding Torque	0.1N·m (1.02Kg·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Stator surface 70°C
Operating Humidity Range	0 to +45% (No condensation)
Size	30×40×25mm
Weight	17g
Remarks	Single Shaft-Type

Dimensional Drawing (Unit: mm)

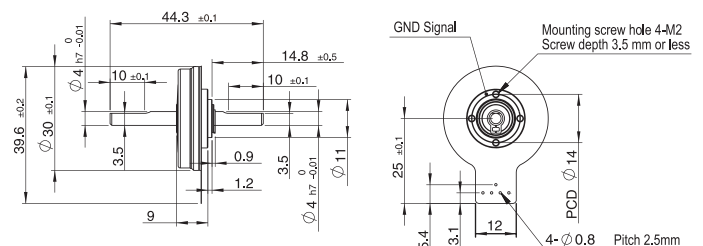


## USR30-B4



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.3W
Maximum Output	2.5W (by Maximum Load)
Rated Speed	250rpm
Maximum Speed	300rpm
Rated Torque	0.05N·m (0.51Kg·cm)
Maximum Torque	0.1N·m (1.02Kg·cm)
Holding Torque	0.1N·m (1.02Kg·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Stator surface 70°C
Operating Humidity Range	0 to +45% (No condensation)
Size	30×40×44.5mm
Weight	19g
Remarks	Double Shaft-Type

Dimensional Drawing (Unit: mm)

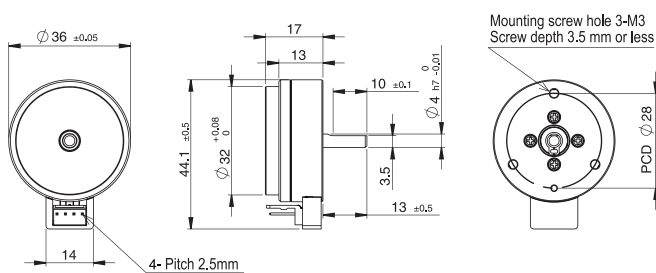


## USR30-S3



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.3W
Maximum Output	2.5W (by Maximum Load)
Rated Speed	250rpm
Maximum Speed	300rpm
Rated Torque	0.05N·m (0.51Kg·cm)
Maximum Torque	0.1N·m (1.02Kg·cm)
Holding Torque	0.1N·m (1.02Kg·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×44×30mm
Weight	43g
Remarks	Single Shaft-Type

Dimensional Drawing (Unit: mm)

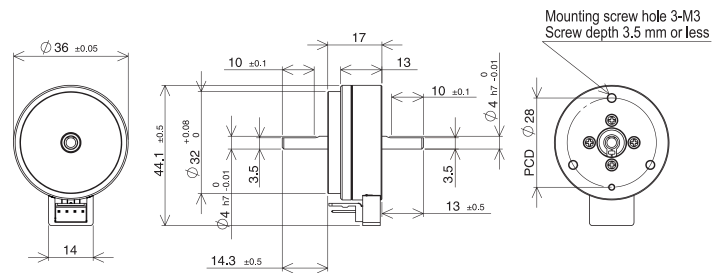


## USR30-S4



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.3W
Maximum Output	2.5W (by Maximum Load)
Rated Speed	250rpm
Maximum Speed	300rpm
Rated Torque	0.05N·m (0.51Kg·cm)
Maximum Torque	0.1N·m (1.02Kg·cm)
Holding Torque	0.1N·m (1.02Kg·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×44×44.5mm
Weight	45g
Remarks	Double Shaft-Type

Dimensional Drawing (Unit: mm)



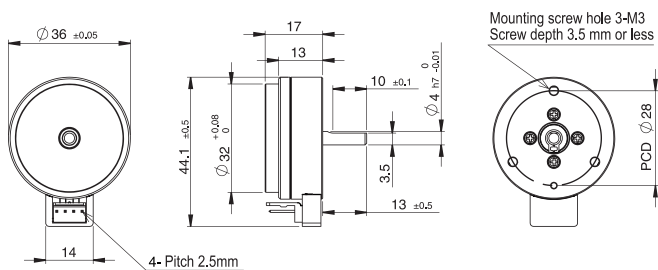
# USR30 Series Motor

## USR30-S3N



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.0W
Maximum Output	2.0W (by Maximum Load)
Rated Speed	200rpm
Maximum Speed	250rpm
Rated Torque	0.05N·m (0.51Kgf·cm)
Maximum Torque	0.1N·m (1.02Kgf·cm)
Holding Torque	0.1N·m (1.02Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×44×30mm
Weight	48g
Remarks	Single Shaft-Type

Dimensional Drawing (Unit: mm)

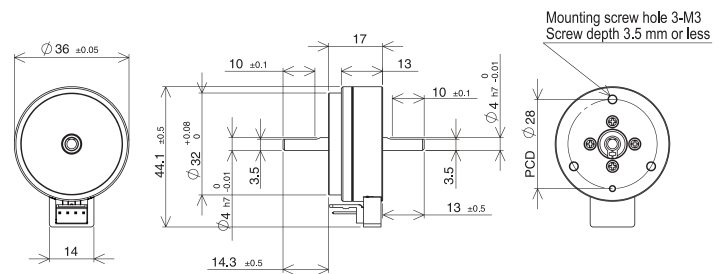


## USR30-S4N



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.0W
Maximum Output	2.0W (by Maximum Load)
Rated Speed	200rpm
Maximum Speed	250rpm
Rated Torque	0.05N·m (0.51Kgf·cm)
Maximum Torque	0.1N·m (1.02Kgf·cm)
Holding Torque	0.1N·m (1.02Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×44×44.5mm
Weight	50g
Remarks	Double Shaft-Type

Dimensional Drawing (Unit: mm)

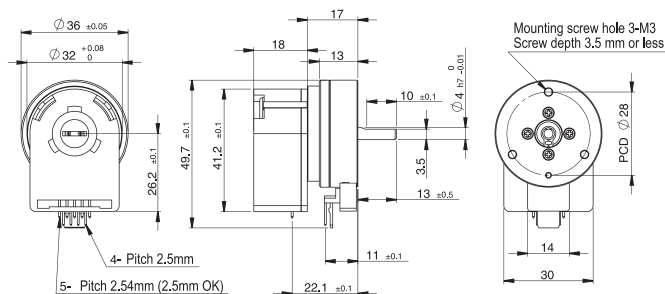


## USR30-E3 (500P/R) / USR30-E3T (1000P/R)



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.3W
Maximum Output	2.5W (by Maximum Load)
Rated Speed	250rpm
Maximum Speed	300rpm
Rated Torque	0.05N·m (0.51Kgf·cm)
Maximum Torque	0.1N·m (1.02Kgf·cm)
Holding Torque	0.1N·m (1.02Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×50×48mm
Weight	64g
Remarks	Encoder Resolution: 500P/R or 1000P/R

Dimensional Drawing (Unit: mm)

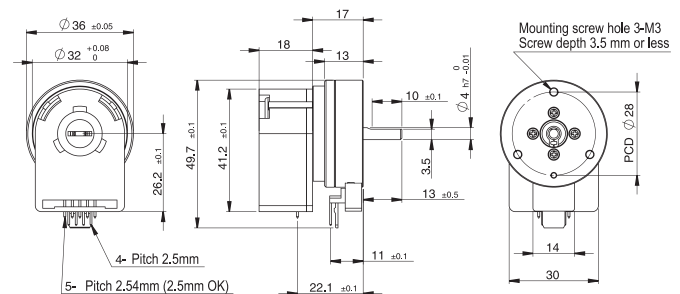


## USR30-E3N (500P/R) / USR30-E3NT (1000P/R)



Drive Frequency	49KHz to 55KHz
Drive Voltage	110Vrms
Rated Output	1.0W
Maximum Output	2.0W (by Maximum Load)
Rated Speed	200rpm
Maximum Speed	250rpm
Rated Torque	0.05N·m (0.51Kgf·cm)
Maximum Torque	0.1N·m (1.02Kgf·cm)
Holding Torque	0.1N·m (1.02Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	36×50×48mm
Weight	68g
Remarks	Encoder Resolution: 500P/R or 1000P/R

Dimensional Drawing (Unit: mm)



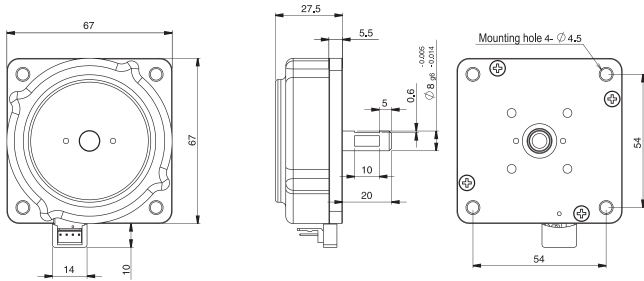
# USR60 Series Motor

## USR60-S3

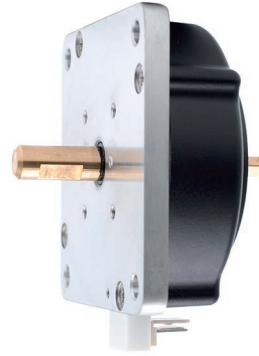


Drive Frequency	40KHz to 5KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×47.5mm
Weight	258g
Remarks	Single Shaft-Type

Dimensional Drawing (Unit: mm)

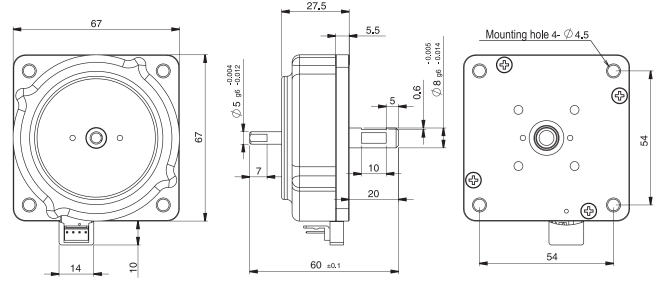


## USR60-S4



Drive Frequency	40KHz to 5KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×60mm
Weight	261g
Remarks	Double Shaft-Type

Dimensional Drawing (Unit: mm)

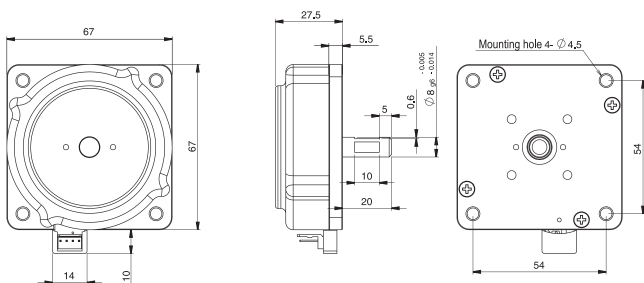


## USR60-S3N

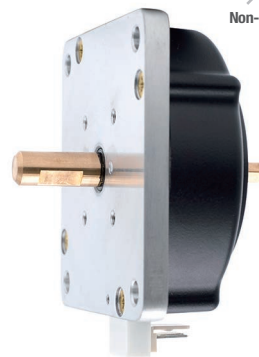


Drive Frequency	40KHz to 45KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×47.5mm
Weight	250g
Remarks	Single Shaft-Type

Dimensional Drawing (Unit: mm)

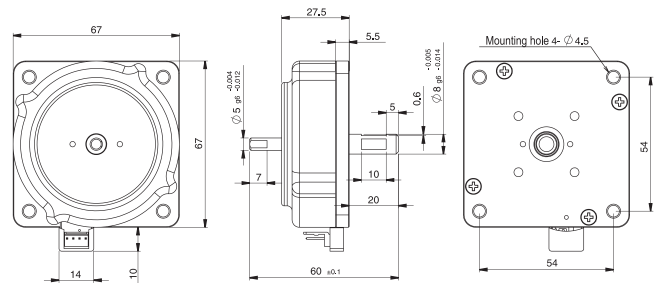


## USR60-S4N



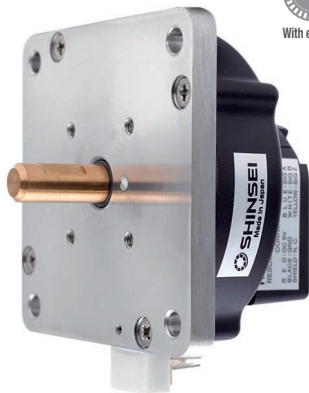
Drive Frequency	40KHz to 45KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×60mm
Weight	254g
Remarks	Double Shaft-Type

Dimensional Drawing (Unit: mm)



## USR60 Series Motor / Driver

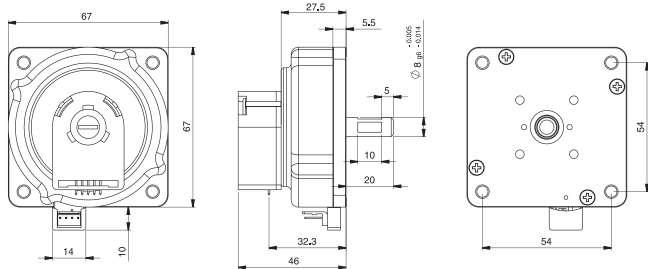
### USR60-E3 (500P/R) / USR60-E3T (1000P/R)



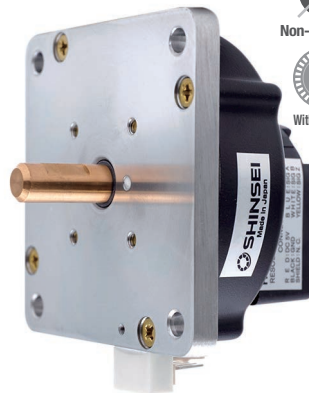
With encoder

Drive Frequency	40KHz to 45KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×66mm
Weight	266g
Remarks	Encoder Resolution: 500P/R or 1000P/R

Dimensional Drawing (Unit: mm)



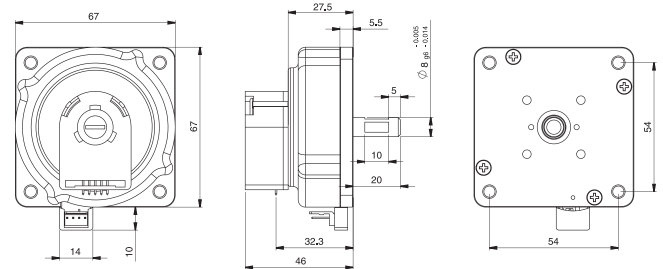
### USR60-E3N (500P/R) / USR60-E3NT (1000P/R)



Non-magnetic  
With encoder


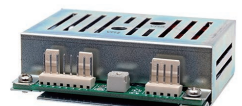
Drive Frequency	40KHz to 45KHz
Drive Voltage	130Vrms
Rated Output	5.0W
Maximum Output	10.0W (by Maximum Load)
Rated Speed	100rpm
Maximum Speed	150rpm
Rated Torque	0.5N·m (5.1Kgf·cm)
Maximum Torque	1.0N·m (10.2Kgf·cm)
Holding Torque	1.0N·m (10.2Kgf·cm)
Responsivity	1ms or less (No inertia load)
Direction of Rotation	CW, CCW
Operating Temperature Range	-10°C to +55°C
Operating Temperature Limit	Case surface 60°C
Operating Humidity Range	0 to +45% (No condensation)
Size	67×77×66mm
Weight	272g
Remarks	Encoder Resolution: 500P/R or 1000P/R

Dimensional Drawing (Unit: mm)

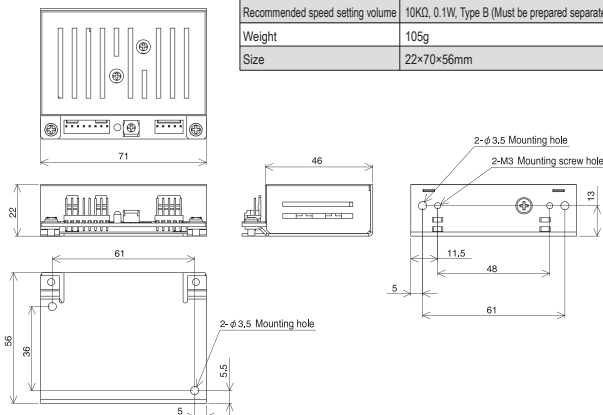


## D6030



Driver for Ultrasonic Motor USR30

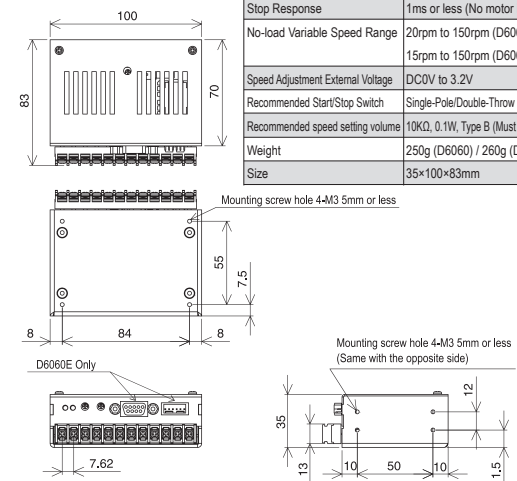
Power Supply Voltage	DC24V±0.5V (DC12V±0.5V)
Oscillation Waveform	Pseudo Sine Wave
Oscillation Frequency	47KHz to 52KHz
Speed transmission system	Frequency Modulation
Frequency Control	Automatic Tracking System with Vibration Amplitude Feedback
Motor Drive Voltage	110Vrms
Current Consumption (Maximum)	DC24V:0.8A / DC12V:1.5A
Overcurrent Protection	24V:0.8A (φ5.2 Midget Fuse) 12V:1.5A (φ5.2 Midget Fuse)
Insulation Resistance	10MΩ or more (Unconnected Motor, Connection Between Case and Terminals)
Dielectric Withstand Voltage	1KVAC (Unconnected Motor, Connection Between Case and Terminals)
Storage Temperature Range	-20°C to +80°C (No Condensation)
Operating Temperature Limit	-10°C to +55°C (No Condensation)
Start/Stop Operation	External Signal Switching (Prepare separately when using switch)
Start-Up Response	50ms or less (No motor inertia load)
Stop Response	1ms or less (No motor inertia load)
No-load Variable Speed Range	30rpm to 300rpm
Speed Adjustment External Voltage	DC0V to 3.2V
Recommended Start/Stop Switch	Single-Pole/Double-Throw Switch with Center (ON-OFF-ON)
Recommended speed setting volume	10KΩ, 0.1W, Type B (Must be prepared separately)
Weight	105g
Size	22×70×56mm



## D6060 / D6060E (With Speed Control Function)

Power Supply Voltage	DC24V±0.5V (DC12V±0.5V)
Oscillation Waveform	Pseudo Sine Wave
Oscillation Frequency	48KHz to 55KHz 41KHz to 46KHz
Speed transmission system	Frequency Modulation
Frequency Control	Automatic Tracking System with Vibration Amplitude Feedback Automatic Tracking with Encoder Signal Feedback
Motor Drive Voltage	110Vrms
Current Consumption (Maximum)	DC24V:2.5A / DC12V:4.0A
Overcurrent Protection	24V:2.5A (φ5.2 Midget Fuse) 12V:4.0A (φ5.2 Midget Fuse)
Insulation Resistance	10MΩ or more (Unconnected Motor, Connection Between Case and Terminals)
Dielectric Withstand Voltage	1KVAC (Unconnected Motor, Connection Between Case and Terminals)
Storage Temperature Range	-20°C to +80 (No Condensation)
Operating Temperature Limit	-10°C to +55°C (No Condensation)
Start/Stop Operation	TTL Level Signal Switching (Prepare separately when using switch)
Start-Up Response	50ms or less (No motor inertia load)
Stop Response	1ms or less (No motor inertia load)
No-load Variable Speed Range	20rpm to 150rpm (D6060) 15rpm to 150rpm (D6060E)
Speed Adjustment External Voltage	DC0V to 3.2V
Recommended Start/Stop Switch	Single-Pole/Double-Throw Switch with Center (ON-OFF-ON)
Recommended speed setting volume	10KΩ, 0.1W, Type B (Must be prepared separately)
Weight	250g (D6060) / 260g (D6060E)
Size	35×100×83mm



## Each Part Names of and Connection Diagram for D6030 Driver

### Name and Function of Each Part for D6030

#### Maximum RPM setting volume (VR2)

No load speed is set at 300 [rpm].

#### Motor Connection Terminal

#### LED indicator (Red)

Lights when the power is ON. It will not light when the internal fuse has blown.

#### Connector to 24[V] power, start-stop switch and speed set volume knob

Refer to the basic connection diagram for the function of each pin.

#### Balance Adjustment Volume (VR3)

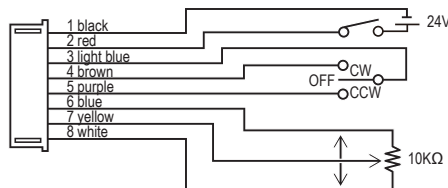
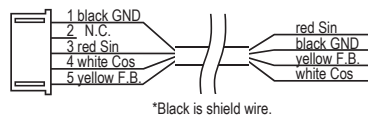
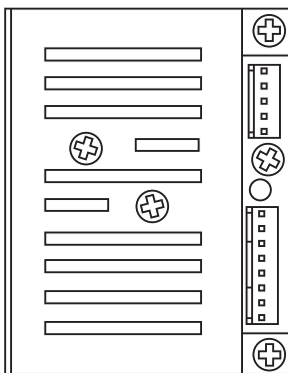
This volume knob adjusts rotational difference of CW and CCW.

#### Minimum Rotational Speed Setting Volume (VR1)

No load speed is set at 30 [rpm].

※ Rotation speed is adjusted. Do not change under normal operation.

### Basic Connection Diagram for D6030



※Speed setting and switching over from start and stop can be done with the volume knob and switch shown on the diagram, as well as with non-contact point (TTL, transistor). Refer to pages 13 and 14 for external control for details.

#### ○ Precautions with Connection

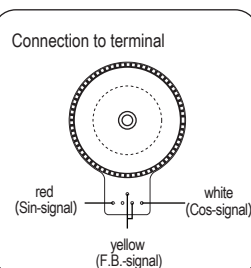
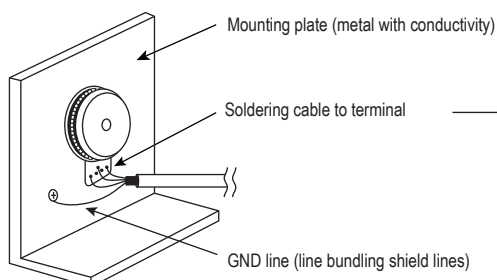
1. Always use the cable provided for the connection of motor and driver. Readjustment of driver is necessary when changing the length of the cable. Refer to page 12 for how to adjust the driver for the readjustment method.

※To change the length of the cable after purchase, we ask that you send the motor, driver and motor cable for readjustment. Please carefully consider the length of cable when purchasing.

2. Shortening the motor cable will blow the fuse to protect the interior. Please note that connecting erroneously, may damage the inner semiconductor.

3. To extend cable for signal, ensure sufficient margin for voltage value and use shield line to prevent noise.

### How to Connect to USB30-B3/B4※



※The driver power side of the motor cable is connected with a connector; however, on the motor side, it must be connected directly by soldering.

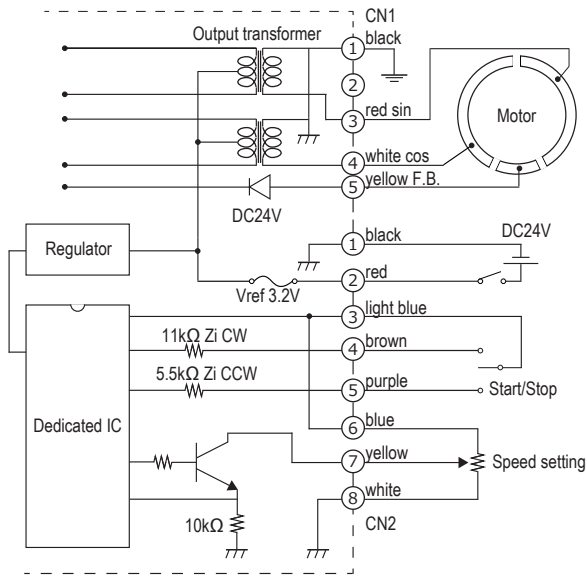
In such case, solder ③ sin red, ④ cos white and ⑤ F.B yellow on the designated position of the FPC input area,

and connect ① GND shield line somewhere on the metallic case with conduction attained with motor installation surface.



# External Control Method for D6030

## Inner Circuit of D6030

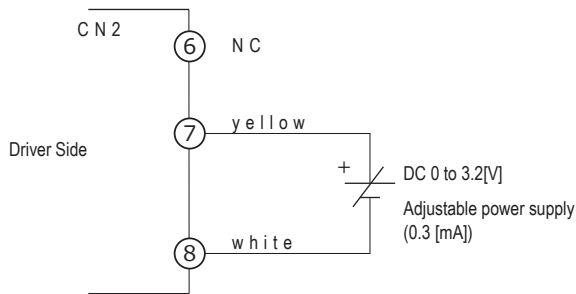


Stabilized voltage of +3.2 [V] Max. 5 [mA] is output to the common terminal ③ light blue and speed setting volume terminal ⑥ blue on the start-stop switch.

CW and CCW start/stop for rotation command terminal ④ brown and ⑤ purple turn ON at input level of Hi +3.3 to +5.5[V] and turn OFF at Lo0 to +0.4[V].

※ Impedance for ④ brown is 11 [KΩ] and impedance for ⑤ purple is 5.5 [KΩ].

## Speed Control by External Voltage

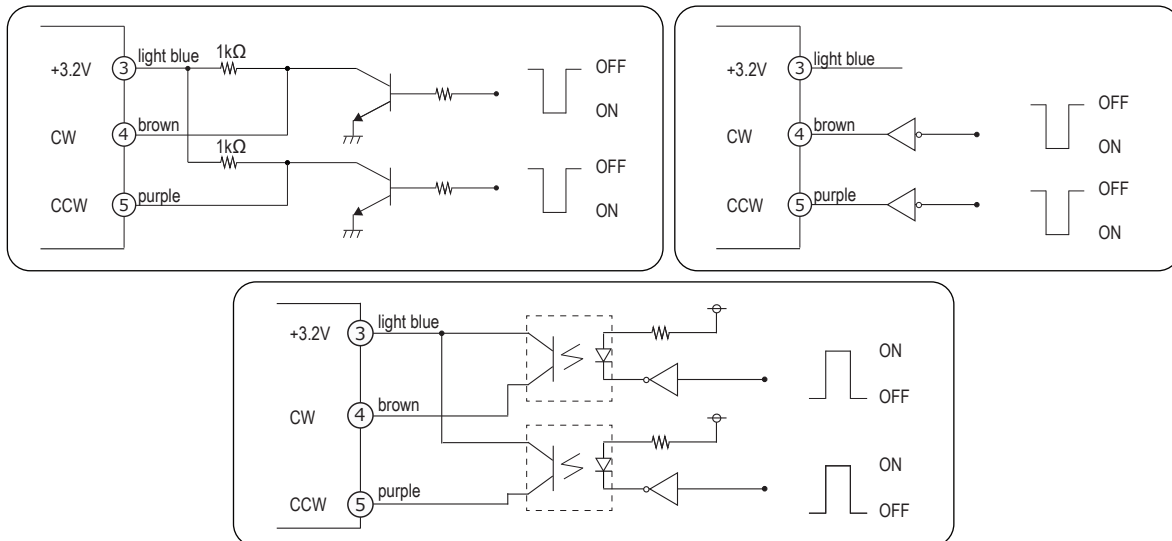


To control speed with external voltage, connect DC variable voltage power as a substitute for volume between terminals ⑦ yellow and ⑧ white.

Changing the voltage to 0 to 3.2[V] enables speed control equivalent to changing volume to 0 to max. Consumption current is below 0.5[mA] and impedance is over 10[KΩ] for external voltage source.

There is a restriction on the change rate of rise for speed command voltage. Refer to the Timing Chart on page 12.

## Start, Stop and Rotation Direction Switching by External Signal



# Each Part Names of and Connection Diagram for D6060/D6060E Driver

## Name and Function of Each Part for D6060/D6060E

### Encoder Connector (\*only D6060E)

This enables speed control using encoder signal, and use of controller enables position control.

### Controller Connector (\*only D6060E)

This is the terminal for encoder signal through output and motor control signal input and output.

Connecting this terminal with the controller enables control of speed and position of the motor. When using this terminal, leave terminals ③ to ⑧ as N.C..

O.L.6 is an open collector. ( L: normal / H: overload )

### Minimum Rotational Speed Setting Volume

No load speed is set at 20 [rpm] (D6060E set at 15 [rpm]).

### Maximum Rotational Speed Setting Volume

No load speed is set at 150 [rpm].

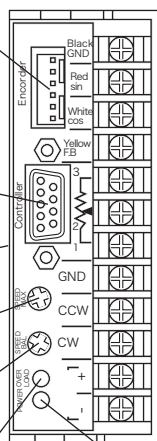
### Balance Adjustment Volume

Volume knob for adjustment of CW and CCW rotational speed difference. (Adjustment not required for D6060E)

### LED indicator (Red)

Lights up when motor is overloaded and stops the motor. To reset, turn OFF the power or start switch, eliminate cause and reboot.

※ Controller connector and encoder connector are D6060E only.  
 ※ Rotation speed is adjusted. Do not change under normal operation.



### Motor Connection Terminal

Connect by matching the color of cables.

### Speed Setting Volume Connecting Terminal

Speed can be set with B10 [KΩ] (0.1 [W]) rheostat.

### Start-stop Switch

In the case of contact, use the snap switch (for minute current) with OFF switch for Single-Pole/Double-Throw Center.

### Power Connection Terminal

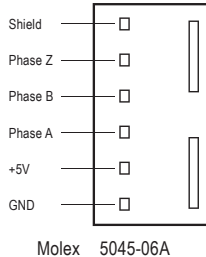
This terminal connects with DC 24[V] power source.

### LED indicator (Green)

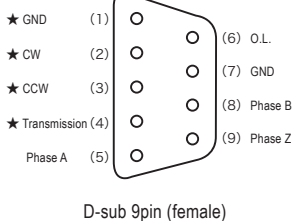
Lights when the power is ON. It will not light when the internal fuse has blown.

## Basic Connection Diagram for D6060/D6060E

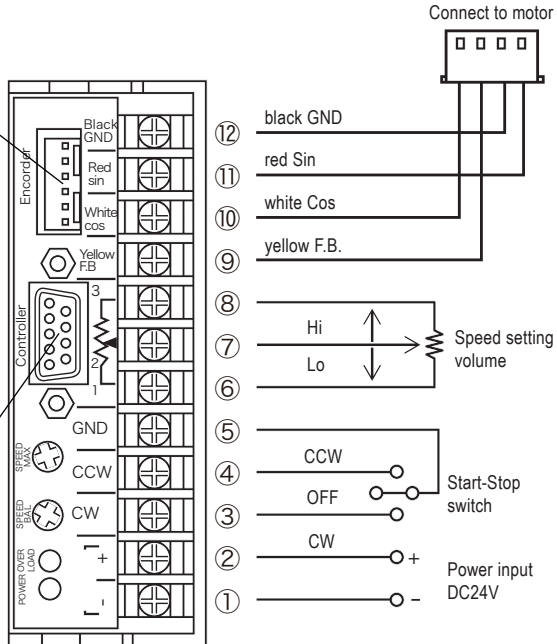
※ To control using encoder signal, connect encoder cable to this connector.  
 Connector pin arrangement is as shown in the diagram on the left.



Use this connector to control sequence with controller. Connector pin arrangement is as shown in the diagram on the left.  
 Encoder output is 5 [V] voltage output.  
 (★ mark is common with connection terminal)

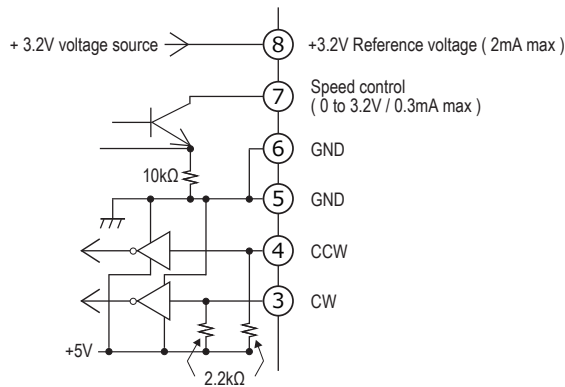


※(6) O.L. is H: Overload, L: Normal  
 (For sink current Max. 20 [mA], output is open connector)



## External Control Method of D6060/D6060E

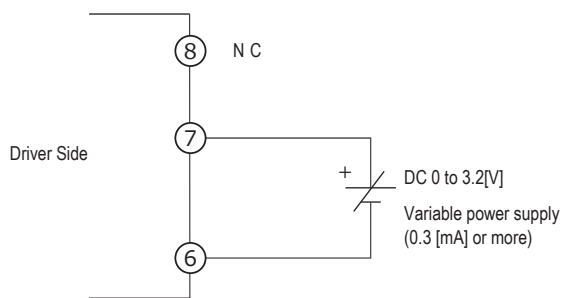
### Inner Circuit of D6060/D6060E



Stabilized voltage of +3.2 [V] (Max2 [mA]) is output to the speed setting volume terminal ⑧ blue.

CW and CCW start/stop for rotation command terminal ④ and ⑤ turns OFF at Hi(2.5 – 5.5 [V]) and turns ON at Lo(0 – 0.4 [V]) of TTL input level.  
 ※ Impedance for current value 2.3 [mA], ③ and ④ is 2.2 [KΩ].

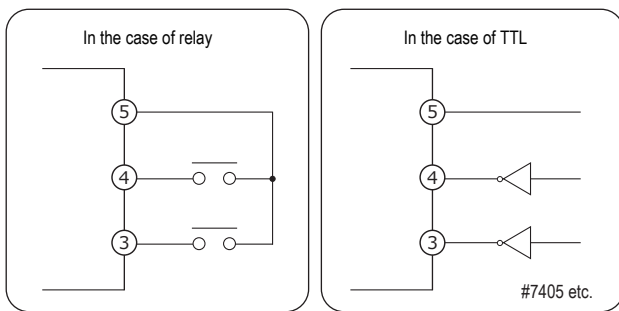
### Speed Control by External Voltage



To control speed with external voltage, connect DC variable voltage power as substitute for volume between terminals ⑥ and ⑦.  
 Changing the voltage to 0 to 3.2 [V] enables speed control equivalent to changing volume to between 0 to max.

※ Consumption current is below 0.5 [mA] for external voltage source.  
 ※ There is a restriction on the change rate of rise for speed command voltage. Refer to the Timing Chart on page 12.

### Start, Stop and Rotation Direction Switching by External Signal

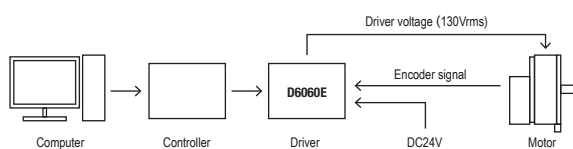


When CW and CCW are turned ON simultaneously, CW takes precedence.  
 Refer to Timing Chart on page 12 for switchover interval.

### Speed control by encoder (\*only D6060E)

For uses requiring minute speed control, speed control using encoder with D6060E will be effective.  
 Speed error value within normal use range is 0.1 to 0.5 [%].

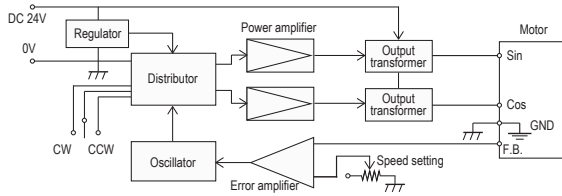
### Servo System with Encoder and Controller (\*Only D6060E)



Simultaneous position and speed control (servo system) are possible with encoder signal and controller. It is possible to determine position and variable speed control in bulk with PC program, and it is also possible to automatically operate with program stored in controller.

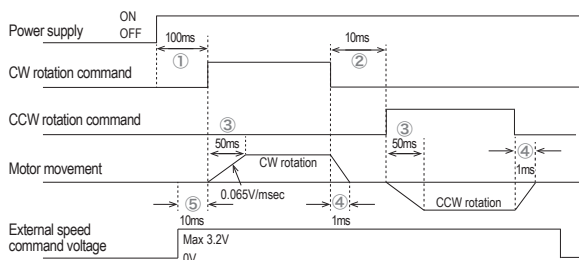
## Other Matters Regarding Driver

### Driver Circuit Configuration



- Driver case has not been dropped to GND electrical potential.
- Motor case is connected to GND (shield line) and dropped to GND electrical potential of power input (24VDC).

### Timing Chart



- ① Time required from driver power ON to start command (CW or CCW) ON is more than 100 [ms].
- ② More than a 10 [ms] interval time is required to switchover forward and reverse rotation.
- ③ Start-up response (when no inertial load) takes approximately 50[ms].
- ④ Stop response (when no inertial load) takes less than 1 [ms].
- ⑤ Reclosing after motor stops due to overload requires about a 10 [s] interval after turning OFF the power. (\*Excluding D6030)

### How to Adjust the Driver

**Motor and driver are set at optimal state matching the specification at the time of shipment. Therefore, as a rule, driver adjustment should not be performed by user. (\*Malfunction from adjustment made by user is not covered by warranty. Request for readjustment will be charged.)**  
**If for some reason there is a need for adjustment, follow the directions below.**

#### What You Need

Frequency meter (Input voltage: higher than 150 [Vrms]) / Ammeter (Capacity: 5 [A]) / Tachometer (Non-contact type is desirable) / Small Phillips screwdriver

**1. Connect frequency meter between GND and Sin (or Cos) of motor cable.** (Caution: High voltage. Exercise care in handling measuring instrument)

**2. Create no-load state for motor to enable measurement with tachometer.**

**3. Adjustment of Minimum Rotational Speed**

When CW/CCW rotation command is made at minimal for external speed setting volume or with 0 [V] outer speed command voltage, adjust the minimum rotation setting volume (turning clockwise increases the rotation speed) to set at 15 or 20 [rpm] for D6060 and D6060E (USR60 series), or 30 [rpm] for D6060E and D6030 (USR30 series).

Check that frequency range is 41 to 44 [KHz] for USR60 series and 51 to 52 [KHz] for USR30 series.

**4. Adjustment of Maximum Rotational Speed**

When CW/CCW rotation command is at maximum for external speed setting volume or with 3.2 [V] outer speed command voltage, adjust the maximum rotation setting volume (turning clockwise increases the rotation speed) to set at 150 [rpm] for USR60 series and 300 [rpm] for USR 30 series.

Check that frequency range is around 40 [KHz] for USR 60 series and around 50 [KHz] for USR 30 series.

**5. Balance Correction** (Correction of unbalanced CW/CCW rotation)

Make adjustment with balance adjustment volume to ensure the same rotation for CW and CCW with the maximum rotation adjustment.

Maximum rotation will change. Repeat steps 4 and 5 several times to make maximum rotation the same for CW and CCW.

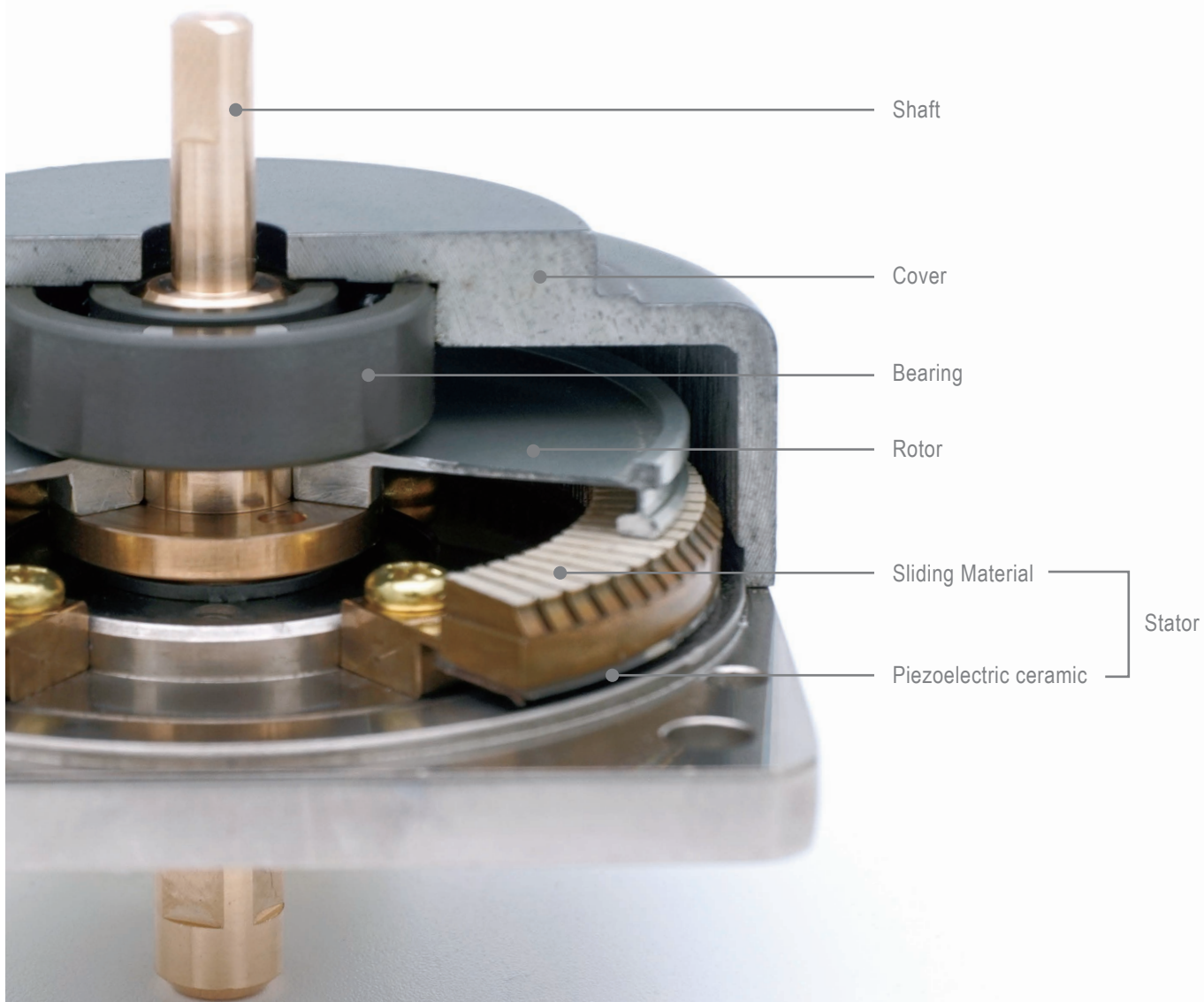
(Balance correction not required for D6060E)

※ **Why is readjustment of driver no longer necessary?**

Increase and decrease in electric resistance when changing the length of motor cable connecting motor and driver, for example, will change the feedback signal. Feedback signal is for the measurement of stator vibration amplitude from the driver side by output of voltage from monitor electrode. Therefore, if the electric resistance increases or decreases during that time, the feedback signal voltage will also change, interfering with driver's appropriate frequency oscillation leading to abnormal rotation. Readjustment of driver is necessary to set the rotation speed to the proper value.

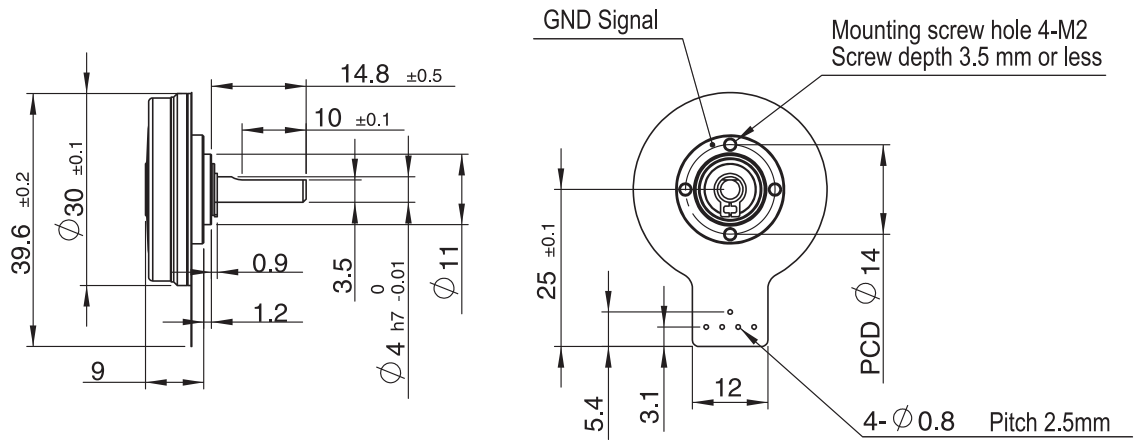
When the length of the motor cable is changed significantly (change of more than 5[m]), impedance between motor and driver increases or decreases, reactive current increases and potentially damaging driver by overheating. In such case, measures such as adding coil to driver to adjust impedance will be required.

# Diagram & Specifications

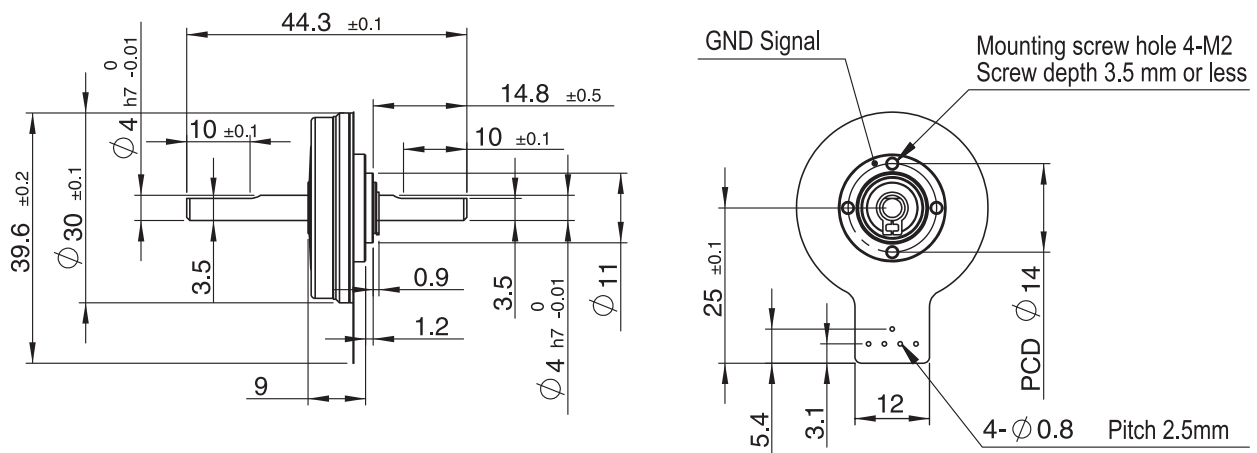


Diagram

USR30-B3

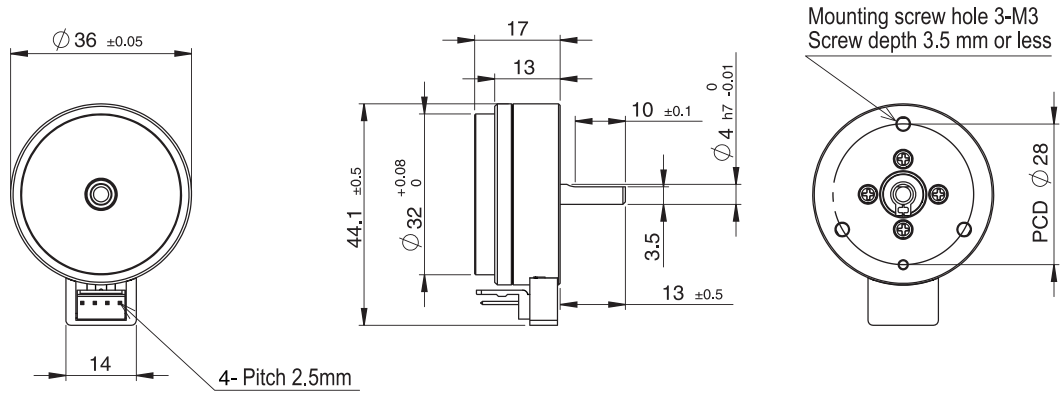


USR30-B4

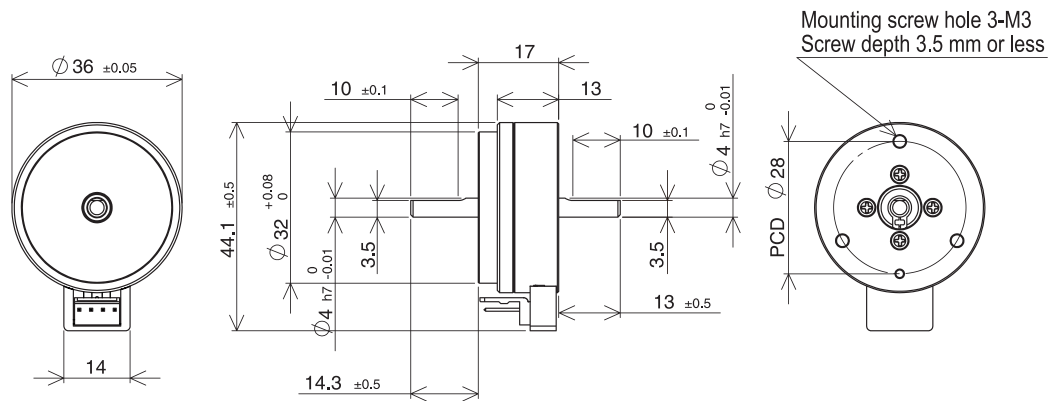


Diagram

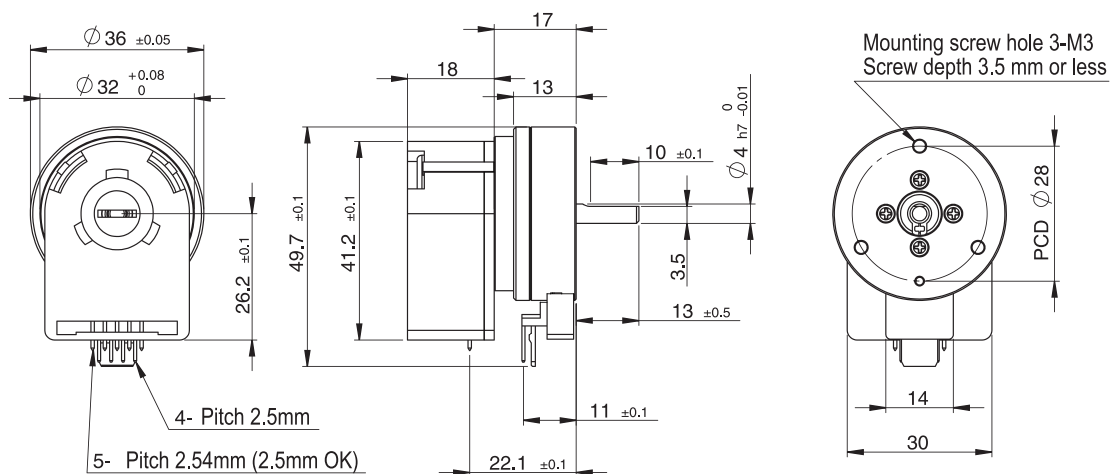
USR30-S3 / USR30-S3N



USR30-S4 / USR30-S4N

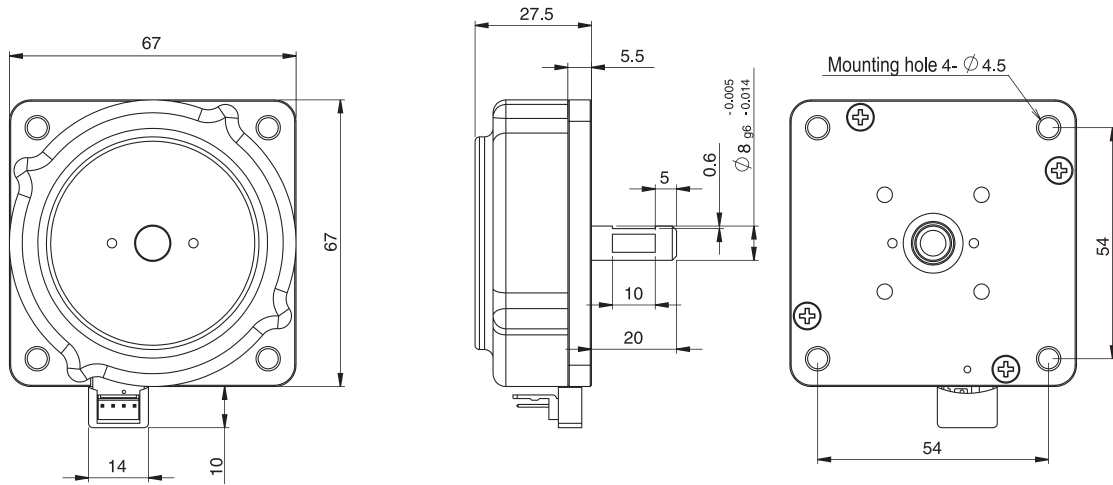


USR30-E3 / USR30-E3T / USR30-E3N / USR30-E3NT

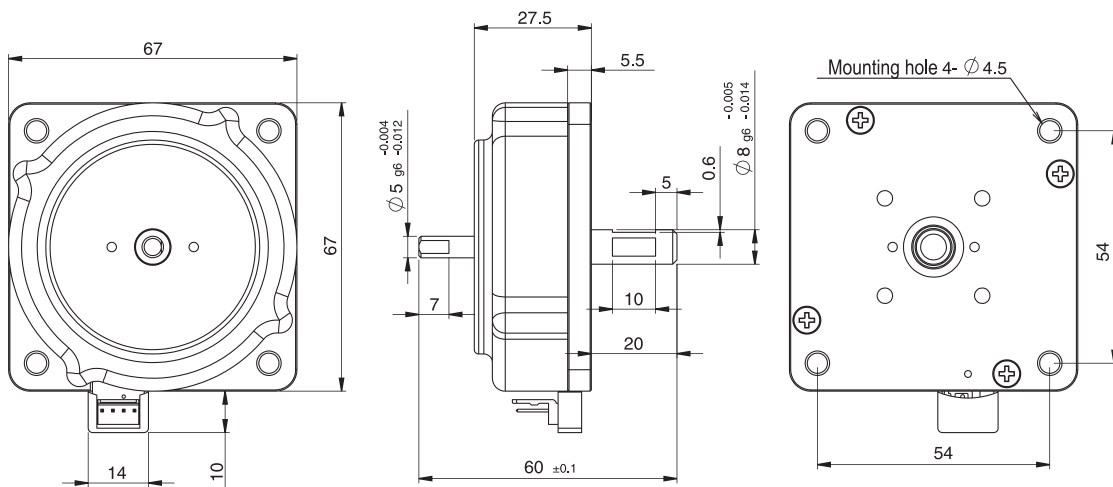


Diagram

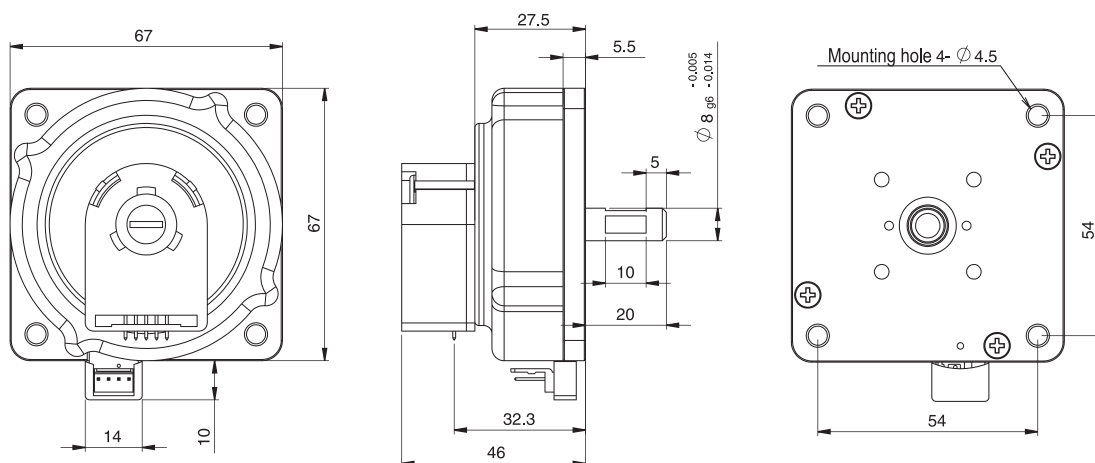
USR60-S3 / USR60-S3N



USR60-S4 / USR60-S4N



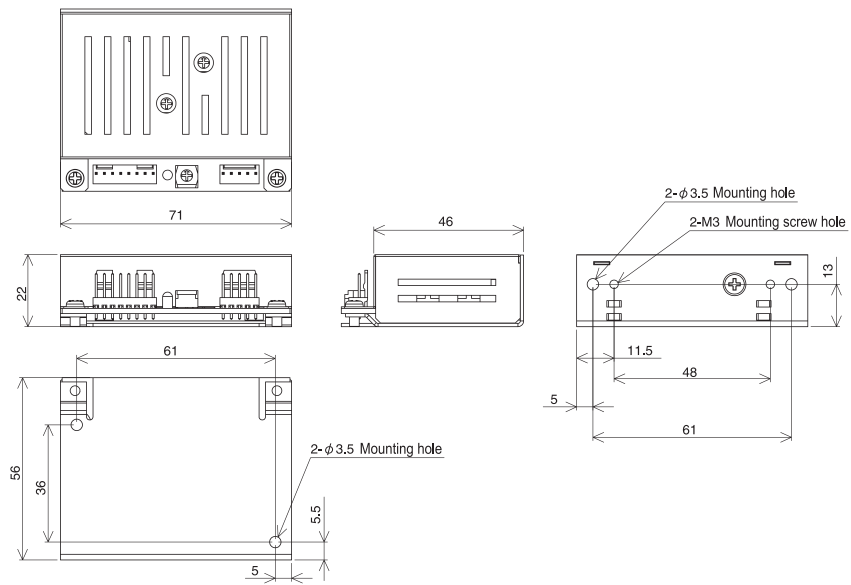
USR60-E3 / USR60-E3T / USR60-E3N / USR60-E3NT



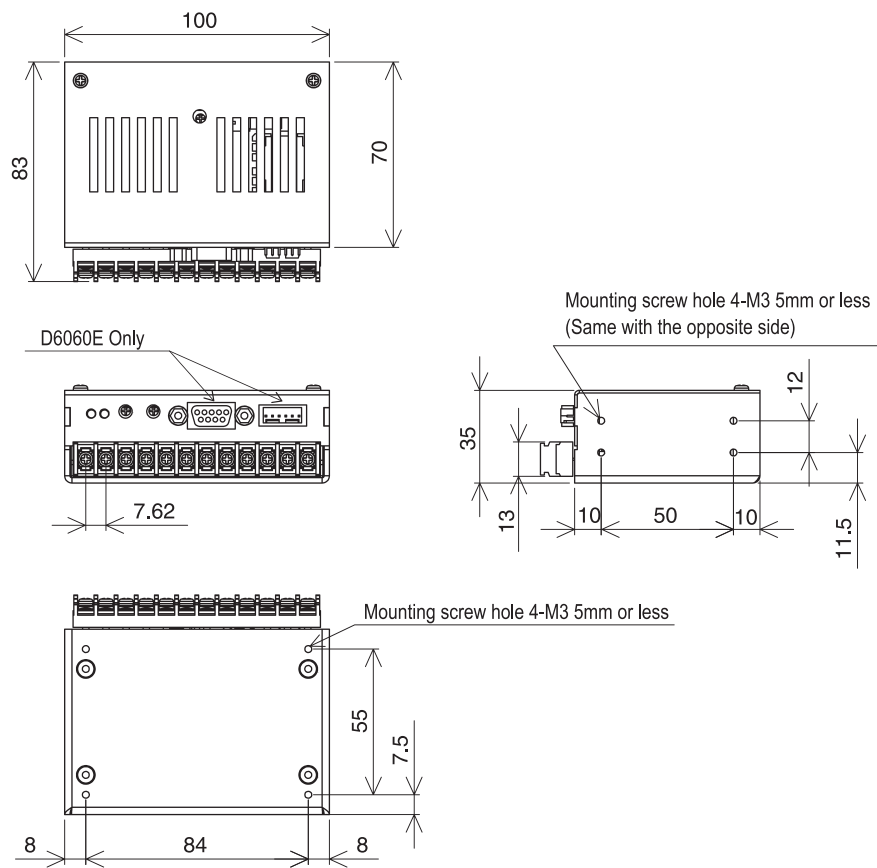


Diagram

D6030



D6060 / D6060E



## List of Specifications

USR30 series										
Model	USR30-B3	USR30-B4	USR30-S3	USR30-S4	USR30-E3	USR30-E3T	USR30-S3N	USR30-S4N	USR30-E3N	USR60-E3NT
Drive Frequency	49KHz to 55KHz									
Drive Voltage	110Vrms									
Rated Output	1.3W					1.0W				
Maximum Output	2.5W (by Maximum Load)					2.0W (by Maximum Load)				
Rated Speed	250rpm					200rpm				
Maximum Speed	300rpm					250rpm				
Rated Torque	0.05N·m (0.51Kgf·cm)									
Maximum Torque	0.1N·m (1.02Kgf·cm)									
Holding Torque	0.1N·m (1.02Kgf·cm)									
Responsivity	1ms or less (No inertia load)									
Direction of Rotation:	CW, CCW									
Operating Temperature Range:	-10°C to +55°C									
Operating Temperature Limit:	Stator surface 70°C, Case surface 60°C									
Operating Humidity Range:	0 to +45% (No condensation)									
Size	30×40×25mm	30×40×44.5mm	36×44×30mm	36×44×44.5mm	36×50×48mm	36×50×48mm	36×44×30mm	36×44×44.5mm	36×50×48mm	36×50×48mm
Weight	17g	19g	43g	45g	64g	64g	48g	50g	69g	69g
Remarks	Single Shaft-Type	Double Shaft-Type	Single Shaft-Type	Double Shaft-Type	Encoder Resolution: 500P/R	Encoder Resolution: 1000P/R	Single Shaft-Type	Double Shaft-Type	Encoder Resolution: 500P/R	Encoder Resolution: 1000P/R
<b>Features and Range of Use</b>										

USR60 series								
Model	USR60-S3	USR60-S4	USR60-E3	USR60-E3T	USR60-S3N	USR60-S4N	USR60-E3N	USR60-E3NT
Drive Frequency	40KHz to 45KHz							
Drive Voltage	130Vrms							
Rated Output	5.0W							
Maximum Output	10.0W (by Maximum Load)							
Rated Speed	100rpm							
Maximum Speed	150rpm							
Rated Torque	0.5N·m (5.1Kgf·cm)							
Maximum Torque	1.0N·m (10.2Kgf·cm)							
Holding Torque	1.0N·m (10.2Kgf·cm)							
Responsivity	1ms or less (No inertia load)							
Direction of Rotation:	CW, CCW							
Operating Temperature Range:	-10°C to +55°C							
Operating Temperature Limit:	Case surface 60°C							
Operating Humidity Range:	0 to +45% (No condensation)							
Size	67×77×47.5mm	67×77×60mm	67×77×66mm	67×77×66mm	67×77×47.5mm	67×77×60mm	67×77×66mm	67×77×66mm
Weight	258g	261g	266g	266g	250g	254g	272g	272g
Remarks	Single Shaft-Type	Double Shaft-Type	Encoder Resolution: 500P/R	Encoder Resolution: 1000P/R	Single Shaft-Type	Double Shaft-Type	Encoder Resolution: 500P/R	Encoder Resolution: 1000P/R
<b>Features and Range of Use</b>								

# List of Specifications

Driver		※12V specifications for each model are optional	
Model	D6030 (24V) / D6030 (12V)※	D6060 (24V) / D6060 (12V)※	D6060E (24V) / D6060E (12V)※
Power Supply Voltage	DC24V±0.5V / DC12V±0.5V		
Oscillation Waveform	Pseudo Sine Wave		
Oscillation Frequency	47KHz to 52KHz	48KHz to 55KHz (USR30 series) / 41KHz to 46KHz (USR60 series)	
Speed transmission system	Frequency Modulation		
Frequency Control	Automatic Tracking System with Vibration Amplitude Feedback		Automatic Tracking with Encoder Signal Feedback
Motor Drive Voltage	110Vrms	130Vrms	
Current Consumption (Maximum)	DC24V : 0.8A / DC12V : 0.5A		DC24V : 2.5A / DC12V : 4.0A
Overcurrent Protection	DC24V:0.8A (φ5.2 Midget Fuse) / DC12V:1.5A (φ5.2 Midget Fuse)		DC24V:2.5A (φ5.2 Midget Fuse) / DC12V:4.0A (φ5.2 Midget Fuse)
Insulation Resistance	10 MΩ or more (Unconnected Motor, Connection Between Case and Terminals)		
Dielectric Withstand Voltage	1KVAV (Unconnected Motor, Connection Between Case and Terminals)		
Storage Temperature Range	-20°C to +80°C (No Condensation)		
Operating Temperature Limit	-10°C to +55°C (No Condensation)		
Start/Stop Operation	TTL Level Signal Switching (Prepare separately when using switch)		
Start-Up Response	50ms or less (No motor inertia load)		
Stop Response	1ms or less (No motor inertia load)		
No-load Variable Speed Range	30rpm to 300rpm	20rpm to 150rpm	15rpm to 150rpm
Speed Adjustment External Voltage	DC 0V to 3.2V		
Recommended Start/Stop Switch	Single-Pole/Double-Throw Switch with Center (ON-OFF-ON)		
Recommended speed setting volume	10KΩ, 0.1W, Type B(Must be prepared separately)		
Size	22×70×56mm	35×100×83mm	
Weight	105g	250g	260g
Remarks	Equipped with speed control function using encoder signal		

Encoder	
Power-supply voltage	DC5V±10%
Current consumption	85 mA or less
Detection method	Optical incremental
Number of pulses	500P/R 1,000P/R
Output form	Voltage
Output phase	A, B, Z(I)
Output voltage H	2.4V DC or more
Output voltage L	0.4V DC or more
<b>Output Circuit</b>	
<b>Signal Waveform</b>	
<b>Encoder Cable</b>	

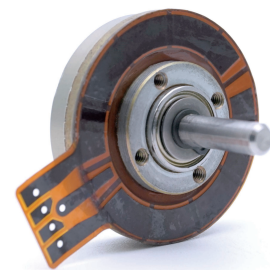
## Company Profile

### Company Profile

Company Name	SHINSEI Corporation
Location	2-1-8 Kasuya, Setagaya-ku, Tokyo, 157-0063 Japan
Business Hours	Mon-Fri: 10: 00-18: 00, Sat-Sun: holiday
Contact	Phone: +81-3-3302-7677 (main) FAX: +81-3-3329-0066 URL: <a href="http://www.shinsei-motor.com">http://www.shinsei-motor.com</a>
Established	March, 1968.
Capital	10 million yen
President	Norio Sashida
Major Clients	Universities and various research institutes (domestic and overseas), MRI and medical equipment manufacturer (domestic and overseas) etc.
Business Contents	Manufacture, sales and development of Ultrasonic motor

### Corporate History

1968	Shinsei Corporation is founded as a lapping machine manufacturer
1975	Head office transferred to Kasuya, Setagaya-Ku, Tokyo (current location) Research and development of ultrasonic motor commences
1978	Founder Toshiiku Sashida announces the world's first "Wedge type Ultrasonic Motor"
1982	Research and development of practical use ultrasonic motor commences
1985	World's first "Rotation Type Ultrasonic Motor" driven by traveling wave announced Development of rotation-type ultrasonic motor for commercialization commences
1999	Rotation-type ultrasonic Motor "USR30 Series" and "USR60 Series" commercialized
2010	Manufacturing of non-magnetic ultrasonic motor for MRI injector commences Lineup of ultrasonic motor with the increase in name value expanded
2015	High-power electrostatic motor announced



### Access

#### By Train



Take the Keio Line from Shinjuku Station and disembark at Hachiman-yama Station (Local or Rapid). Approximately 10-minute walk in the direction of Roka Koshunen (toward Roka Koen Station).

#### By Car



Shinsei Corporation building is located on the Yahatayama Sancho-me intersection along Kanjo Road 8. It takes about 40 minutes from Shinjuku Station via Koshu Kaido.

※Parking spaces for three vehicles available. If there is no vacancy, make use of the coin-operated parking in Roka Koshunen

