

Motor Driver D6030 Series

User's Manual

1. Introduction

Thank you very much for purchasing our product. The D6030 is available as the motor driver required for USR30 series operation. We are sure that combined use of USR30 series and D6030 series will meet your needs.

2. Check Accessories

The following items are included in this set.

- Ultrasonic motor body
- Motor driver
- Motor cable
- Encoder cable (E3, E3T, E3N and E3NT only)

* Separate purchase of a signal cable for CW, CCW and speed command voltage is required.

3. Precautions

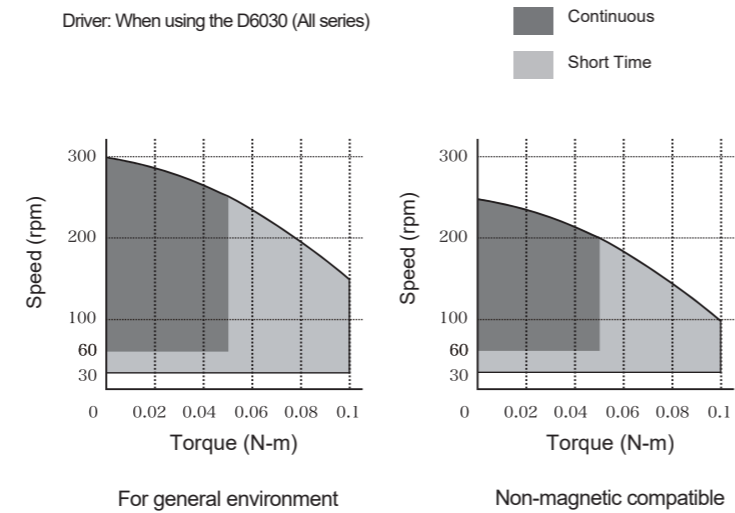
- Inaccurate equipment wiring may cause harm to the driver. Read and understand these instructions before attempting to connect with an external device.
- Always use the designated motor cable. Readjustment is required for the driver when changing the length of the cable. * If you require a change of cable length after purchase, send the motor and driver to our company. In such case, you will be charged for the adjustment.
- Use shielded wire for signal cables for CW, CCW and speed command voltage to prevent noise.
- Power for the driver: 24 VDC has sufficient allowance for current capacity. Please use ones with less ripple. (1.5A or more)
- Excessive inertial load will cause motor slippage when starting or stopping the motor. This slippage will cause wear on the motor and shorten working life.
- Avoid continuous operation in excess of rated load torque. It will cause wear on the motor parts and shorten working life. * When the motor is overloaded, the driver overload display LED (red) will light up and the motor will stop. When the overload display LED (red) lights, turn OFF the power connected to the driver. Eliminate the cause before turning the power ON again.
- The ultrasound motor operates under friction drive causing a larger calorific value. Sufficient measures must be taken for heat dissipation of motor and driver. Fix onto metal plate or metal chassis with good thermal conductivity to prevent case surface temperature from exceeding 55 °C.
- When using or storing motor, ensure that the humidity of the surrounding area is below 45 %.
- The dimensional tolerance of the motor output shaft is set at g6. Avoid press fitting to the counter hole or fitting by pounding. Doing so may cause motor rotation failure.
- Maintain overhang load at the minimum. Permissible load is less than 2 [Kg] at shaft end.
- Maintain thrust load at the minimum. Permissible load is less than 2 [Kg] at shaft end.

4. Motor and Driver Features

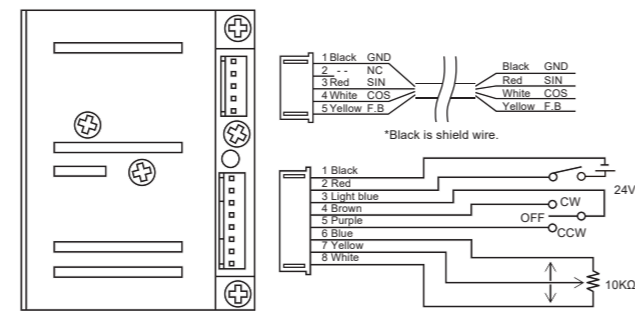
D6030 driver: Torque characteristics when using D6030 are shown in the graph below. When combining USR30 series motor mounted with encoder and D6060E, the property around the minimum speed will improve. The relationship between speed command voltage and motor speed is linear.

The D6030 includes a motor speed change function; however, it does not have a speed stabilization function. The D6030 requires a servo system to stabilize speed.

The D6060E uses an encoder signal installed on the motor to control motor speed. Minimum speed can be set lower than when using the D6060, and the speed control range will be 15 [rpm] to 150 [rpm]. Relationship between speed command voltage and motor speed will be first-order straight line, as shown in the graph.



5. Basic Connection Method



* 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 External control for details.

○ Precautions with Connection

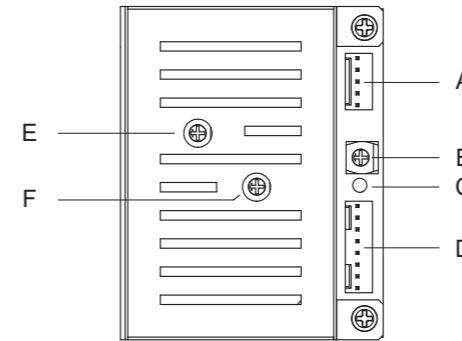
1. Always use the cable provided for the connection of motor and driver. Readjustment of driver is necessary when changing the length of the cable. Refer to How to Adjust the Driver for the readjustment method. * To change the length of the cable after purchase, we ask that you send the motor, driver 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.

6. Names and Functions of Driver Parts

The driver is mounted with an LED that shows the operational status, 3 volumes for adjustment and terminals to connect to the power and motor. Refer to information on the type and color of cables to be connected on the driver panel for accurate connection.

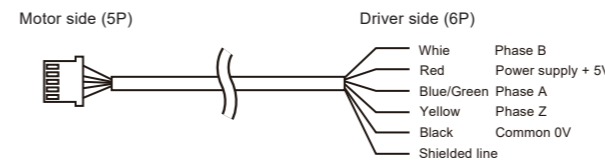
The details of each terminal are as follows:

D6030

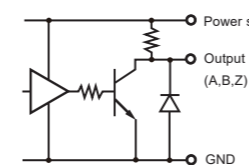


- A: Motor Connection Terminal
Check the color of cable for accurate connection.
- B: Minimum Rotational Speed Setting Volume
No load speed is set at 300 [rpm].
- C: LED Indicator (Red)
Lights when the power is ON.
It will not light when the internal fuse has blown.
- D: Connection terminal to 24 [V] power, start-stop switch and speed setting volume
Refer to the basic connection diagram for the function of pins.
- E: Encoder Connector
This volume knob adjusts rotational difference of CW and CCW.
- F: Maximum Rotational Speed Setting Volume
No load speed is set at 30 [rpm].

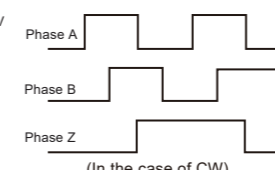
Encoder Cable



Output Circuit



Signal Waveform

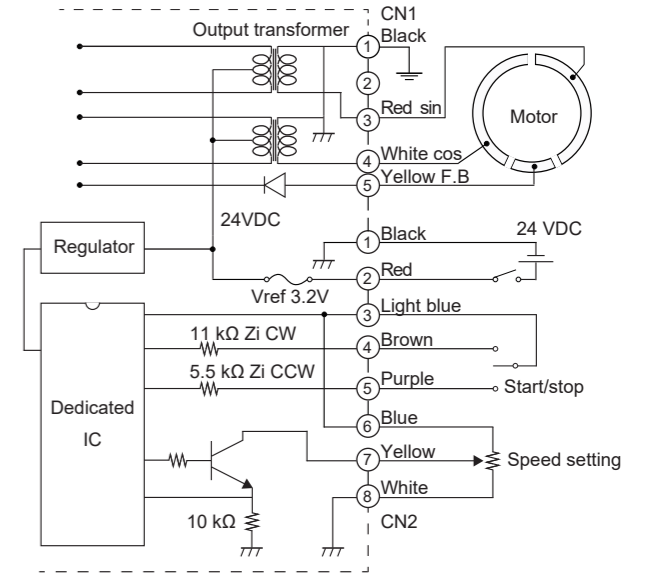


Through output of the encoder is 5V voltage output.

7. Control from External

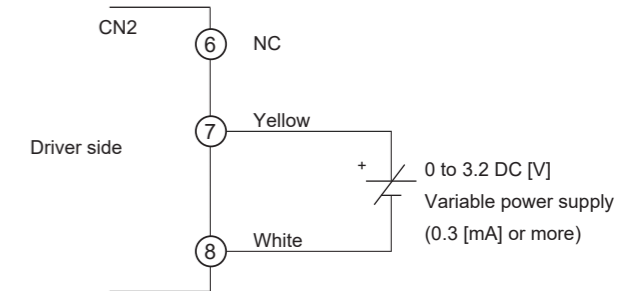
○ Inner Circuit of Driver

- 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 Lo (0 to +0.4 [V]).
* Impedance ④ is 11 [KΩ] and impedance ⑤ is 5.5 [KΩ].

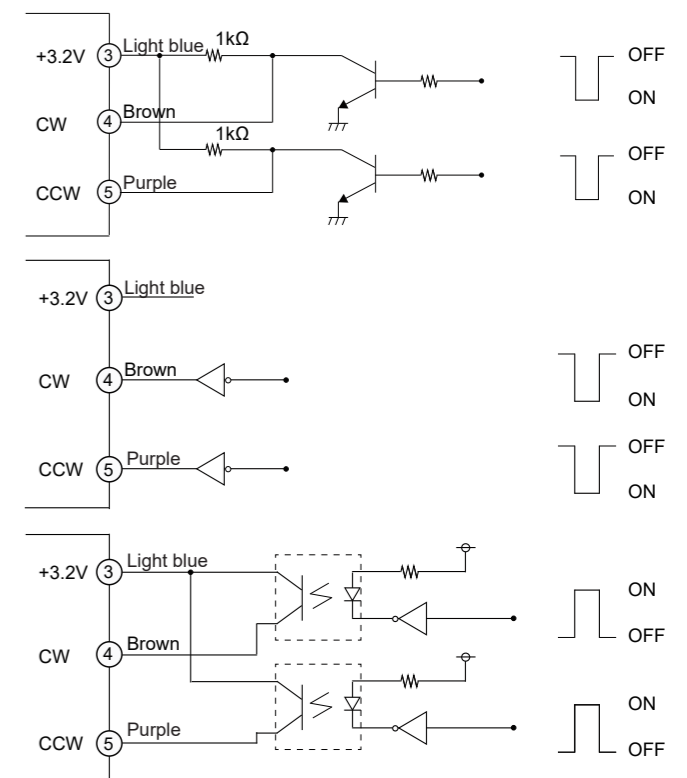


○ Speed Control by External Voltage

- 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. See Timing Chart.

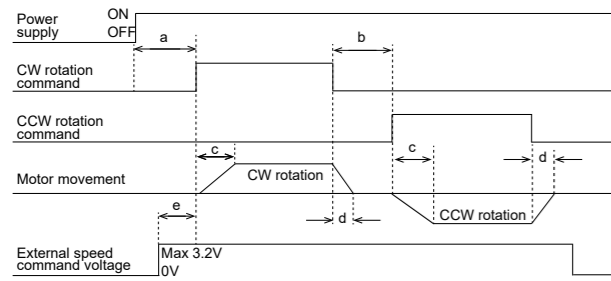


○ Start, Stop and Rotation Direction Switching by External Signal



8. Timing Chart

Operational timing for the D6030 is as described below:



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

9. 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. If for some reason there is a need for adjustment, follow the directions below:

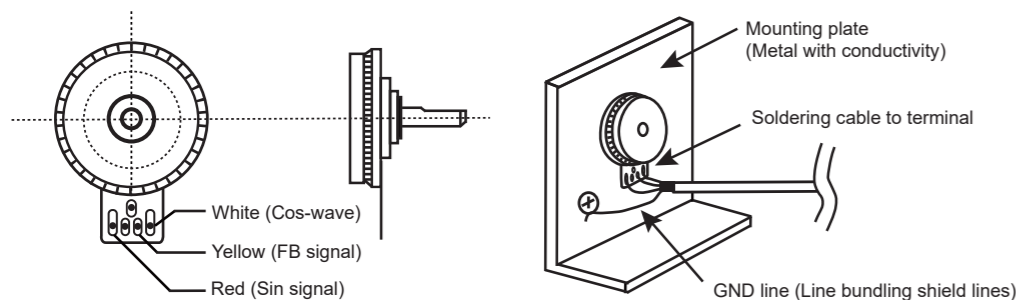
○ What You Need

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

○ Adjustment procedure

- Step 1. Connect frequency meter between GND and Sin (or Cos) of the motor cable. (Be careful with the measuring instrument because of high voltage.)
- Step 2. Connect the speedometer and motor under a no load state.
- Step 3. Adjustment of Minimum Rotational Speed (See E in the driver detail diagram)
Give rotation command to the CW direction with speed setting volume of the external at minimum, or with external speed command voltage as 0 [V]. Adjust Volume E (turn clockwise to increase speed) to 30 [rpm] under this condition. Ensure that the drive frequency for the USR30 series is between 51 and 52 [KHz].
- Step 4. Adjustment of Maximum Rotational Speed (See D in the driver detail diagram)
Give rotation command to the CW direction with external speed setting volume at maximum, or external speed command voltage at 3.2 [V]. Under this condition, adjust volume D (speed increase when turning clockwise) to set the speed between 280 and 300 [rpm]. Ensure that the drive frequency for the USR60 series is somewhere around 50 to 51 [KHz].
- Step 5. Balance Correction (See C in the driver detail diagram)
Change the rotation direction of the CW/CCW and adjust volume C to ensure the same maximum speed for CW and CCW. Maximum speed changes according to the amount of change of volume C; repeat steps 4 and 5 to ensure the maximum speed for CW and CCW are the same.

*How to Connect to USR30-B3 / B4

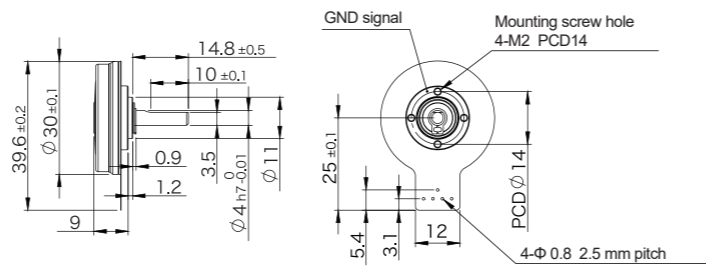


* The driver power side of the motor cable is connected with a connector; however, on the motor side, it must be connected directly by soldering. In such case, solder ③ sin red, ④ cos white and ⑤ F.B yellow on the designated position of the FPC input area, and connect ① GND shield line somewhere on the metallic case with conduction attained with motor installation surface.

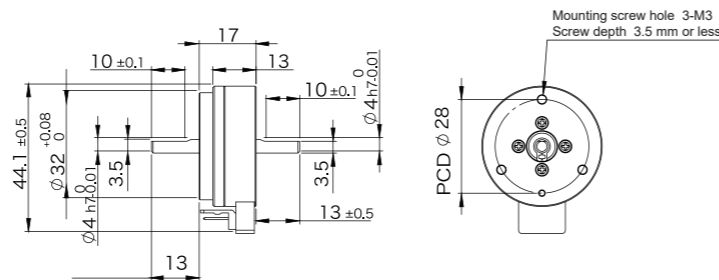
10. Motor and Driver Specifications

USR30 Series Motor

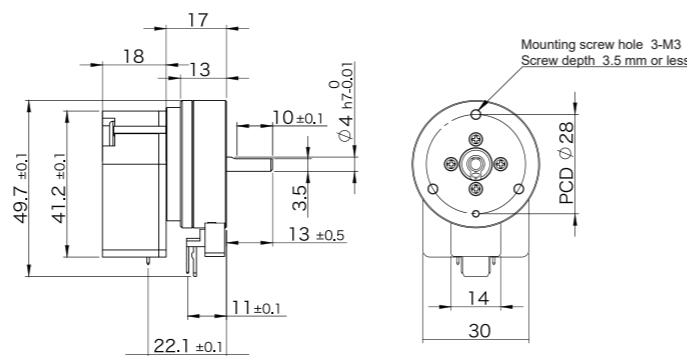
USR30-B3



USR30-B3 / S4 / S3N / S4N



USR30-B3 / E3T / E3N / E3NT

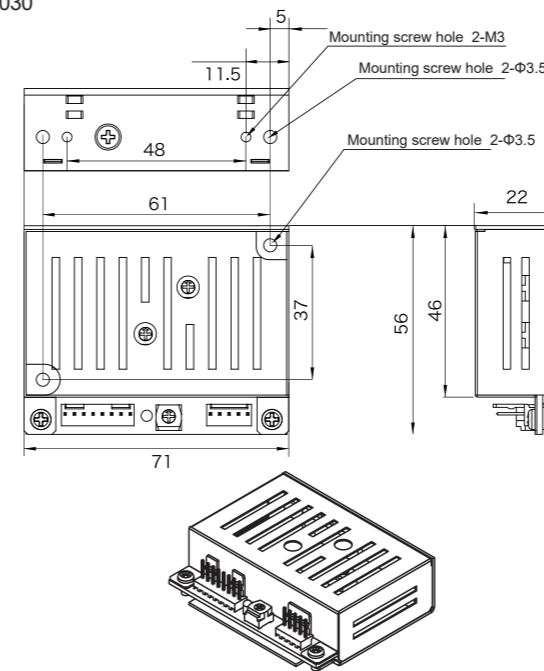


USR30 Series Specification Table

Model Name	Motor for General Environment						Non-Magnetic Compatible Motor			
	USR30-B3	USR30-B4	USR30-S3	USR30-S4	USR30-E3	USR30-E3T	USR30-S3N	USR30-S4N	USR30-E3N	USR30-E3NT
Drive Frequency	49 KHz to 55 KHz						49 KHz to 55 KHz			
Drive Voltage	110 Vrms						110 Vrms			
Rated Output	1.3 W						1.0 W			
Maximum Output	2.5 W (by Maximum Load)						2.0 W (by Maximum Load)			
Rated Speed	250 rpm						200 rpm			
Maximum Speed	300 rpm						250 rpm			
Rated Torque	0.05 N-m (5.0 Kg-cm)						0.05 N-m (5.0 Kg-cm)			
Maximum Torque	0.1 N-m (1.0 Kg-cm)						0.1 N-m (1.0 Kg-cm)			
Holding Torque	0.1 N-m (1.0 Kg-cm)						0.1 N-m (1.0 Kg-cm)			
Response	1 ms or less (with no load)						1 ms or less (with no load)			
Direction of Rotation	CW, CCW						CW, CCW			
Operational Temperature Range	-10 °C to +55 °C						-10 °C to +55 °C			
Temperature Limit	Surface of Stator 70 [°C], Surface of Case 60 [°C]						Surface of Stator 70 [°C], Surface of Case 60 [°C]			
Operational Humidity Range	0 to +45 % (No condensation)						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	17 g	19 g	43 g	45 g	64 g	64 g	48 g	50 g	69 g	69 g
Remarks	Single Shaft	Double Shaft	Single Shaft	Double Shaft	Encoder resolution:500 P/R	Encoder resolution:1,000 P/R	Single Shaft	Double Shaft	Encoder resolution: 500P/R	Encoder resolution: 1,000 P/R

Driver for USR30 Series

D6030



D6030 Series Specification Table

Model Name	D6030
Power Supply Voltage	24 V ±0.5 V DC (12 V ±0.5 V DC)
Oscillation Waveform	Pseudo Sine Wave
Oscillation Frequency	47 KHz to 52 KHz
Speed Adjustment Method	Frequency Change
Frequency Control	Automatic Tracking Method Using Feedback of Amplitude by Vibration
Motor Drive Voltage	110 Vrms
Consumption Current	24 VDC: 0.8 A / 12 VDC: 1.5 A (Maximum)
Over Current Protection	24 V: 0.8 A (φ5.2 Midget Fuse) 12 V: 1.5 A (φ5.2 Midget Fuse)
Insulation Resistance	10 MΩ or more (Motor Unconnected)
Withstand Voltage	1 KVAC (Motor Unconnected)
Storage Temperature Range	-20 °C to +80 °C
Operational Temperature Limit	-10 °C to +55 °C
Start-Stop Control	Switching Voltage (Prepare separately when using switch)*
Start-up Response	50 ms or less (with no load)
Stopping Response	1 ms or less (with no load)
No-load Adjustable Speed Range	30 rpm to 300 rpm
Speed Setting External Voltage	0 V to 3.2 V DC
Recommended Switch	Toggle Switch (ON-OFF-ON)
Recommended Volume	10 KΩ, 0.1 W, B type (Must be prepared separately)
Weight	105 g
Outline Size	(Vertical) 22 × (Horizontal) 70 × (Height) 56 [mm]
Remarks	* See [7.Control from External]

11. Warranty

Guarantee period is one year or 1,000 hours of operation, whichever comes first. Malfunction during the guarantee period which is clearly caused by us will be repaired or replaced free of charge. The product is manufactured under the strictest quality control system. Should you experience product malfunction, check the following points and contact us.

1. Model (Example: USR60-S3)
2. Serial number
3. Operating time
4. Place of purchase
5. State of malfunction



Precautions Please give particular care to the points described below:

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.

■Sales/Manufacturer■



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