

FBL II Series

The **FBL II** series consists of a high performance, compact, brushless DC motor and driver. This product is available with 75W and 120W output power.

For easy installation, the motor and gearhead come pre-assembled.



Product Number Code

FBL 5 75 A W - 5

Number: Gear Ratio
A: Round Shaft Type
W: Conform to standards
Voltage A: Single-Phase 100V-115V
C: Single-Phase 200V-230V
S: Three-Phase 200V-230V

Output Power **75:** 75W
120: 120W

Motor Frame Size **5:** 3.54 in. sq (90 mm sq.)

FBL II series

* Approved product names under all safety standards will refer to motor units and driver units.

Features

- The high power, compact brushless DC motor and driver allow the user to easily downsize applications.
- In addition to offering a wide speed control range from 300r/min to 3000r/min, the motor generates constant torque across the entire speed range.
- The driver is provided with an acceleration/deceleration function which makes it possible to start and stop the motor smoothly.
- Geared types use specially designed high-strength **GFB** gearheads that provide maximum permissible torques of 260 lb-in (30N·m).
- Excellent speed fluctuation characteristics of -1% maximum with load, $\pm 1\%$ maximum with voltage and $\pm 1\%$ maximum with temperature.
- The distance between the motor and the driver can be extended up to 35ft. (10.5m) by using an optional extension cable.

Safety Standards

The design conforms to typical global safety standards. Applications have been made for UL, CSA and EN standard approvals.

CE Marking

The CE Marking is being used in accordance with the low voltage directive.

Safety Standards and CE Marking

	Standards	Certification Body	Standards File No.	CE Marking
Motor	UL1004	UL	E62327	Low Voltage Directive
	CAN/CSA-C22.2 No. 100			
	EN60950	DEMKO*	124888/DK 98-03353	
EN60034-1 EN60034-5				
Driver	UL508C	UL	E171462	Low Voltage Directive
	CAN/CSA-C22.2 No.14			
	EN60950	DEMKO*	124886/DK 98-03350	

* Three-Phase 200-230V type conform to EN standards (EN certifications are scheduled).

- Recognized name and certified name of each safety standards are motor model name and driver name.
- For installation conditions for EN/IEC standards, see page D-2.

Combination type

The combination type come with the motor and its dedicated gearhead already assembled. This simplifies installation in equipment. Motors and gearheads are also available separately so they can be on hand to make changes or repairs.



Install the motor and gear combination using the four hexagonal socket head screws ①.
To replace the gearhead, remove the two small screws ②.

Product Lines

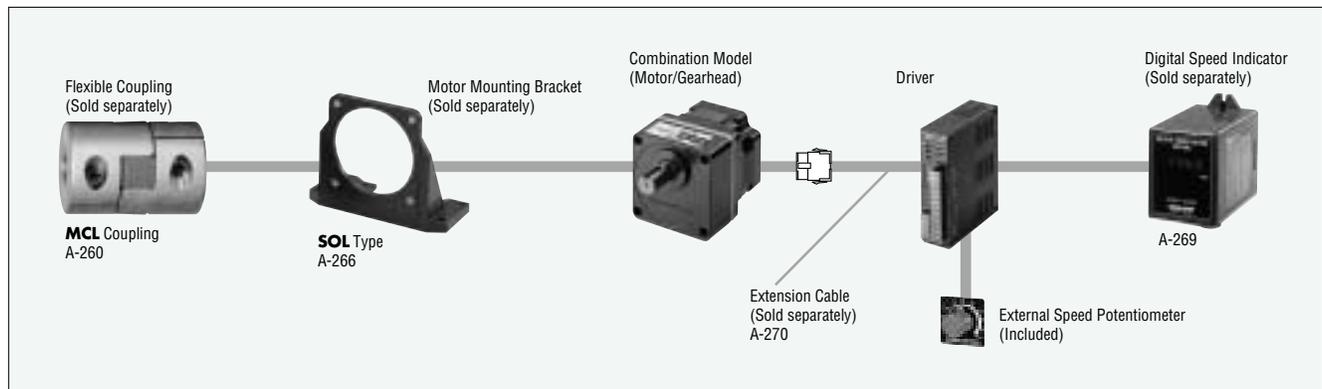
Combination Models

Voltage	Output Power		Model
	HP	W	
Single-Phase 100V-115V	1/10	75	FBL575AW-5, 10, 15, 20 FBL575AW-30, 50, 100, 200
		1/6	120
	1/10		75
		1/6	120
Three-Phase 200V-230V	1/10		75
		1/6	120

Round shaft Models

Voltage	Output Power		Model
	HP	W	
Single-Phase 100V-115V	1/10	75	FBL575AW-A
	1/6	120	FBL5120AW-A
Single-Phase 200V-230V	1/10	75	FBL575CW-A
	1/6	120	FBL5120CW-A
Three-Phase 200V-230V	1/10	75	FBL575SW-A
	1/6	120	FBL5120SW-A

Construction



Specifications



		1/10 HP 75W			1/6 HP 120W		
		Single-phase 100V-115V ± 10%	Single-phase 200V-230V ± 10%	Three-phase 200V-230V ± 10%	Single-phase 100V-115V ± 10%	Single-phase 200V-230V ± 10%	Three-phase 200V-230V ± 10%
Model	Combination Type	FBL575AW -□	FBL575CW -□	FBL575SW -□	FBL5120AW -□	FBL5120CW -□	FBL5120SW -□
	Round Shaft Type	FBL575AW-A	FBL575CW-A	FBL575SW-A	FBL5120AW-A	FBL5120CW-A	FBL5120SW-A
Rated Speed	r/min	3000					
Rated Torque	oz-in (N·m)	34.7 (0.25)			55.5 (0.4)		
Starting Torque	oz-in (N·m)	44.4 (0.32)			69.4 (0.5)		
Variable Speed Range	r/min	300~3000					
Permissible Inertial Load J* ¹	oz-in ² (kgm ²)	20.5 (3.75×10 ⁻⁴)			30.7 (5.6×10 ⁻⁴)		
Acceleration/Deceleration Time		0.5~15 sec. (at 3000 r/min)					
Speed Regulation	Load	-1% Max. (0~rated torque, at 3000 r/min)					
	Voltage	±1% Max. (Power supply voltage ±10%, at 3000 r/min with no load)					
	Temperature	±1% Max. (32°F~+104°F/0°C~+50°C) at 3000 r/min with no load					
Input Power	Voltage	Single-phase 100V-115V ± 10%	Single-phase 200V-230V ± 10%	Three-phase 200V-230V ± 10%	Single-phase 100V-115V ± 10%	Single-phase 200V-230V ± 10%	Three-phase 200V-230V ± 10%
	Frequency	50/60Hz					
	Maximum Input Current	2.6A	2.0A	1.2A	3.8A	1.6A	1.6A
Motor Insulation Class		Class E [248°F(120°C)]* ³					
Speed Control Method		1. By built-in potentiometer 2. By external potentiometer (20 kΩ, 1/4W) 3. By DC voltage (0~5V DC)					
Input Signal		Photocoupler Input Input Impedance 4.8 kΩ, 21.6~26.4V DC EXT, VR, CW, CCW, SLOW DOWN					
Output Signal		Open Collector Output External Use Condition 24V DC, 10mA Max. SPEED OUT, ALARM OUT					
Protection Functions* ²		When the following are activated, the alarm signal will be output and the motor will come to a stop: <ul style="list-style-type: none"> ●Overload Protection: This will be activated within approximately 5 seconds of the motor load exceeding rated torque. ●Overheat Protection: This will be activated when internal temperature of driver exceeds 162°F (90°C). ●Overvoltage Protection: This will be activated when driving a load exceeding the permissible load inertia, or when motor speed is increased due to gravitational forces. ●Out-of-phase Protection: This will be activated when motor signals are abnormal, due to disconnection of cable, etc. ●Under Voltage Protection: This will be activated when a input voltage to the driver is less than specifications voltage. 					
Rating		Continuous					

*1: The permissible inertial load specified above is only applicable for round shaft type.

*2: With the **FBLII** series, motor speed cannot be controlled in applications where the motor's shaft is turned by the load, as in lowering operations. Also, to prevent damage to the driver during lowering operations, the motor comes to a natural stop if the primary voltage of the driver's inverter e exceeds the permissible value.

*3: Motor insulation is recognized as class A (105°C) by UL and CSA standards.

General Specifications

Item	Motor	Driver
Insulation Resistance	100M Ω or more when 500V DC is applied between the windings and the frame.	100M Ω or more when 500V DC is applied between the power supply input terminal and the P.E. terminal (I/O terminal).
Dielectric Strength	Sufficient to withstand 1.5kV at 50Hz applied between the windings and the frame for 1 minute.	Sufficient to withstand 1.8kV (3kV) AC at 50Hz applied between the P.E. terminal (I/O terminal) and the power supply input terminal for 1 minute.
Operating Environmental Conditions	Ambient Temperature	32°F~122°F (0°C~+50°C), nonfreezing
	Humidity	85% maximum, noncondensing
	Atmosphere	No corrosive gases or dust
Degree of Protection	IP40	IP10

■ Gearmotor — Torque Table

Unit = Upper value: lb-in/Lower values: N·m

Gear Ratio		5	10	15	20	30	50	100	200
Model	Speed Range r/min	60~600	30~300	20~200	15~150	10~100	6~60	3~30	1.5~15
FBL575AW- <input type="checkbox"/>		9.8	20	29	39	56	93	187	260
FBL575CW- <input type="checkbox"/>		1.1	2.3	3.4	4.5	6.5	11	22	30
FBL575SW- <input type="checkbox"/>									
FBL5120AW- <input type="checkbox"/>		16	31	47	62	89	149	260	260
FBL5120CW- <input type="checkbox"/>		1.8	3.6	5.4	7.2	10	17	30	30
FBL5120SW- <input type="checkbox"/>									

- Enter the gear ratio in the box () within the model number. A colored background indicates gear shaft rotation in the same direction as the motor shaft; a white background indicates rotation in the opposite direction.

■ Permissible Overhung Load · Permissible Thrust Load

Unit = Upper value: lb. / Lower value: N

Gear Ratio		5	10	15	20	30	50	100	200
Permissible Thrust Load		33 150							
Permissible Overhung Load [0.4 in. (10mm) from shaft end]		66 300		88 400				110 500	
Permissible Overhung Load [0.8 in. (20mm) from shaft end]		88 400		110 500				143 650	

- Enter the gear ratio in the box () within the model number.

■ Permissible Inertial Load (J)

Unit = Upper value: lb-in² / Lower values: ×10⁻⁴kgm²

Model	Gear Ratio	5	10	15	20	30	50	100	200
FBL575AW- <input type="checkbox"/>									
FBL575CW- <input type="checkbox"/>		8.5	34	76.5	136	306	850	850	850
FBL575SW- <input type="checkbox"/>									
FBL5120AW- <input type="checkbox"/>		25	100	225	400	900	2500	2500	2500
FBL5120CW- <input type="checkbox"/>									
FBL5120SW- <input type="checkbox"/>									

- Enter the gear ratio in the box () within the model number.

■ Torque — Speed Characteristics

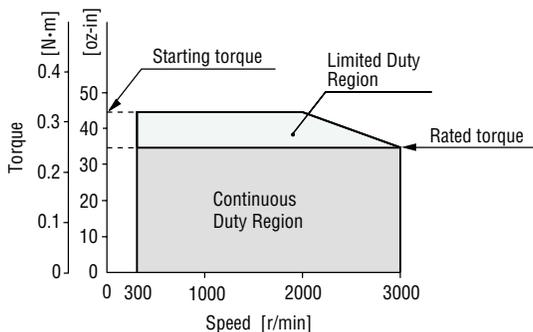
● Continuous Duty Region

Continuous operation is possible in this region.

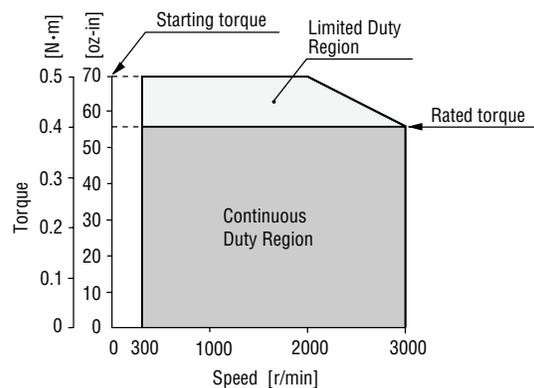
● Limited Duty Region

This region is used primarily when accelerating. When a load that exceeds the rated torque is applied continuously for approximately 5 seconds, overload protection is activated and the motor comes to stop.

FBL575AW-**/FBL575CW-****/FBL575SW-**
FBL575AW-A/FBL575CW-A/FBL575SW-A



FBL5120AW-**/FBL5120CW-****/FBL5120SW-**
FBL5120AW-A/FBL5120CW-A/FBL5120SW-A

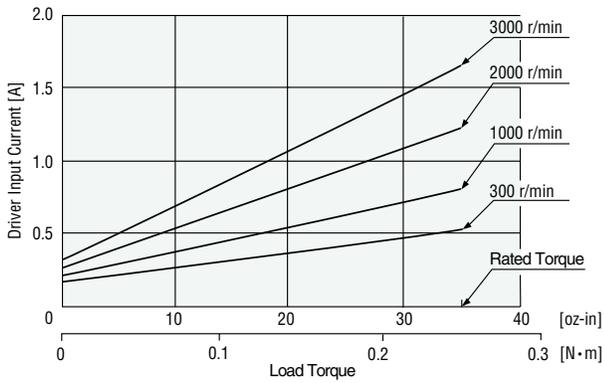


■ Load Torque - Driver Input Current Characteristics

Driver input current of brushless DC motors varies with the load torque. Load torque is roughly proportional to driver input current. These characteristics may be used to estimate load torque from the driver input current. It is valid only when the motor is rotating at a steady speed. Starting and bi-directional motions require greater current input, so the relationship does not apply to these operations.

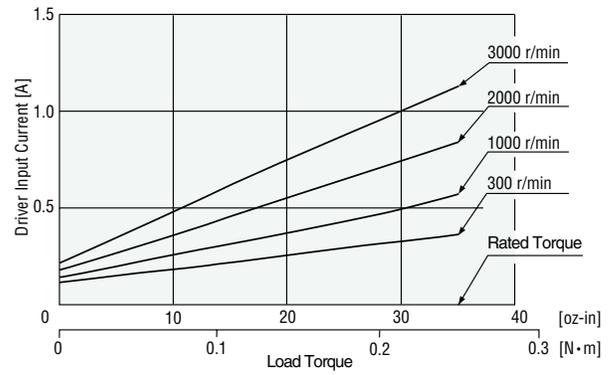
FBL575AW-□

FBL575AW-A



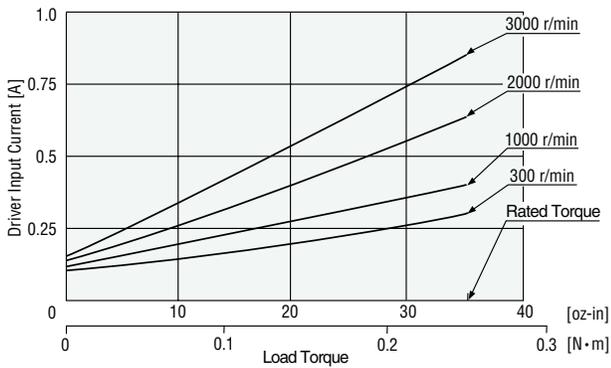
FBL575CW-□

FBL575CW-A



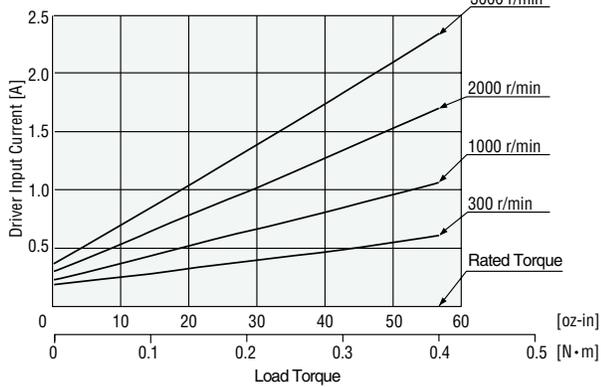
FBL575SW-□

FBL575SW-A



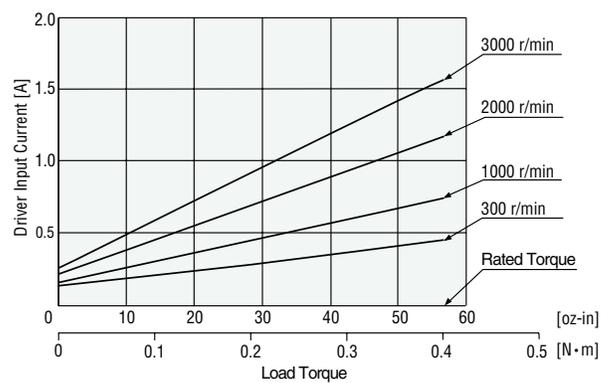
FBL5120AW-□

FBL5120AW-A



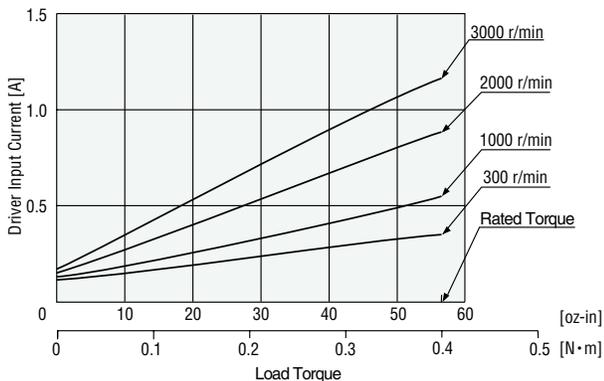
FBL5120CW-□

FBL5120CW-A



FBL5120SW-□

FBL5120SW-A



Operation of FBL II Series

Driver Functions

Built-in Potentiometer	
Display	Function
SS	Timing Potentiometer for Acceleration
SD	Timing Potentiometer for Deceleration
SPEED	Speed Potentiometer

For Motor Connector

Power Supply Terminal



LED Display		
Display	Function	Lighting Condition
POWER	Power Indicator	Lights when the power is ON.
ALARM	Alarm Indicator	<ul style="list-style-type: none"> ● When a load exceeding the rated torque is applied to the motor for 5 seconds or more. ● When the driver's internal temperature exceeds approximately 162°F (90°C). ● When the motor is driving an inertial load exceeding the permissible inertial load, or when the motor shaft is turned by the load (during lowering operation). ● When there is an abnormality in the motor's feedback signals due to disconnection of the motor cable, etc. ● When an input voltage to the driver is less than specification voltage.

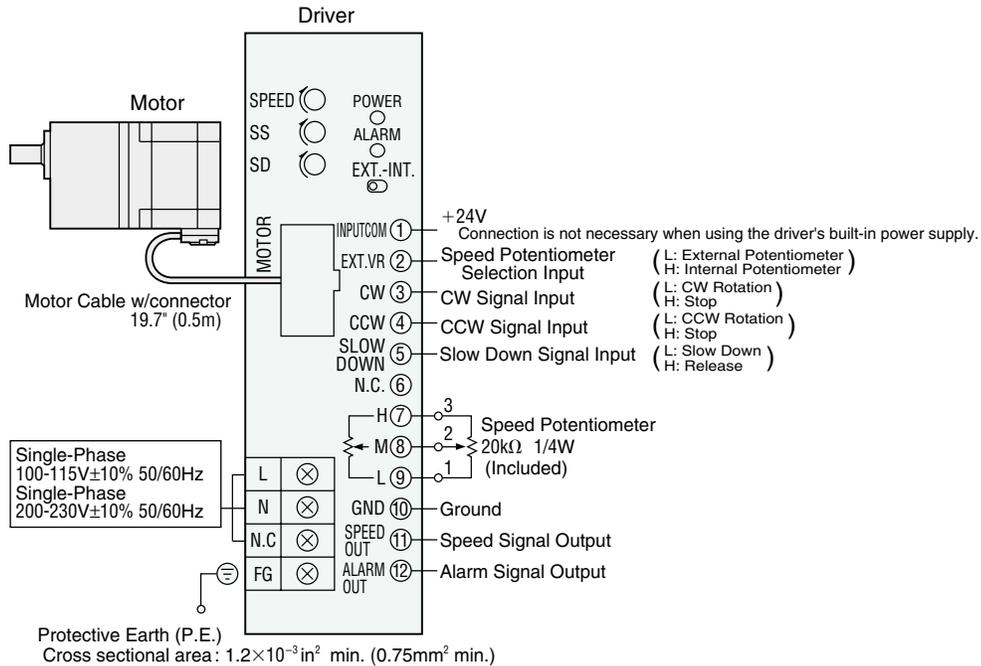
I/O Power Supply Switch	
Display	Function and Operation
EXT	When controlling from a PLC or other external power supply. (Set at time of shipment)
INT	When controlling with a relay or switch. (Driver built-in power supply)

When the switch is set to EXT, the input circuit is insulated by the photocoupler. However when the switch is set to INT, the input circuit is not insulated, so the system will not work, even if an input signal is input, unless GND is connected to a PLC.

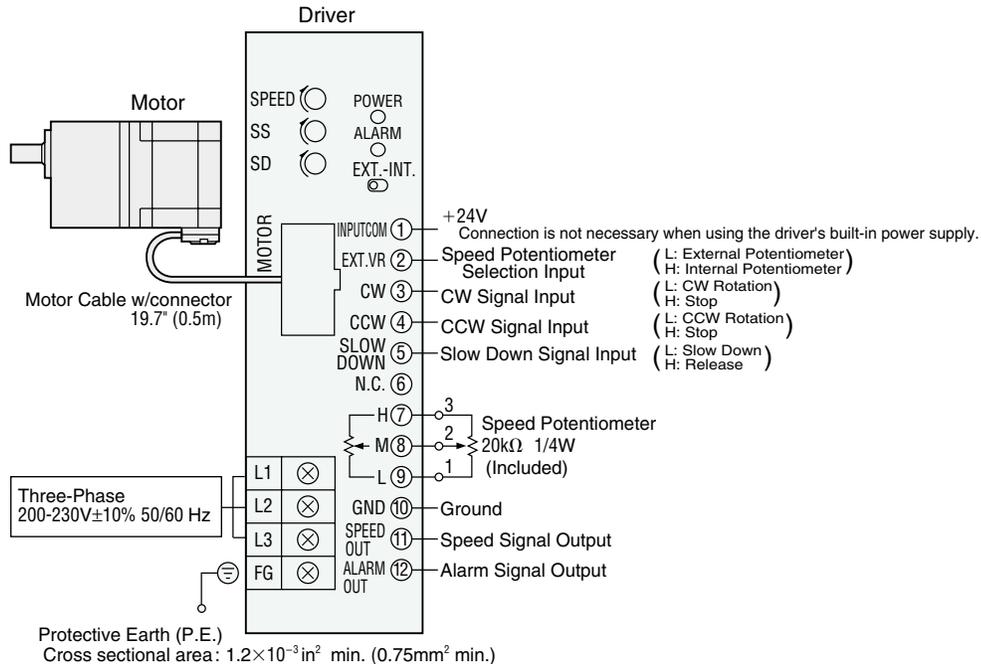
Input/Output Signal Terminals		
Display	Signal	Function and Operation
INPUT COM	Power Supply for Input Signal	External DC power supply +24V A connection is not necessary when using the driver's built-in power supply.
EXT. VR	Speed Potentiometer Selection Input	Input signal for selecting built-in or external speed potentiometer.
CW	CW Rotation Input	Input signal for selecting CW rotation/stop.
CCW	CCW Rotation Input	Input signal for selecting CCW rotation/stop.
SLOW DOWN	Deceleration Input	Input terminal for decelerating the motor to a stop.
N.C	—	Not used.
H M L	Speed Control Input	Used when controlling the speed by the external potentiometer or DC voltage without use of the built-in potentiometer.
GND	Ground	Ground terminal for input/output signals.
SPEED OUT	Speed Signal Output (Open-Collector Output)	Used when monitoring the rate of rotation; 12 pulses are output for each motor rotation.
ALARM OUT	Alarm Signal Output (Open-Collector Output)	This signal is output when the protection functions are activated. The ALARM LED lights and the motor comes to a stop. To reset, cut the power for 10 seconds, then turn motor on again.

■ Wiring Diagrams

FBL575AW, FBL575CW Type FBL5120AW, FBL5120CW Type



FBL575SW, FBL5120SW Type



Note:

- Motor cable should be no more than 34 ft. (10.5m) in length. The motor comes equipped with a 1.6 ft. (0.5m) long connector-equipped cable which can be extended by using an optional extension cable. Extension Cable Model (Sold separately)

CC01FBL 3.3 ft. (1m)	CC05FBL 16.4 ft. (5m)
CC02FBL 6.6 ft. (2m)	CC07FBL 23.0 ft. (7m)
CC03FBL 9.8 ft. (3m)	CC10FBL 32.8 ft. (10m)

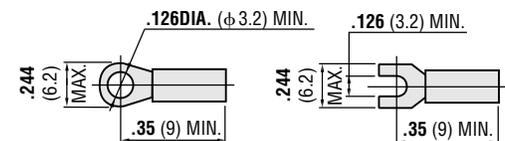
See page A-147 for more information.

Tests using a noise simulator have confirmed that the motor will operate without error even if a noise of 500V, 1μF is applied to the motor lead wires. However, protection against external noise is recommended.

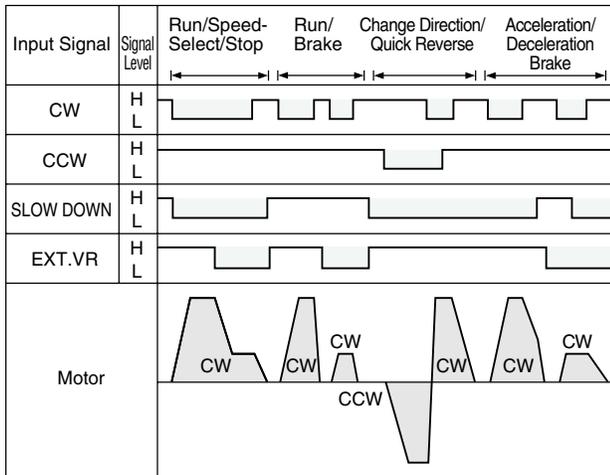
- Signal wires and motor wires should be kept away from equipment, power cables and other sources of magnetic noise.

● Suitable crimp-style terminals Unit = inch (mm)

Ring type terminal with insulation U type terminal with insulation



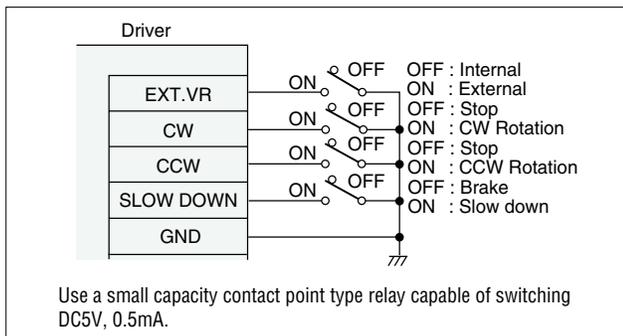
Signal Input Timing Chart



- All operations of run, stop, direction change, deceleration and instantaneous stop can be controlled by the input signals of CW, CCW and SLOW DOWN.
- If the CW input is set to "L" level, the motor rotates in a clockwise direction as viewed from the shaft end of the motor; if the CW input is set to "H" level, the motor stops. If the CCW input is set to "L" level, the motor rotates in the counterclockwise direction as viewed from the shaft end of the motor; if the CCW input is set to "H" level, the motor stops. If both of the CW and CCW input are set to "L" level, the motor rotates in the clockwise direction. The acceleration time is set by the built-in acceleration potentiometer (SS).
- If the SLOW DOWN input is set to "L" level, the deceleration time is the value set by the built-in deceleration potentiometer (SD); if this input is set to "H" level, the motor stops instantaneously.
- If the EXT. VR input is set to "L" level, the external speed potentiometer or external DC voltage can be selected; if this input is set to "H" level, the built-in speed potentiometer is selected.

Controlled by Small Capacity Relays

Flip the I/O power supply switch to "INT.".

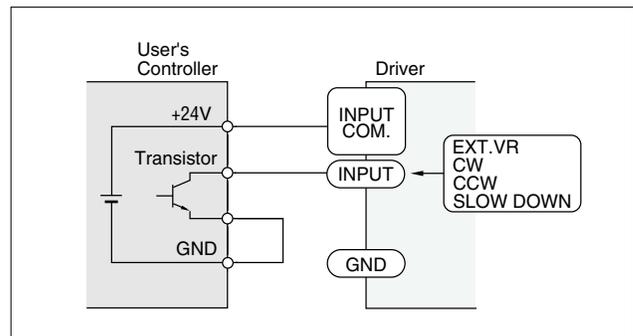


Precautions for Operation

1. Pay attention to the temperature rise of the motor when used in applications requiring short cycles or bi-directional operation.
2. Operate the motor so that the temperature of the motor case remains below 162°F (90°C) and the temperature of the driver remains 176°F (80°C). If the temperature of the heat radiating plate in the driver exceeds 162°F (90°C), the overheat protection activates and stops the motor.
3. **FBL II** series motors cannot be used for lowering the load or other operations in which the load exerts a rotational force on the motor shaft, since this causes the inverter's primary voltage in the driver to exceed permissible levels, damaging the driver.

Control by Transistor type PLC

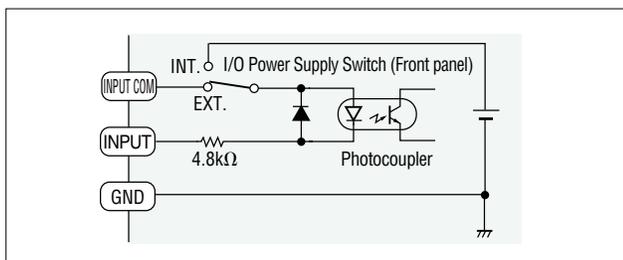
Flip the I/O power supply switch to +24V (set at time of shipment).



Input / Output Signal Circuit

Input Signal Circuit

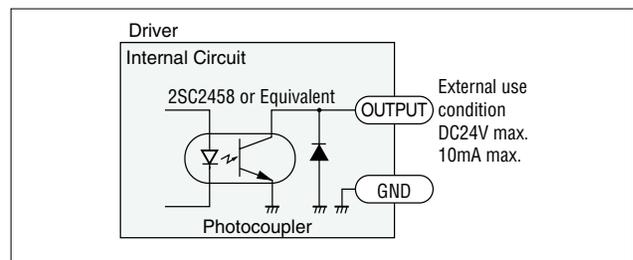
Common to EXT. VR, CW, CCW and SLOW DOWN



- If the controller will be supplying the power for this circuit, set the EXT-INT to the EXT. position.

Output Signal Circuit

Common to SPEED OUT and ALARM OUT



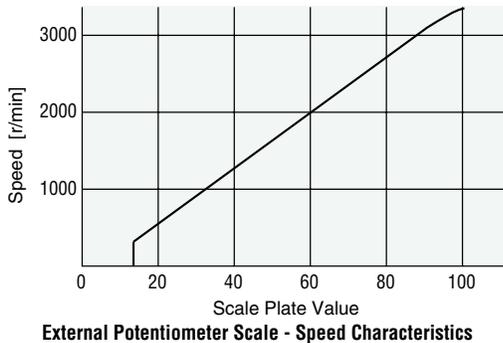
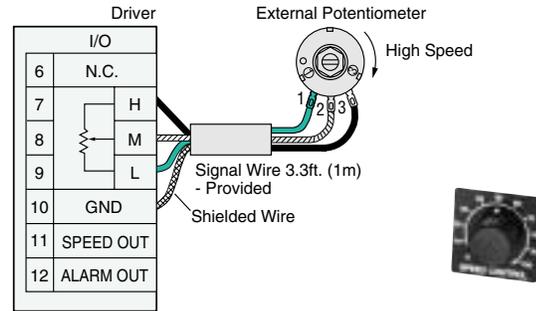
Speed Control

Speed Control by Built-in Potentiometer

Motor speed is adjusted by using a built-in potentiometer located on the front panel. The built-in potentiometer is selected when EXT. VR input has been set to OFF ("H" level).

Speed Control by External Potentiometer

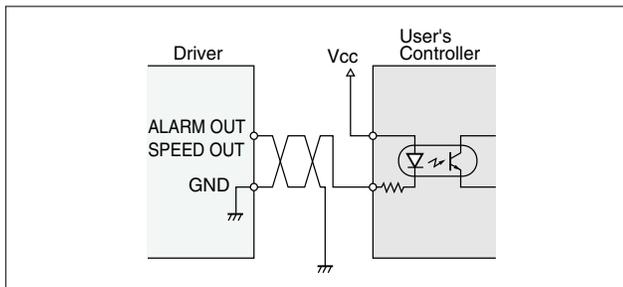
To control the speed of the motor when it is separated from the driver, connect the external potentiometer provided with the motor as follows. The EXT. VR input should be set to ON ("L" level).



Precautions for Connection

Signal wires provided with the products should be used. (0.13in. dia. 3.3ft. long) The shielded wire of the signal line should be connected to the GND terminal. Also ensure that the shielded wire does not come into contact with other terminals on the external potentiometer or DC voltage source.

Connection of Output Signals

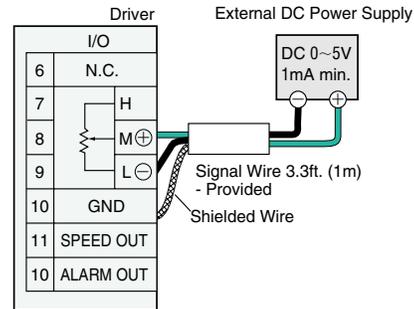


At 24V or less, a current of 10mA or less can be switched on and off at Vcc. This connection is necessary only if the speed monitoring and alarm functions are used.

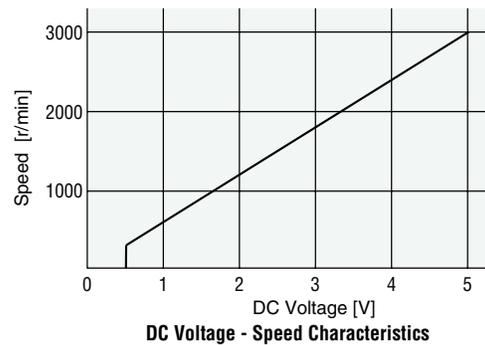
- To check the motor speed visually, connect a speed indicator model **SDM496** (sold separately). See page A-269 for more information.

Speed Control by External DC Voltage

To control the speed of the motor by DC voltage, connect the DC power supply as follows. The EXT. VR input should be set to ON ("L" level).



- Do not allow the voltage to exceed 5V, and be sure there are no errors in polarity when making the connections.



Speed Signal Output:

It is output at a rate of 12 pulses per motor rotation.

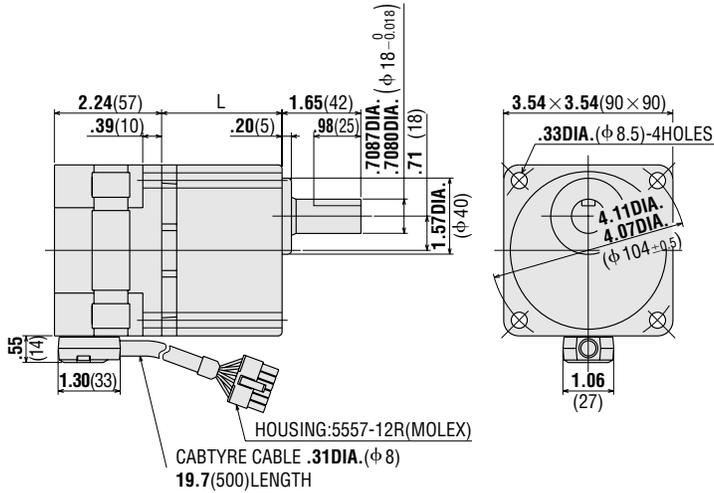
$$\text{Motor speed} = \frac{\text{Speed output cycle rate [Hz]} \times 60 [\text{r/min}]}{12}$$

Alarm Signal Output:

This signal is output when the protection function for overload, overheat, overvoltage or out-of-phase has been activated.

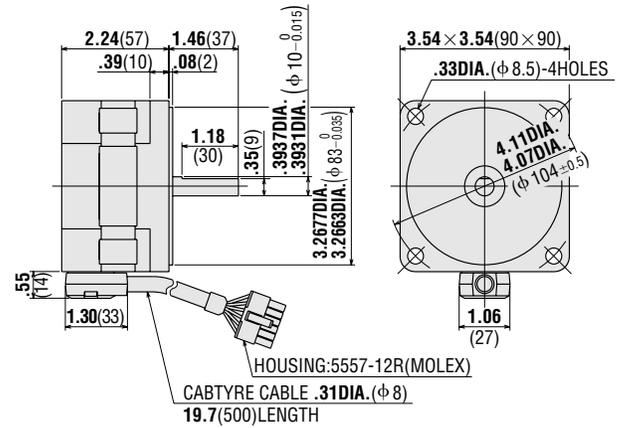
■ Dimensions Scale 1/4, Unit = inch (mm)

FBL575□W-□ (Combination Model) Weight (Mass): 6.6 lb. (3.0 kg)
 Motor: FBLM575W-GFB
 Gearhead: GFB5G□

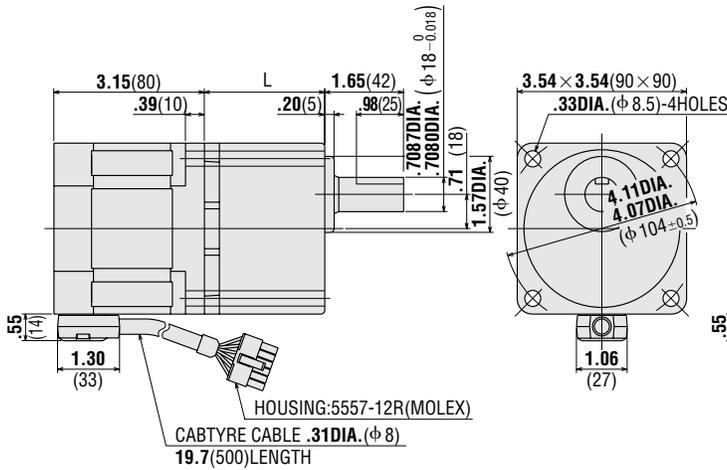


L = 1.77 (45) **FBL575□W-5 ~ 20**
 L = 2.28 (58) **FBL575□W-30 ~ 100**
 L = 2.52 (64) **FBL575□W-200**

FBL575□W-A (Round Shaft Type) Weight (Mass): 3.3 lb. (1.5 kg)
 Motor: FBLM575W-A

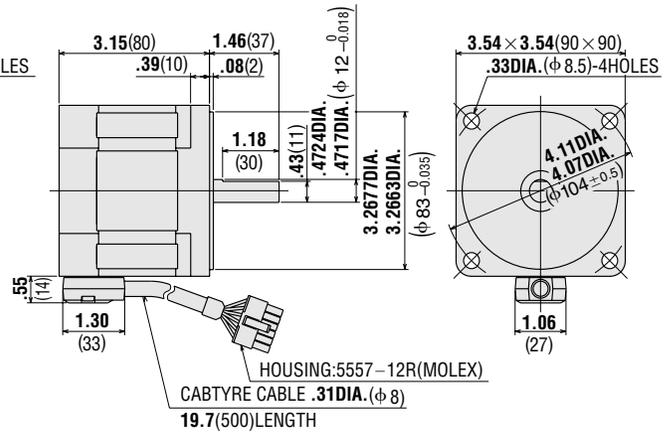


FBL5120□W-□ (Combination Model) Weight (Mass): 8.8 lb. (4.0 kg)
 Motor: FBLM5120W-GFB
 Gearhead: GFB5G□



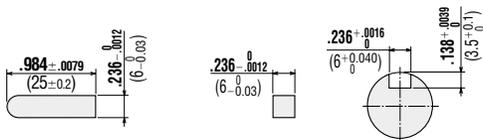
L = 1.77 (45) **FBL5120□W-5 ~ 20**
 L = 2.28 (58) **FBL5120□W-30 ~ 100**
 L = 2.52 (64) **FBL5120□W-200**

FBL5120□W-A (Round Shaft Type) Weight (Mass): 5.5 lb. (2.5 kg)
 Motor: FBLM5120W-A



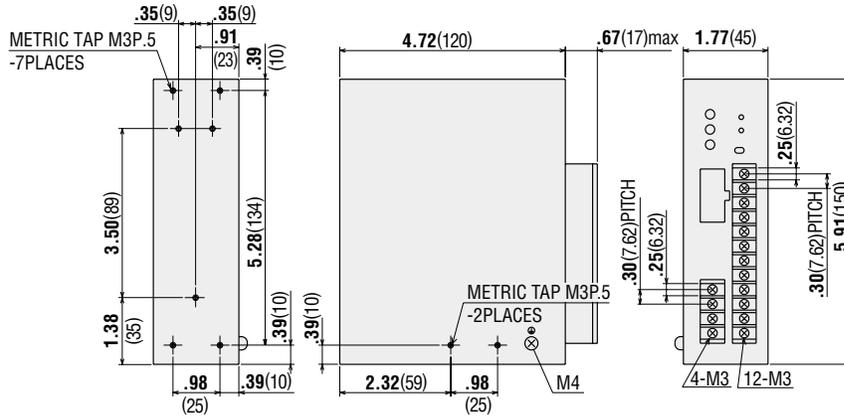
● Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)

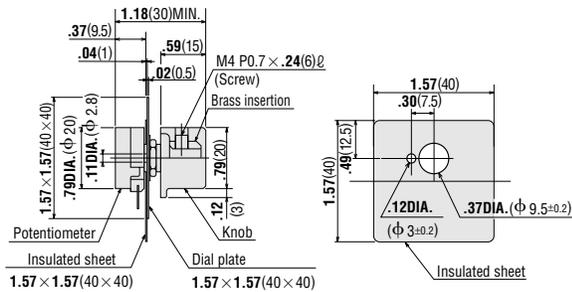


● **Driver**

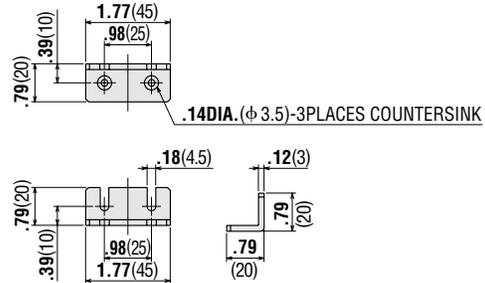
FBLD75AW, FBLD75CW, FBLD75SW
 FBLD120AW, FBLD120CW, FBLD120SW



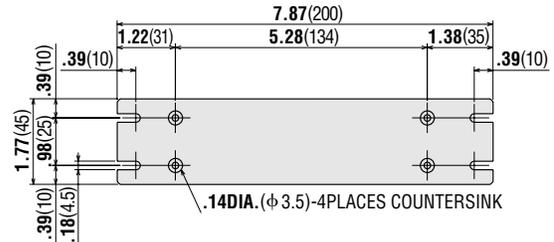
● **External Potentiometer (included)**



● **Driver Mounting Tab (1 set of 2 pieces included)**



● **Driver Mounting Tab (1 piece included)**



■ **List of Motor and Driver Combinations**

Model numbers for motor/driver combinations are shown below.

● **Combination Type**

Output Power HP W	Package Model	Motor Model	Gearhead Model	Driver Model
1/10 75	FBL575AW-□	FBLM575W-GFB	GFB5G□	FBLD75AW
	FBL575CW-□			FBLD75CW
	FBL575SW-□			FBLD75SW
1/6 120	FBL5120AW-□	FBLM5120W-GFB		FBLD120AW
	FBL5120CW-□			FBLD120CW
	FBL5120SW-□			FBLD120SW

● Enter the gear ratio in the box (□) within the model number.

● **Round Shaft Type**

Output Power HP W	Package Model	Motor Model	Driver Model
1/10 75	FBL575AW-A	FBLM575W-A	FBLD75AW
	FBL575CW-A		FBLD75CW
	FBL575SW-A		FBLD75SW
1/6 120	FBL5120AW-A	FBLM5120W-A	FBLD120AW
	FBL5120CW-A		FBLD120CW
	FBL5120SW-A		FBLD120SW

■ Accessories (Sold Separately)

● Motor Mounting Brackets

Optional die-cast aluminum mounting brackets are available. They can be used to install motors without gearheads. See page [A-266] for more information.

Model name: **SOL5M8**



● Flexible Couplings

Optional flexible coupling. See page [A-260] for more information.



● Digital Speed Indicator

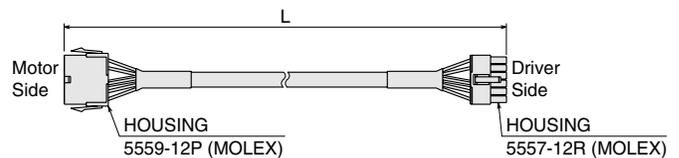
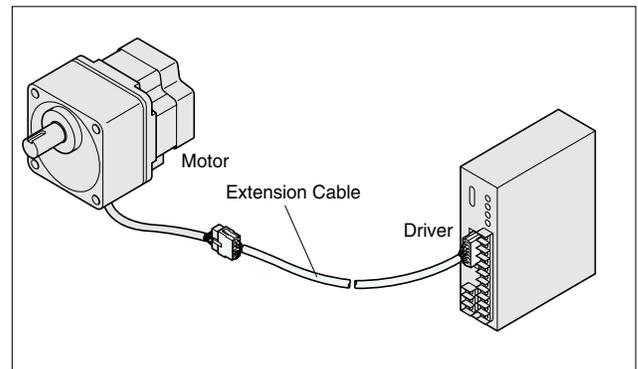
To check the speed of speed control motors, connect the speed indicator. See page [A-269] for more information.

Model name: **SDM496**



● Extension Cable

The motor comes equipped with a 1.6 ft. (0.5m) long cable which can be extended by using an optional extension cable up to 35 ft. (10.5m).



Cable Model	Length		Weight	
	ft.	m	lb.	kg
CC01FBL	3.3	1	0.26	0.12
CC02FBL	6.6	2	0.48	0.22
CC03FBL	9.8	3	0.70	0.32
CC05FBL	16.4	5	1.17	0.53
CC07FBL	23.0	7	1.61	0.73
CC10FBL	32.8	10	2.2	1.0

● Not a standard certified product.

● Din Rail Mounting Bracket

Use when installing the driver on DIN Rail. See page [A-266] for more information.

Model name: **PADPO1**

