Brushless DC Motor Systems

FBLⅡ Series

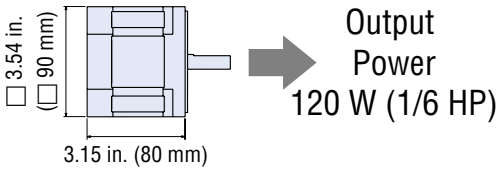
The **FBLⅡ** Series consists of a high performance, compact, brushless DC motor and driver. This product is available with 75 W (1/10 HP) and 120 W (1/6 HP) output power.
For easy installation, the combination type (pre-assembled gearmotors) comes with the motor and gearhead already assembled.

Combination Type (Pre-assembled Gearmotors)
The combination type (pre-assembled gearmotors) 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 repair.

Features

Compact and High Power

The use of brushless DC motor greatly reduces the total motor length while achieving high power. The **FBLⅡ** outputs a high power of 120 W (1/6 HP) with a frame size of 3.54 in. sq. (90 mm sq.) and a total length of 3.15 in. (80 mm), allowing to easily downsize applications.



FBL5120

Excellent Speed Stability

The **FBLⅡ** Series offers excellent speed fluctuation characteristics. Speed fluctuation is only minimally affected by the load.
Speed regulation: with load −1% maximum,
with voltage ±1% maximum,
with temperature ±1% maximum

Wide Range of Speed Control

In addition to offering a wide speed control range from 300 r/min to 3000 r/min, the motor generates constant torque across the entire speed range.

Acceleration and Deceleration Function

The driver is provided with an acceleration/deceleration function which makes it possible to smoothly start and stop the motor.

High Strength Gearheads

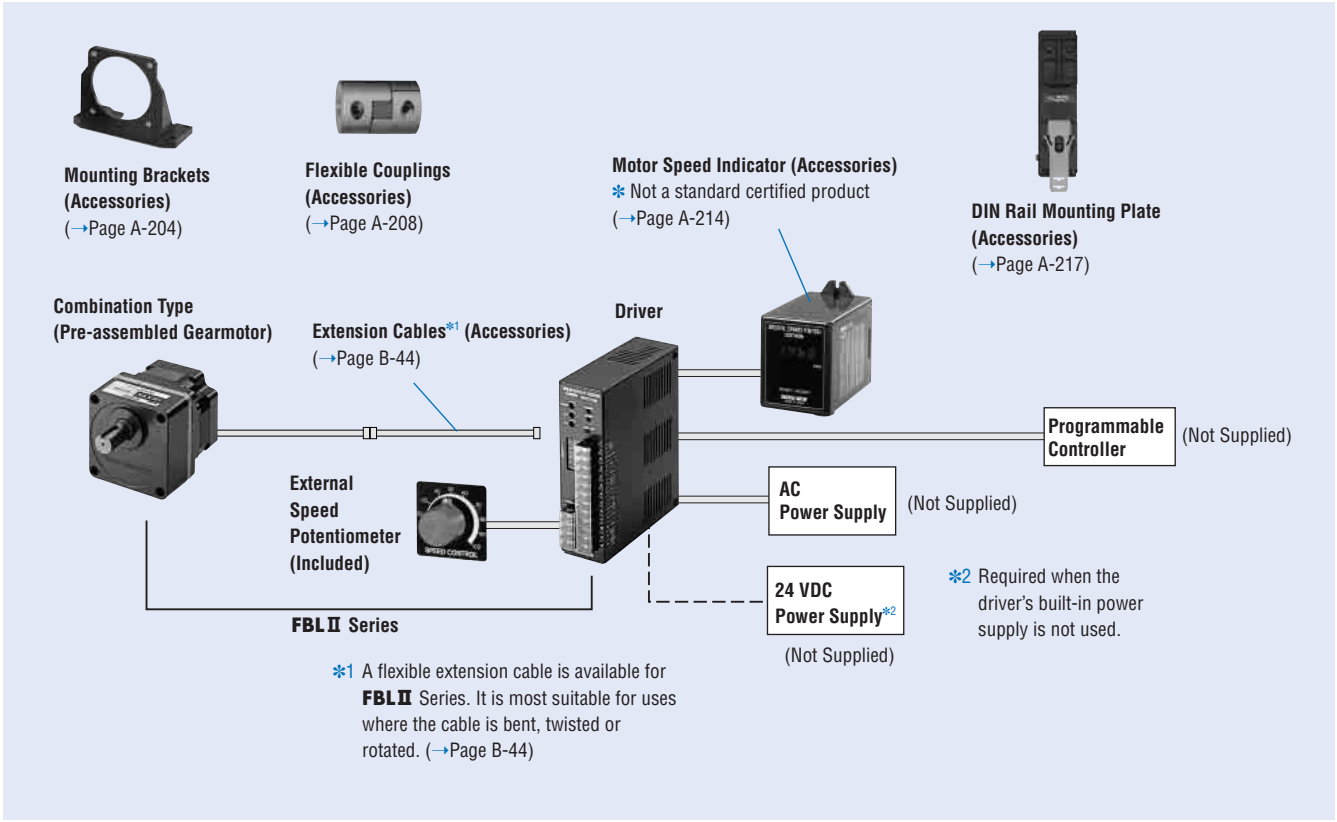
Pre-assembled gearmotors use specifically designed high strength **GFB** gearheads, providing torque of up to 260 lb-in (30 N·m).

Safety Standards and CE Marking

Standards		Certification Body	Standards File No.	CE Marking
Motor	UL1004	UL	E62327	Low Voltage Directives
	CSA C22.2 No.100			
	EN60950	DEMKO	124888	
	EN60034-1	Conform to EN/IEC Standards		
	EN60034-5			
Driver	UL508C	UL	E171462	
	CSA C22.2 No.14			
	EN60950*	DEMKO	131974	

✻ The three-phase 200-230 VAC type conforms to EN standards.
- **Details of Safety Standards**→Page G-2
- When the system is approved under various safety standards, the model names in the motor and driver nameplates are the approved model names.
  List of Motor and Driver Combinations → Page B-43

System Configuration



The system configuration shown is an example. Other configurations are available.

Product Number Code

FBL 5 75 A W - 5

- **Number**: Gear Ratio
- **A**: Round Shaft Type
- **W**: Meets Safety Standards
- **Voltage** **A**: Single-Phase 100-115 VAC, **C**: Single-Phase 200-230 VAC, **S**: Three-Phase 200-230 VAC
- **Output Power** **75**: 75 W (1/10 HP), **120**: 120 W (1/6 HP)
- **Motor Frame Size** **5**: 3.54 in. sq. (90 mm sq.)
- **Series** **FBL** : **FBLⅡ** Series

Product Line

Combination Type

Output Power HP	Output Power W	Power Supply Voltage	Model	Gear Ratio
1/10	75	Single-Phase 100-115 VAC	**FBL575AW-□**	**5, 10, 15, 20, 30, 50, 100, 200**
		Single-Phase 200-230 VAC	**FBL575CW-□**	**5, 10, 15, 20, 30, 50, 100, 200**
		Three-Phase 200-230 VAC	**FBL575SW-□**	**5, 10, 15, 20, 30, 50, 100, 200**
1/6	120	Single-Phase 100-115 VAC	**FBL5120AW-□**	**5, 10, 15, 20, 30, 50, 100, 200**
		Single-Phase 200-230 VAC	**FBL5120CW-□**	**5, 10, 15, 20, 30, 50, 100, 200**
		Three-Phase 200-230 VAC	**FBL5120SW-□**	**5, 10, 15, 20, 30, 50, 100, 200**

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

Round Shaft Type

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

Specifications

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 Output Power		HP (W)	1/10 (75)			1/6 (120)		
Power Source	Voltage		Single-Phase 100-115 VAC±10%	Single-Phase 200-230 VAC±10%	Three-Phase 200-230 VAC±10%	Single-Phase 100-115 VAC±10%	Single-Phase 200-230 VAC±10%	Three-Phase 200-230 VAC±10%
	Frequency		50/60 Hz					
	Rated Input Current	A	2.3	1.4	0.75	3.0	1.8	1.0
	Maximum Input Current	A	2.6	2.0	1.2	3.8	2.7	1.6
Rated Torque		oz-in (N·m)	35 (0.25)			56 (0.4)		
Starting Torque		oz-in (N·m)	45 (0.32)			71 (0.5)		
Permissible Load Inertia J *1		oz-in^2 ($\times10^{-4}$ kg·m^2)	20 (3.75)			30 (5.6)		
Rated Speed		r/min	3000					
Variable Speed Range		r/min	300～3000					
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～122°F (0°C～+50°C) at 3000 r/min with no load]					

*1 The permissible load inertia specified above is only applicable for round shaft type. Permissible Load Inertia for Combination Type → Page B-37
*2 Single-phase motors are certified by DEMKO.
● Enter the gear ratio in the box (□) with the model name.
● The values for each item is for the motor only.

Common Specifications

Item	Specifications
Acceleration/Deceleration Time	0.5～15 sec. (at 3000 r/min)
Speed Control Method	Any one of the following methods 1. By built-in potentiometer (1 piece) 2. By external potentiometer (20 kΩ 1/4 W) 3. By DC voltage control (0～5 VDC)
Input Signal	Photocoupler Input Input Impedance 4.8 kΩ 24 VDC±10% Common to EXT. VR., CW, CCW, SLOW DOWN
Output Signal	Open Collector Output External Use Condition 26.4VDC, 10 mA Max. Common to SPEED OUT, ALARM OUT
Protection Functions*1	When the following are activated, the alarm signal will be output and the motor will come to a natural stop: ● Overload Protection: Activated within approximately 5 seconds of the motor load exceeding rated torque. ● Overheat Protection: Activated when the temperature of the heat sink inside driver exceeds approximately 194°F (90°C). ● Overvoltage Protection: Activated when driving a load exceeding the permissible load inertia, or when motor speed is increased due to gravitational forces. ● Undervoltage Protection: Activated when an input voltage to the driver is less than the specified voltage (−10%). ● Out-of-phase Protection: Activated when the sensor wire inside the motor cable is disconnected during motor operation.
Motor Insulation Class*2	Class E [248°F (120°C)]
Rating	Continuous

*1 With the **FBL Ⅱ** 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, if the primary voltage of the driver's inverter exceeds the permissible value, the protection circuit engages and the motor comes to a natural stop.
*2 Motor insulation is recognized as Class A [221°F (105°C)] by UL and CSA standards.

General Specifications

Item		Motor	Driver
Insulation Resistance		100 MΩ or more when 500 VDC megger is applied between the windings and the frame under normal ambient temperature and humidity.	100 MΩ or more when 500 VDC megger is applied between the power supply input terminal and the Protective Earth terminal, between the power supply input terminal and I/O terminal after continuous operation under normal ambient temperature and humidity.
Dielectric Strength		Sufficient to withstand 1.5 kV at 50 Hz applied between the windings and the frame for 1 minute after continuous operation under normal ambient temperature and humidity.	Sufficient to withstand 1.8 kV (3 kV) at 50 Hz applied between the power supply input terminal and the Protective Earth terminal (I/O terminal) for 1 minute after continuous operation under normal ambient temperature and humidity.
Operating Environmental Conditions	Ambient Temperature	32°F～122°F (0°C～+50°C) (nonfreezing)	
	Ambient Humidity	85% maximum (noncondensing)	
	Atmosphere	No corrosive gases or dust	
Degree of Protection		IP40	IP10

Gearmotor — Torque Table

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

Model	Speed Range r/min	60~600	30~300	20~200	15~150	10~100	6~60	3~30	1.5~15
	Gear Ratio	**5**	**10**	**15**	**20**	**30**	**50**	**100**	**200**
FBL575AW-□ **FBL575CW-□** **FBL575SW-□**		9.7 1.1	20 2.3	30 3.4	39 4.5	57 6.5	95 10.8	190 21.5	260 30
FBL5120AW-□ **FBL5120CW-□** **FBL5120SW-□**		15.9 1.8	31 3.6	47 5.4	63 7.2	91 10.3	152 17.2	260 30	260 30

- Enter the gear ratio in the box (□) within the model name.
- 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 and Permissible Thrust Load

Combination Type

Model	Gear Ratio	Permissible Overhung Load				Permissible Thrust Load	
		0.39 in. (10 mm) from shaft end		0.79 in. (20mm) from shaft end			
		lb.	N	lb.	N	lb.	N
FBL575AW-□ **FBL575CW-□**	**5**	67	300	90	400	33	150
FBL575SW-□ **FBL5120AW-□**	**10~20**	90	400	112	500		
FBL5120CW-□ **FBL5120SW-□**	**30~200**	112	500	146	650		

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

Round Shaft Type

Model	Permissible Overhung Load			
	0.39 in. (10mm) from shaft end		0.79 in. (20 mm) from shaft end	
	lb.	N	lb.	N
FBL575AW-A **FBL575CW-A** **FBL575SW-A**	29	130	33	150
FBL5120AW-A **FBL5120CW-A** **FBL5120SW-A**	36	160	38	170

- Permissible Thrust Load: Avoid thrust loads as much as possible.
  If thrust load is unavoidable, keep it to no more than half the motor weight.

Permissible Load Inertia J for Combination Type

Unit = Upper values: oz-in^2/Lower values: $\times 10^{-4}$ kg·m^2

Model / Gear Ratio	5	10	15	20	30	50	100	200
FBL575AW-□ **FBL575CW-□** **FBL575SW-□**	137	550	1230	2200	4900	13700	13700	13700
FBL5120AW-□ **FBL5120CW-□** **FBL5120SW-□**	25	100	225	400	900	2500	2500	2500

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

Speed — Torque Characteristics

(The characteristics shown below are only applicable for the motors only.)

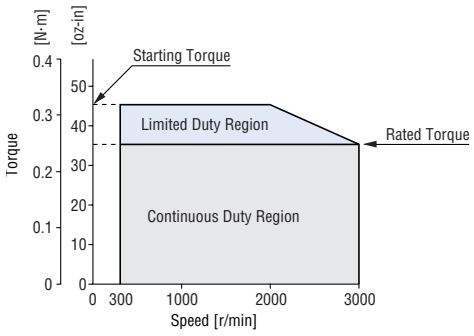
Continuous Duty Region

Continuous operation is possible in this region.

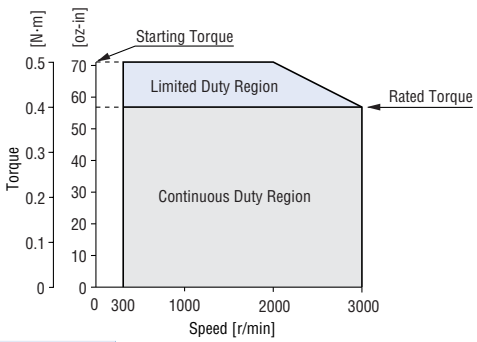
Limited Duty Region

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



Dimensions B-38 | Connection and Operation B-40 | Motor and Driver Combinations B-43

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

Mounting screws are included with the combination type. Dimensions for screws→ Page B-133

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

Motor/Gearhead

FBL575AW-□, FBL575CW-□, FBL575SW-□ (Combination Type)

Motor: FBLM575W-GFB

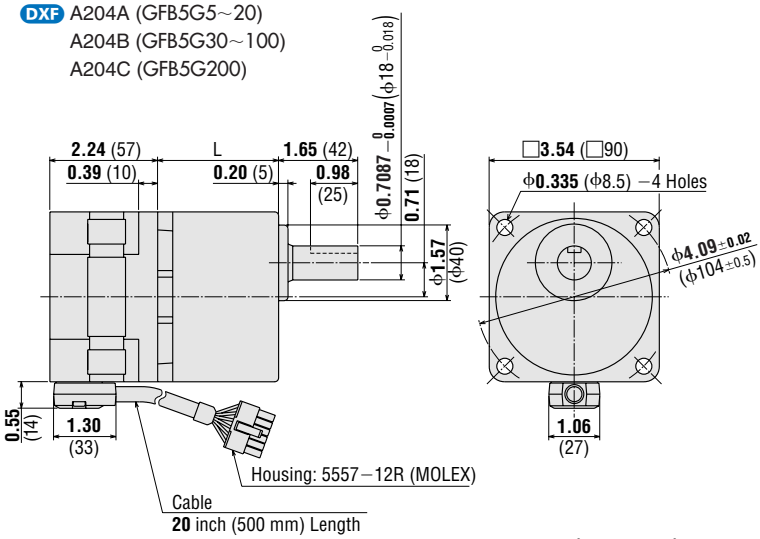
Gearhead: GFB5G□

Weight: 6.6 lb. (3.0 kg) included gearhead

DXF A204A (GFB5G5～20)

A204B (GFB5G30～100)

A204C (GFB5G200)

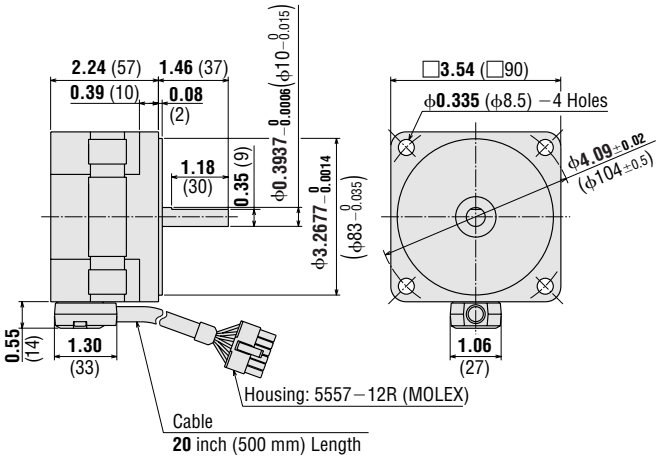


FBL575AW-A, FBL575CW-A, FBL575SW-A (Round Shaft Type)

Motor: FBLM575W-A

Weight: 3.3 lb. (1.5 kg)

DXF A206



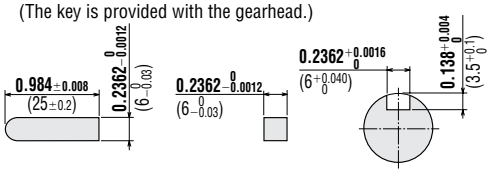
GFB5G5～20: L = **1.77** (45)

GFB5G30～100: L = **2.28** (58)

GFB5G200: L = **2.52** (64)

●Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)



Motor/Gearhead

FBL5120AW-□, FBL5120CW-□, FBL5120SW-□ (Combination Type)

Motor: FBLM5120W-GFB

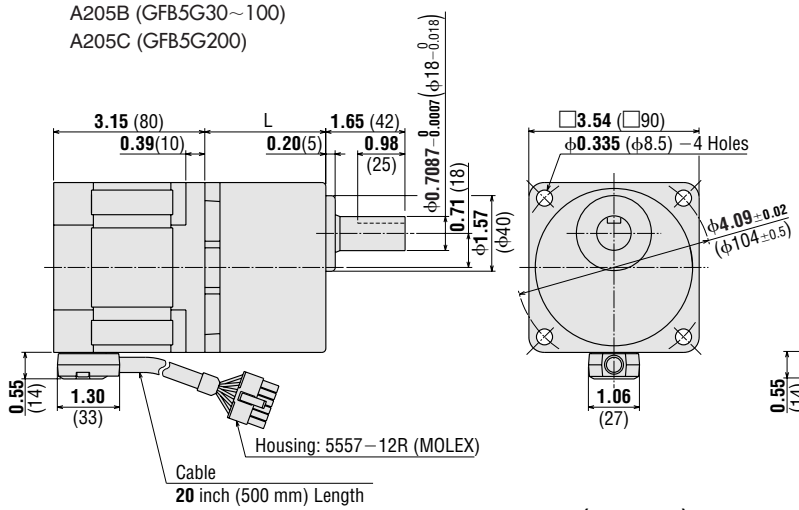
Gearhead: GFB5G□

Weight: 8.8 lb. (4.0 kg) included gearhead

DXF A205A (GFB5G5～20)

A205B (GFB5G30～100)

A205C (GFB5G200)

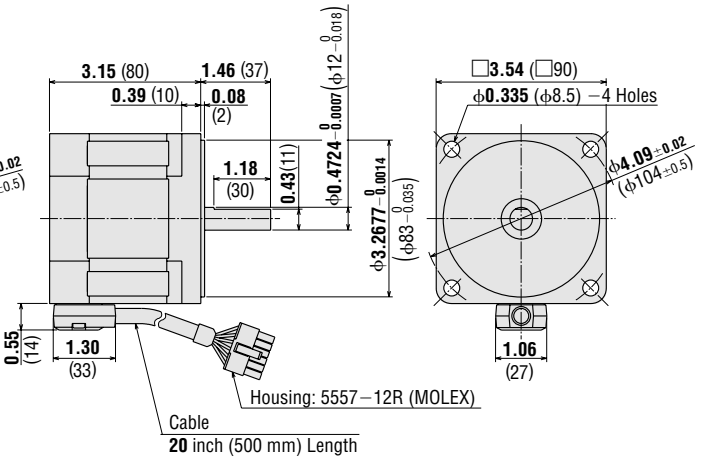


FBL5120AW-A, FBL5120CW-A, FBL5120SW-A (Round Shaft Type)

Motor: FBLM5120W-A

Weight: 5.5 lb. (2.5 kg)

DXF A207



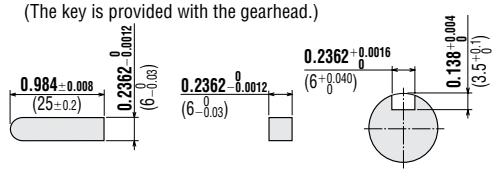
GFB5G5～20: L = **1.77** (45)

GFB5G30～100: L = **2.28** (58)

GFB5G200: L = **2.52** (64)

●Key and Key Slot (Scale 1/2)

(The key is provided with the gearhead.)

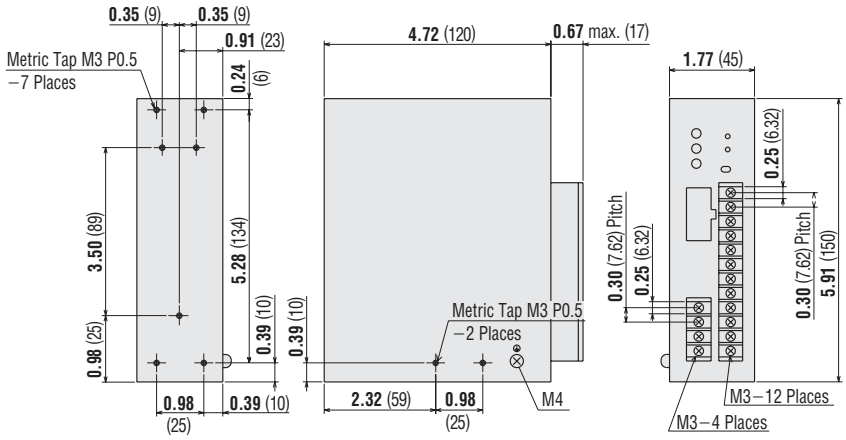


Driver

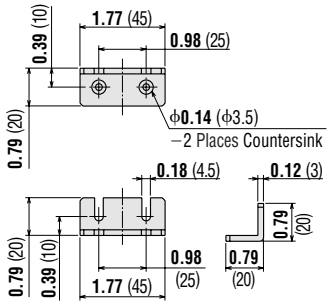
FBLD75AW, FBLD75CW, FBLD75SW, FBLD120AW, FBLD120CW, FBLD120SW

Weight: 1.8 lb. (0.8 kg)

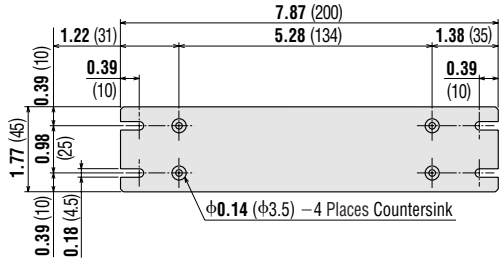
DXF A283



Driver Base Mounting Bracket Tab (1 set of 2 pieces included)

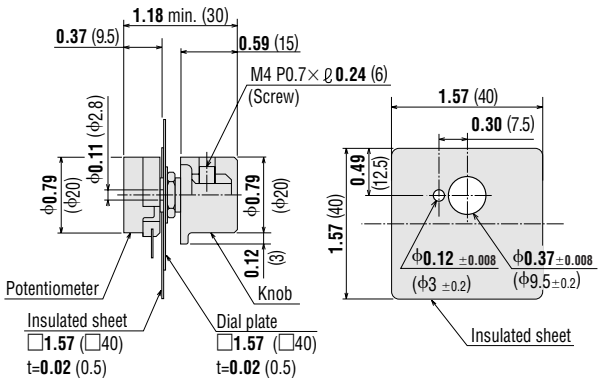


Driver Back Mounting Tab (included)



External Speed Potentiometer (included) (Scale 1/2)

PAVR-20KZ

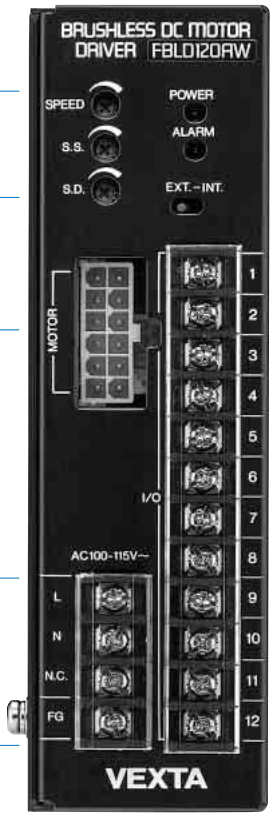


Connection and Operation

Built-in Potentiometer	
Display	Function
SPEED S.S. S.D.	Built-in Speed Potentiometer Potentiometer for Acceleration Time 0.5~15 sec. (at 3000 r/min) Potentiometer for Deceleration Time 0.5~15 sec. (at 3000 r/min)

For Motor Connector

Power Supply Terminal Block



LED Display		
Display	Function	Lighting Condition
POWER	Power Indicator	Lights when the power is ON.
ALARM	Alarm Indicator	●When a load exceeding the rated torque is applied to the motor for 5 seconds or more. ●When the temperature of the heat sink inside driver exceeds approximately 194°F (90°C). ●When the motor is driving a load inertia exceeding the permissible load inertia, or when the motor shaft is turned by the load (during lowering operations). ●When an input voltage to the driver is less than the specified voltage (−10%). ●When the sensor wire inside the motor cable is disconnected.

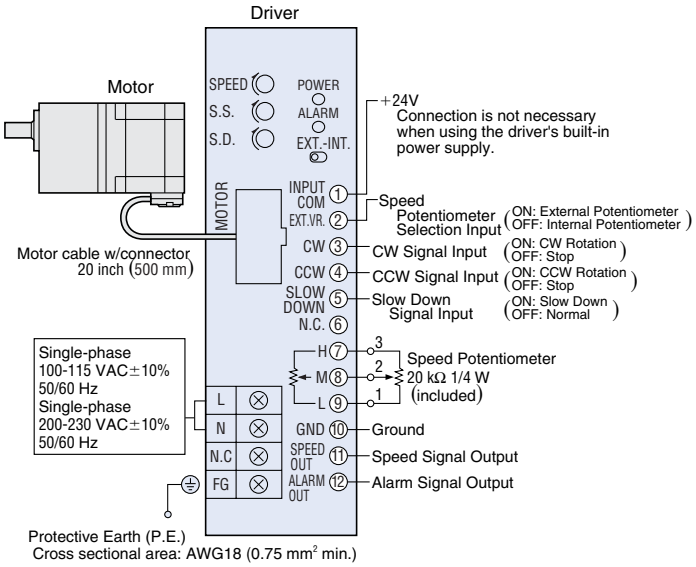
I/O Power Supply Switch	
Display	Function and Operation
EXT.	When controlling from a programmable controller or other external power supply. (Factory setting)
INT.	When controlling with a relay or switch. (Driver built-in power supply)

✻ 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 controller.

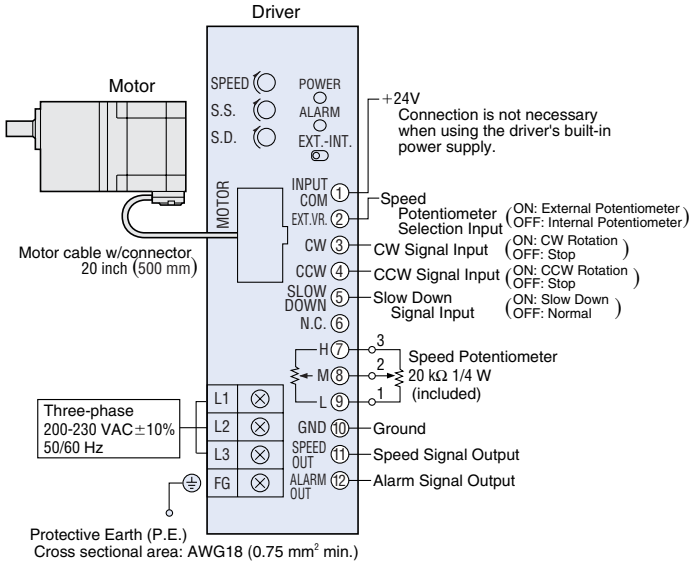
Input/Output Signal Terminal Block		
Display	Signal	Function and Operation
INPUT COM	Power Supply for Input Signals	External power supply +24 VDC A connection is not necessary when using the driver's built-in power supply.
EXT. VR.	Speed Potentiometer Selection Input	Input signal for selecting built-in 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 an external potentiometer or DC voltage.
GND	Ground	Common 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 a protection function is activated. The ALARM LED lights and the motor comes to a stop. To reset, turn off the power for 30 seconds, then turn the power on again.

Connection Diagrams

FBL575AW, FBL575CW, FBL5120AW, FBL5120CW



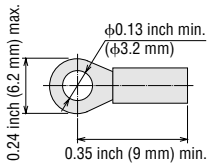
FBL575SW, FBL5120SW



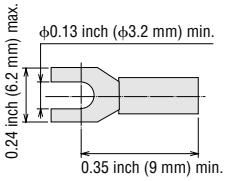
- Motor cable should be no more than 34.4 feet (10.5 m) in length. The motor comes with 20 inch (500 mm) long connector-equipped cable which can be extended by using an accessory extension cable (sold separately).
- There are six different length extension cables. Also there are flexible extension cables.
  [Length: 3.3 ft. (1 m), 6.6 ft. (2 m), 9.8 ft. (3 m), 16.8 ft. (5 m), 23 ft. (7 m), 32.8 ft. (10 m)]
- Extension Cables→ Page B-44
- Signal wires and motor wires should be kept away from equipment, power cables and other sources of magnetic noise.

Terminals

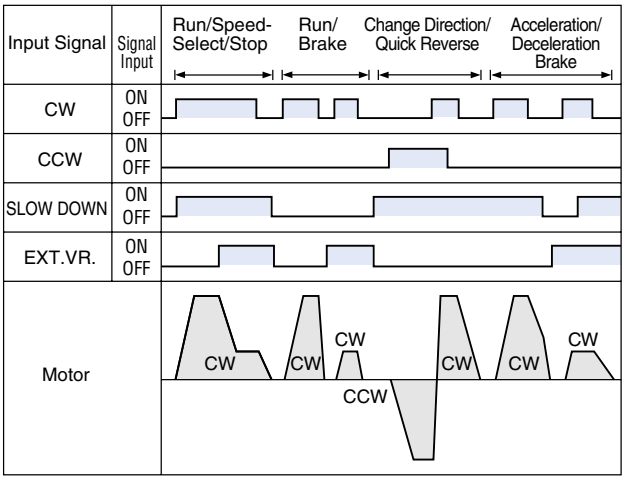
- Round Terminal with Insulation



- U-Shape 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 ON, the motor rotates in a clockwise direction as viewed from the shaft end of the motor; if the CW input is set to OFF, the motor stops. If the CCW input is set to ON, the motor rotates in the counterclockwise direction as viewed from the shaft end of the motor; if the CCW input is set to OFF, the motor stops. If both of the CW and CCW input are set to ON, the motor rotates in the clockwise direction. The acceleration time is set by the built-in acceleration potentiometer (S.S.).
- If the SLOW DOWN input is set to ON, the deceleration time is the value set by the built-in deceleration potentiometer (S.D.); if this input is set to OFF, the motor stops instantaneously.
- If the EXT. VR. input is set to ON, the external speed potentiometer or external DC voltage can be selected; if this input is set to OFF, the built-in speed potentiometer is selected.

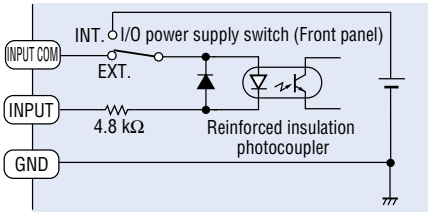
Notes:

- Pay attention to the temperature rise of the motor when used in applications requiring short cycles or bi-directional operation.
- Operate the motor so that the temperature of the motor case remains below 194°F (90°C) and the temperature of the driver remains below 176°F (80°C). If the temperature of the heat sink in the driver exceeds 194°F (90°C), the overheat performing protection activates and stops the motor.
- Precautions should be taken to ensure that while lowering the load or other operations in which the load exerts a rotational force on the motor shaft, the inverter's primary voltage does not exceed permissible levels, which could damage the driver.

● Input Signal Circuit

◆ Input Circuit

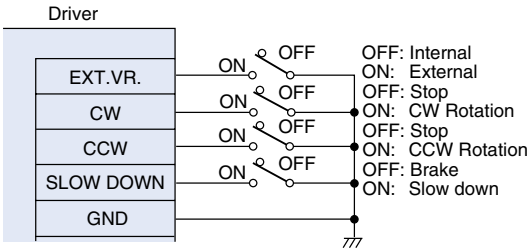
Common to EXT.VR., CW, CCW, SLOW DOWN



◆ Connection Example for Input Signals

· Control by Small Capacity Relays

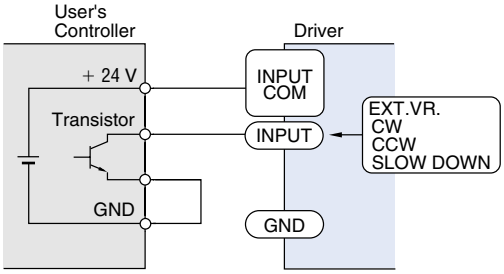
Flip the I/O power supply switch to "INT.".



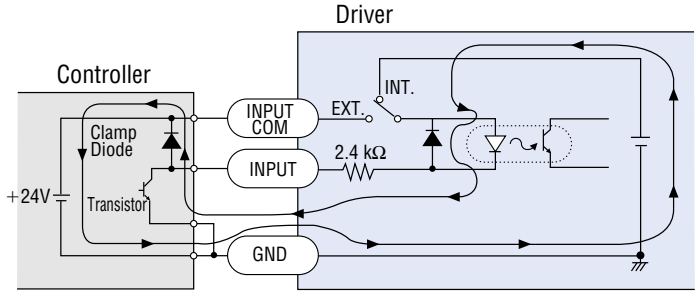
Use a small capacity contact point type relay capable of switching 24 VDC, 0.5 mA.

· Control by Transistor Output Type PLC

Flip the I/O power supply switch to EXT. position (factory setting).



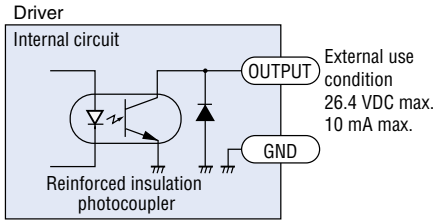
Precautions to observe when using a controller with an internal clamp diode: When using a controller with an internal clamp diode, be sure to set the I/O power supply switch on the front panel to the EXT. (external DC power supply) position. If the I/O power supply switch is in the INT. (built-in power supply) position, the current will flow as indicated by the arrows in the diagram, thereby causing the motor to run abnormally.



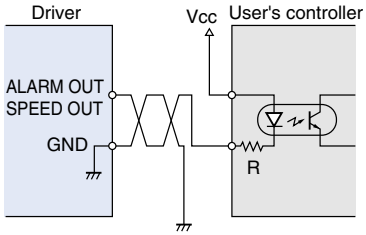
● Output Signal Circuit

◆ Output Circuit

Common to SPEED OUT and ALARM OUT



◆ Connection Example for Output Signals



Note:

- Since the signal output is an "Open Collector" output, an external power supply (Vcc) is necessary. For the external power supply, use 26.4 VDC or less and connect a limit resistance (R) not exceeding 10 mA. This connection is not necessary when the speed output or the alarm output functions are not used.

Speed signal output: Output at a rate of 12 pulses per motor rotation.

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

Alarm signal output: Output when the protection function for overload, overheat, overvoltage, under voltage or out-of-phase has been activated. When output, the current flows between ALARM OUT and GND terminal.

✻ To check the motor speed visually, connect a speed indicator **SDM496** (sold separately). See page A-214 for more information.

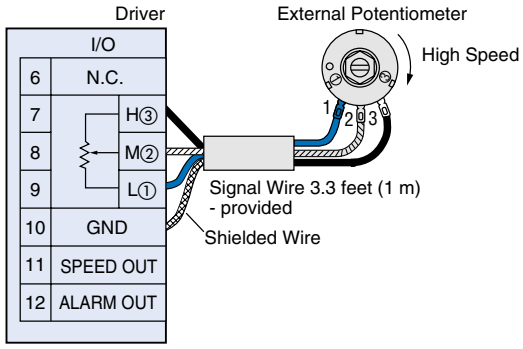
● Method of Speed Setting

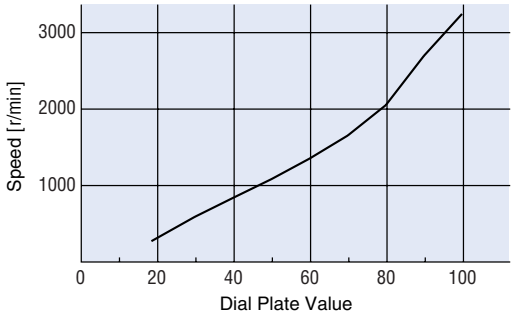
◆ Speed Control by Built-in Potentiometer

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

◆ Speed Control by External Potentiometer

To control the speed of the motor with an external potentiometer, connect the external potentiometer provided with the motor as follows. The EXT. VR. input should be set to ON.

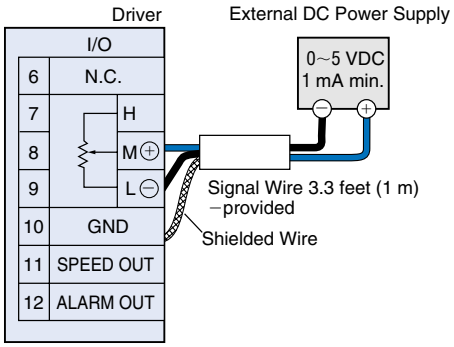


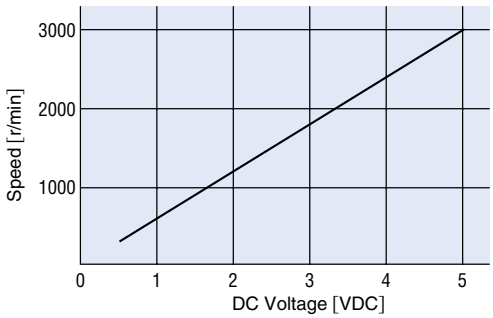


External speed potentiometer dial scale–speed characteristics (Representative Values)

◆ 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.





DC voltage–speed characteristics (Representative Values)

Notes:

- Signal wires provided should be used. (0.13 in. dia. 3.3 ft. length)
  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.
- Do not allow the voltage to exceed 5V, and be sure that there are no errors in polarity when making the connections.

■ List of Motor and Driver Combinations

Model name for motor, driver and gearhead combinations are shown below.

● Combination Type

Output Power HP	Output Power W	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 (□) with the model name.

● Round Shaft Type

Output Power HP	Output Power W	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

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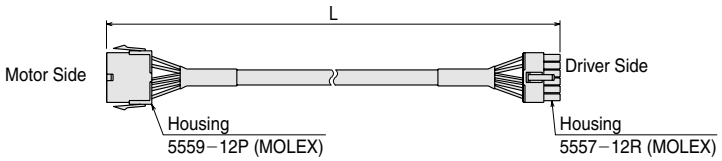
Accessories (Sold separately)

Extension Cable

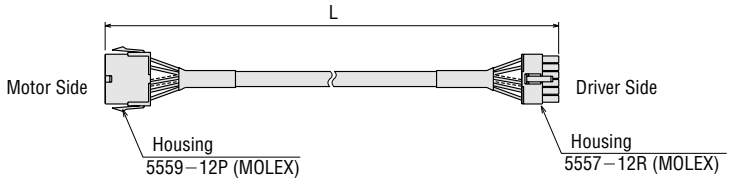
Model	Length: L [ft. (m)]
CC01FBL	3.3 (1)
CC02FBL	6.6 (2)
CC03FBL	9.8 (3)
CC05FBL	16.4 (5)
CC07FBL	23.0 (7)
CC10FBL	32.8 (10)



- Max. extended length: 34.5 feet (10.5 m)

Flexible Extension Cable

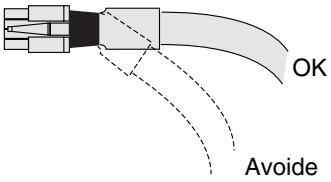
Model	Length: L [ft. (m)]
CC01FBLR	3.3 (1)
CC02FBLR	6.6 (2)
CC03FBLR	9.8 (3)
CC05FBLR	16.4 (5)
CC07FBLR	23.0 (7)
CC10FBLR	32.8 (10)



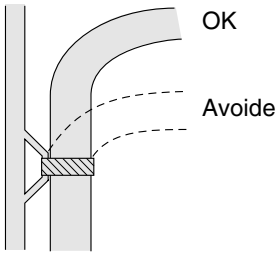
- Max. extended length: 34.5 feet (10.5 m)

Precautions for use of the Flexible Extension Cables

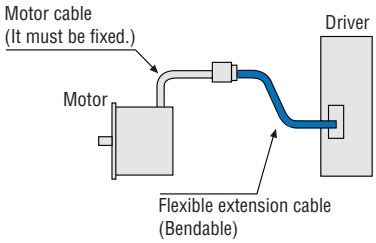
(1) Do not bend the cable at the cable connector location.



(2) Use the product with a minimum bend radius of 2.36 inch (60 mm).



(3) The motor cable itself is not designed to be bent. When bending is necessary, be sure to bend at the flexible extension cable.



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Dimensions B-38