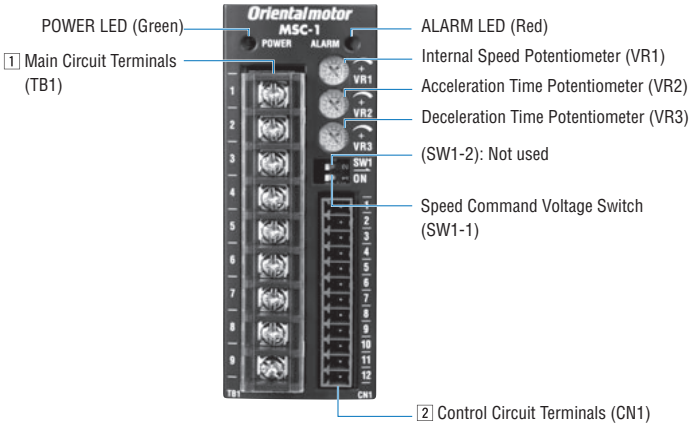
Connection and Operation

Names and Functions of Speed Controller Parts



Name	Description
POWER LED (Green)	Lights while the AC power is supplied to the speed controller.
ALARM LED (Red)	Blinks when the alarm is invoked. The alarm output signal turns OFF (H level).
Internal Speed Potentiometer (VR1)	Sets the motor's speed.
Acceleration Time Potentiometer (VR2)	Sets the acceleration time at starting of motor.
Deceleration Time Potentiometer (VR3)	Sets the deceleration time at stopping of motor.
Speed Command Voltage Switch (SW1-1)	To set speeds using external DC voltage, set this switch to either 5 V or 10 V.
Control Circuit Terminals (CN1)	Connects the DC power supply for control (24 VDC) and the I/O signals.
Main Circuit Terminals (TB1)	Connects to the AC power supply, motor, tachogenerator, and capacitor.

1 Main Circuit Terminals (TB1)

Pin Number	Terminal Name
1	Tachogenerator connection terminal
2	
3	Motor connection terminal
4	
5	

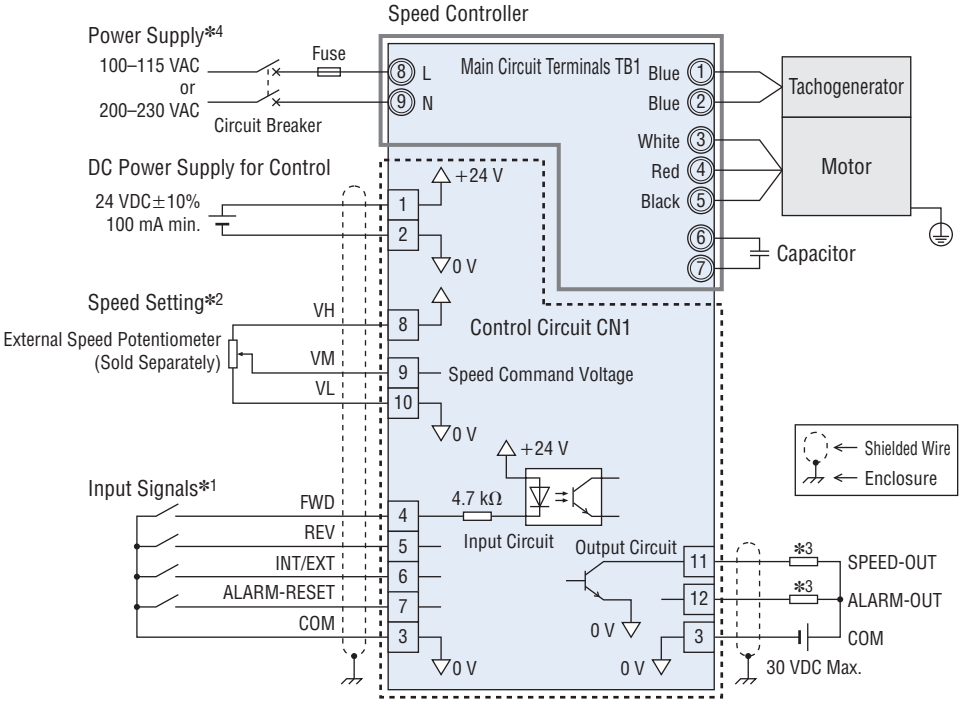
Pin Number	Terminal Name
6	Capacitor connection terminal
7	
8	AC power supply connection terminal
9	

2 Control Circuit Terminals (CN1)

Pin Number	Signal	Signal Name	Description
1	Power supply for control	+24 V	Connects 24 VDC for the control circuit.
2		0 V (GND)	
3	Common	COM (GND)	I/O signal common
4	Input	FWD	The motor rotates in clockwise direction.
5		REV	The motor rotates in counterclockwise direction.
6		INT/EXT	Switches to internal or external speed potentiometer.
7		ALARM-RESET	Resets alarms
8	Input	VH	Connect when setting the speed externally.
9		VM	
10		VL (GND)	
11	Output	SPEED-OUT	12 pulses are output for each rotation of the motor output shaft.
12		ALARM-OUT	This signal is output when an alarm is generated (normally closed).

●Connection Diagram

The figure shows an example in which a **V** Series motor is connected and operated with contact switches such as relays and switches.
When operating the motor, be sure to connect the DC power supply for control.
For motors of 60 W (1/12 HP) or higher output, connect the lead wires for the fan (2 orange leads) to the AC power supply terminals (8 and 9 of TB1).



*1 Note that mechanical contacts, sink transistor or any other device connected to input signals should have a leak current of 1 mA or less.
*2 Refer to page 15 for methods for setting the speed.
*3 Insert a limiting resistor so that SPEED-OUT output is 10 mA or less, and ALARM-OUT output is 40 mA or less.
*4 The power-supply input for the power controller should be the same as the rated voltage of the motor connected.

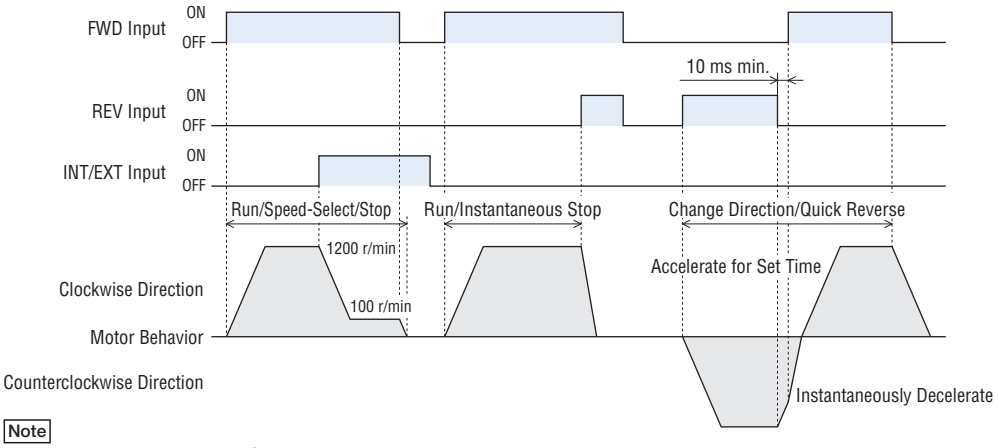
◇Fuse Ratings

For overcurrent protection, make sure to insert a fuse in the power supply line.

Fuse Ratings	Single-Phase 100/110/115 VAC	216 Series (Littlefuse, Inc.) 10 A or equivalent
	Single-Phase 200/220/230 VAC	216 Series (Littlefuse, Inc.) 6.3 A or equivalent

●Timing Chart during Operation

The timing chart below shows an example of a 2-speed control operation, where the internal speed potentiometer is set to 1200 r/min, and the external speed potentiometer is set to 100 r/min.



● When the FWD input is turned ON, the motor rotates in clockwise direction, as viewed from the shaft end of the motor. When the REV input is turned ON, the motor rotates in counterclockwise direction, as viewed from the shaft end of the motor. If both FWD and REV inputs are turned ON simultaneously, the motor will stop instantaneously.

Note

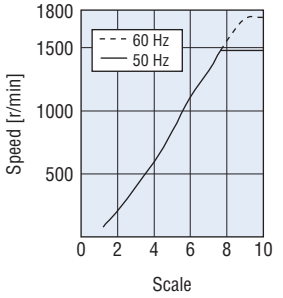
●The duration of each signal in the ON state must be 10 ms or longer.
When switching between FWD and REV inputs, hold for 10 ms min. between switching.

●Speed Setting Methods

The following 3 methods can be used for setting the speed. The setting speed range is 90～1400 r/min at 50 Hz, or 90～1600 r/min at 60 Hz.

◇Internal Speed Potentiometer

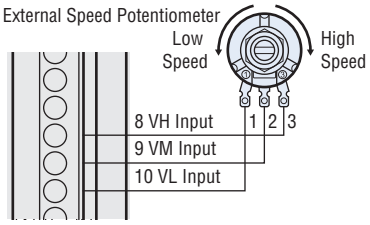
When the dial on the internal speed potentiometer (VR1) is turned in the clockwise direction, the speed will be faster.
Factory setting: 0 r/min

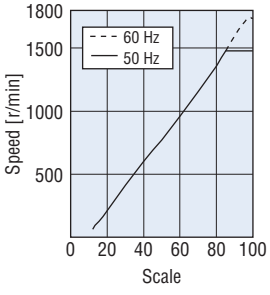


Internal Speed Potentiometer–
Speed Characteristics
(Representative values)

◇External Speed Potentiometer (Sold Separately)

By connecting the separately-sold external speed potentiometer (**PAVR-20KZ**) to CN1 and turning ON the INT/EXT input, the external speed potentiometer becomes effective. When the dial on the external speed potentiometer is turned in the clockwise direction, the speed will be faster.





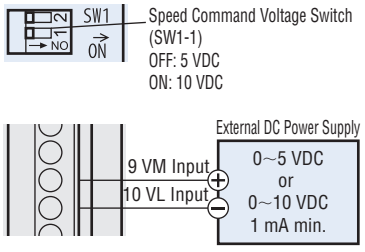
External Speed Potentiometer–
Speed Characteristics
(Representative values)

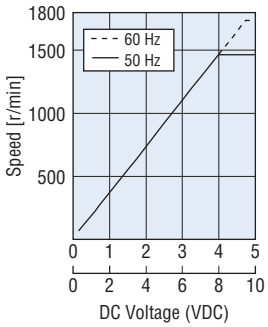
◇External DC Voltage

Set the external DC voltage at 5 VDC or 10 VDC. Use the speed command voltage switch (SW1-1) to match it to the voltage you are using. To set it with the external DC voltage, turn ON the INT/EXT input.

Note

●Make sure that the voltage is set to the selected voltage (5 VDC or 10 VDC), and ensure the correct polarity when connecting.





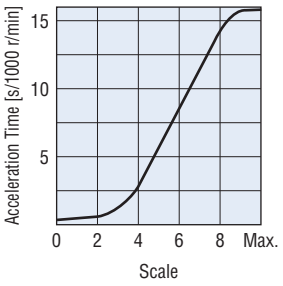
External DC Voltage–
Speed Characteristics
(Representative values)

●Acceleration/Deceleration

You can adjust the acceleration/deceleration time when the motor starts, stops, and changes speed, so that no shock is applied to the load. This is set via the acceleration time potentiometer and the deceleration time potentiometer. The setting range is approximately 0.3～15 seconds (at 1000 r/min, with no inertial load). However, if the load inertia is large, the deceleration time cannot be set shorter than the time the motor would take to coast to a stop.

◇Acceleration (ACCEL)

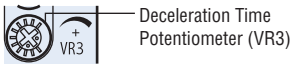
The acceleration function is activated at starting or when the speed is switched to the higher setting in a two-level speed control. The setting time is increased by turning the switch clockwise.
Factory setting: Min.

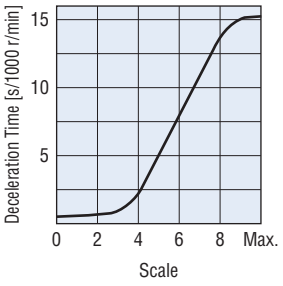


Acceleration Characteristics
(Representative Values)

◇Deceleration (DECEL)

The deceleration function is activated when coasting to a stop, or when the speed is switched to the lower setting in a two-level speed control. The setting time is increased by turning the switch clockwise.
Factory setting: Min.





Deceleration Characteristics
(Representative Values)

●Parallel-Motor Operation

2 or more motors can be operated at the same speed by using an external speed potentiometer or an external DC power supply.

◇Using an External Speed Potentiometer

Up to 20 speed controllers can be operated in parallel-motor operation using an external speed potentiometer.

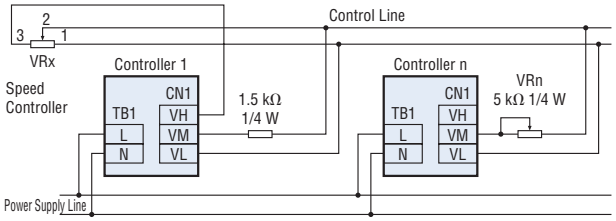
- Connect the I/O signals for each speed controller.
- If the motors are at different speeds, adjust by doing the following.

  Speed controller 1:

  Connect a 1.5 kΩ, 1/4 W resistor to the VM terminal.

  Speed controllers 2 and thereafter:

  Connect a 5 kΩ, 1/4 W variable resistor VRn.



How to Calculate the Resistance (VRx) When Connecting n Speed Controllers

Resistance (VRx) = 20/n (kΩ), n/4 (W)

Example: When connecting 2 speed controllers

Resistance (VRx) = 20/2 (kΩ), 2/4 (W), i.e. resistance of 10 kΩ, 1/2 W.

◇Using an External DC Voltage

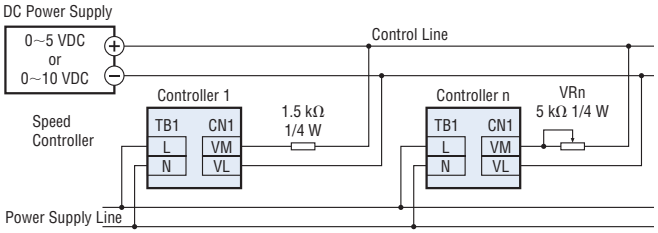
- Connect the I/O signals for each speed controller.
- If the motors are at different speeds, adjust by doing the following.

  Speed controller 1:

  Connect a 1.5 kΩ, 1/4 W resistor to the VM terminal.

  Speed controllers 2 and thereafter:

  Connect a 5 kΩ, 1/4 W variable resistor VRn.



How to Calculate the Current Capacity (I) of External DC Power When Connecting n Speed Controllers

Current Capacity (I) = 1 × n (mA)

Example: When connecting 2 speed controllers

Current Capacity (I) = 1 × 2 (mA), i.e. current capacity of 2 mA min.

●Repetition Cycle of Running and Instantaneous Stops

When running and instantaneous stopping of the motor is repeated in short cycles, the motor temperature rise will increase and the continuous operating time will be limited. Use the repetition cycle given in the table below for running and instantaneous stopping. The motor's heat generation may become higher depending on the driving conditions. Be sure to keep the temperature of the motor case under 90˚C (194˚F).

Motor Output Power	Repetition Cycle
6 W (1/125 HP)~40 W (1/19 HP)	2 seconds min. (Running time 1 second, stopping time 1 second)
60 W (1/12 HP), 90 W (1/8 HP)	4 seconds min. (Running time 2 second, stopping time 2 second)

●Braking Current

When the motor is stopped instantaneously, a large braking current (refer to the table below) flows through the motor. When connecting a circuit breaker (or fuse) of the equipment, refer to the table below for the braking current (peak value) and select its current capacity.

Motor Output Power	Braking Current (Peak Value)	
	Single-Phase 100/110/115 VAC	Single-Phase 200/220/230 VAC
6 W (1/125 HP)	2 A	1 A
15 W (1/50 HP)	4 A	3 A
25 W (1/30 HP)	8 A	4 A
40 W (1/19 HP)	12 A	7 A
60 W (1/12 HP)	22 A	9 A
90 W (1/8 HP)	29 A	13 A

■Dimensions Unit = mm (in.)

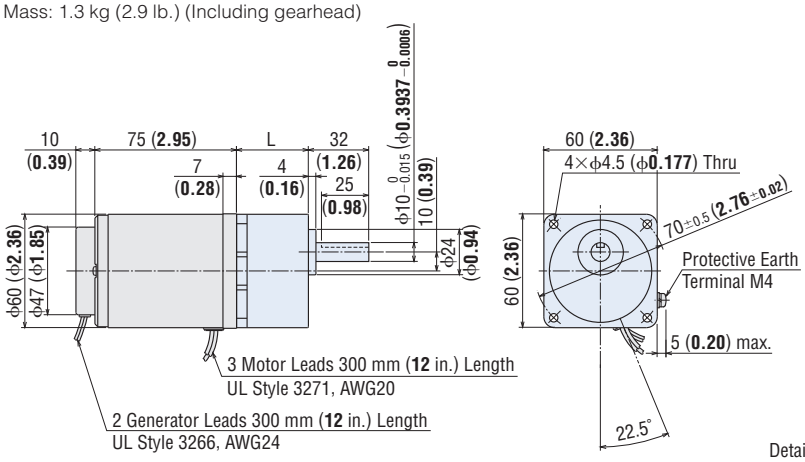
● Mounting screws are included with the combination type.

●6 W (1/125 HP)

◇Motor/Gearhead (Combination type)

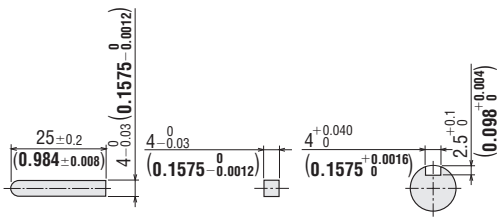
Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI206A2-□U	VSI206A2-GV	GV2G□	**5~25**	34 (1.34)	A500A
VSI206C2-□E	VSI206C2-GV		**30~120**	38 (1.50)	A500B
VSR206A2-□U	VSR206A2-GV		**150~360**	43 (1.69)	A500C
VSR206C2-□E	VSR206C2-GV				

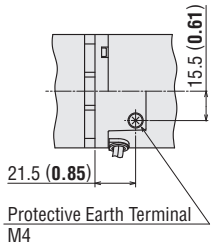
Mass: 1.3 kg (2.9 lb.) (Including gearhead)



◇Key and Key Slot

(The key is included with the gearhead)





Detail Drawing of Protective Earth Terminal

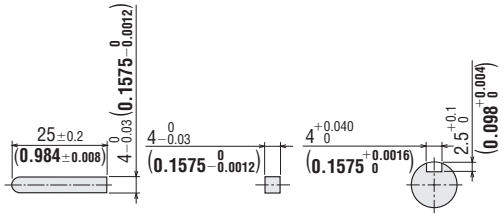
●15 W (1/50 HP)

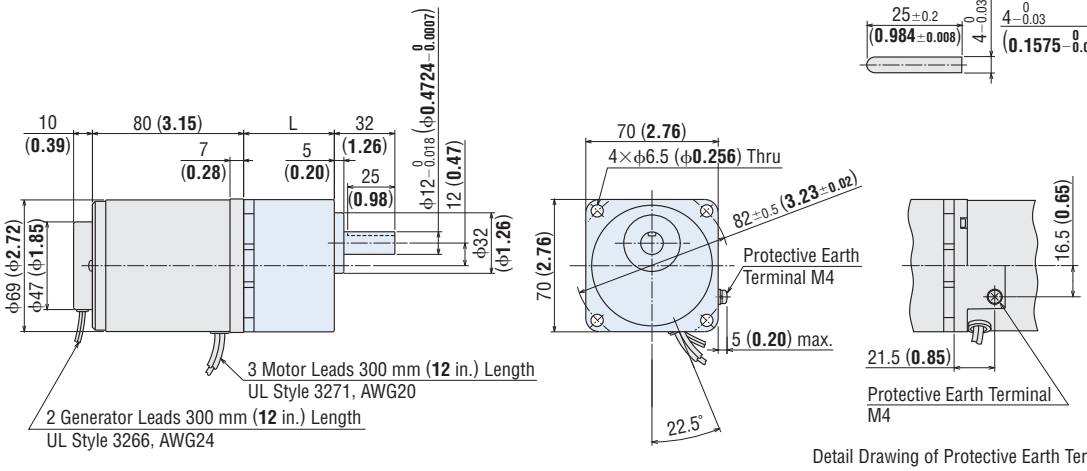
◇Motor/Gearhead (Combination type)

Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI315A2-□U	VSI315A2-GV	GV3G□	**5**～**25**	38 (1.50)	A501A
VSI315C2-□E	VSI315C2-GV		**30**～**120**	43 (1.69)	A501B
VSR315A2-□U	VSR315A2-GV				
VSR315C2-□E	VSR315C2-GV		**150**～**360**	48 (1.89)	A501C

Mass: 1.8 kg (4.0 lb.) (Including gearhead)

◇Key and Key Slot
(The key is included with the gearhead)





Detail Drawing of Protective Earth Terminal

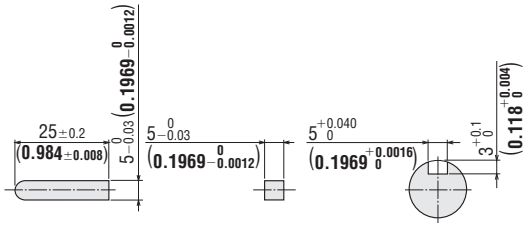
●25 W (1/30 HP)

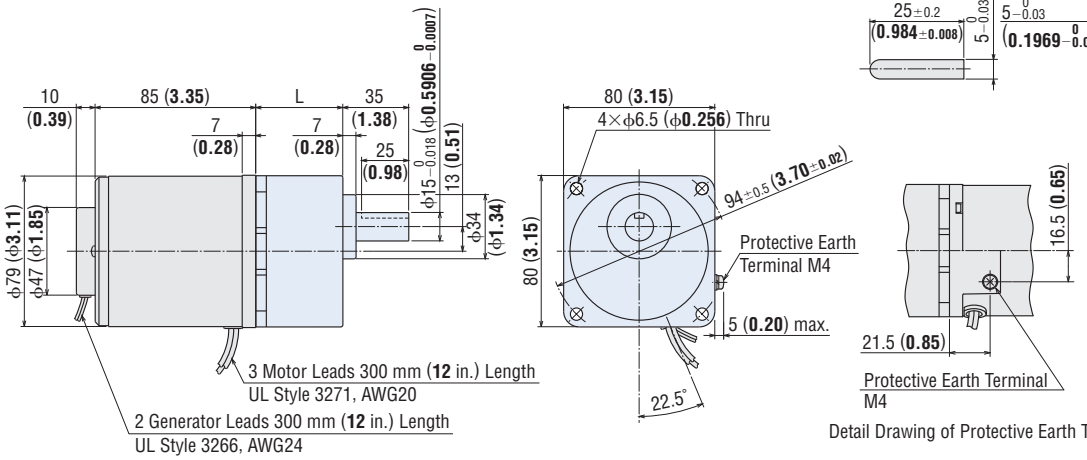
◇Motor/Gearhead (Combination type)

Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI425A2-□U	VSI425A2-GV	GV4G□	**5**～**25**	41 (1.61)	A502A
VSI425C2-□E	VSI425C2-GV		**30**～**120**	46 (1.81)	A502B
VSR425A2-□U	VSR425A2-GV				
VSR425C2-□E	VSR425C2-GV		**150**～**360**	51 (2.01)	A502C

Mass: 2.55 kg (5.6 lb.) (Including gearhead)

◇Key and Key Slot
(The key is included with the gearhead)





Detail Drawing of Protective Earth Terminal

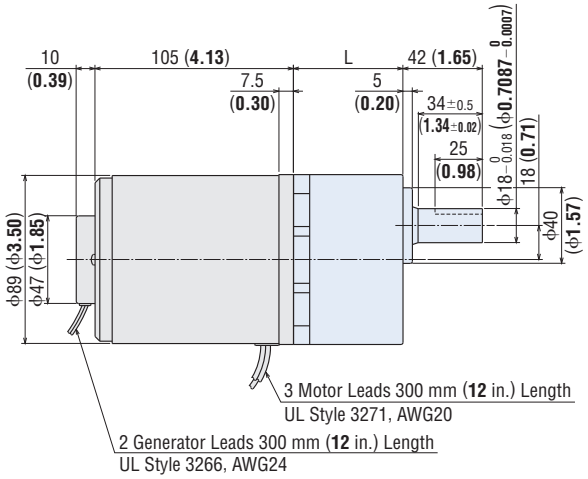
●Enter the gear ratio in the box (□) within the model name.

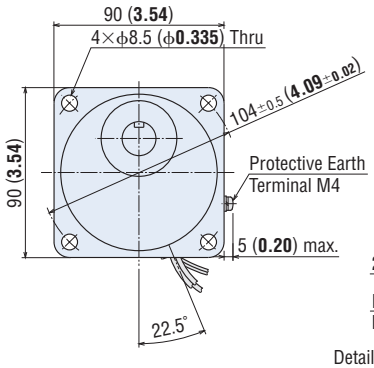
●40 W (1/19 HP)

◇Motor/Gearhead (Combination type)

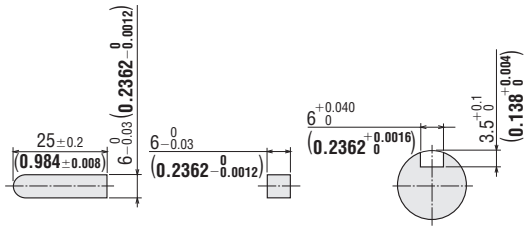
Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI540A2-□U	VSI540A2-GVH	GVH5G□	**5**～**18**	45 (1.77)	A503A
VSI540C2-□E	VSI540C2-GVH		**25**～**100**	58 (2.28)	A503B
VSR540A2-□U	VSR540A2-GVH				
VSR540C2-□E	VSR540C2-GVH		**120**～**300**	64 (2.52)	A503C

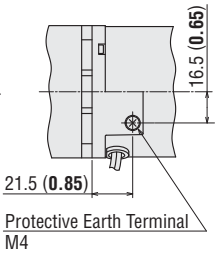
Mass: 4.1 kg (9.0 lb.) (Including gearhead)





◇Key and Key Slot
(The key is included with the gearhead)





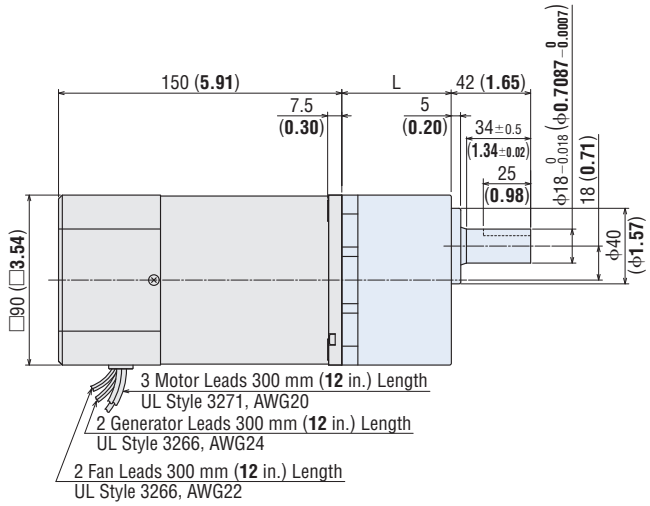
Detail Drawing of Protective Earth Terminal

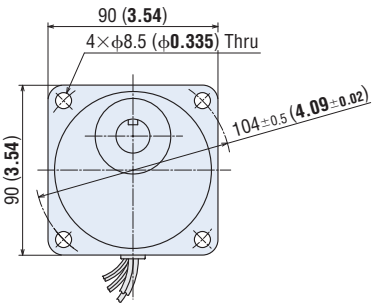
●60 W (1/12 HP)

◇Motor/Gearhead (Combination type)

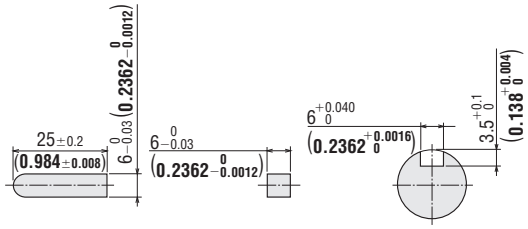
Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI560A-□U	VSI560A-GVH	GVH5G□	**5**～**18**	45 (1.77)	A395A
VSI560C-□E	VSI560C-GVH		**25**～**100**	58 (2.28)	A395B
VSR560A-□U	VSR560A-GVH				
VSR560C-□E	VSR560C-GVH		**120**～**300**	64 (2.52)	A395C

Mass: 4.3 kg (9.5 lb.) (Including gearhead)





◇Key and Key Slot
(The key is included with the gearhead)



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

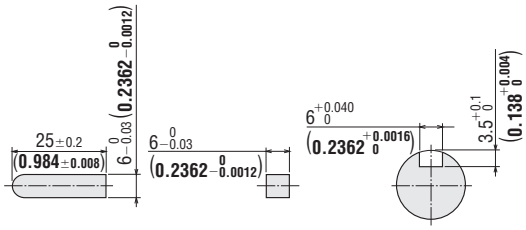
●90 W (1/8 HP)

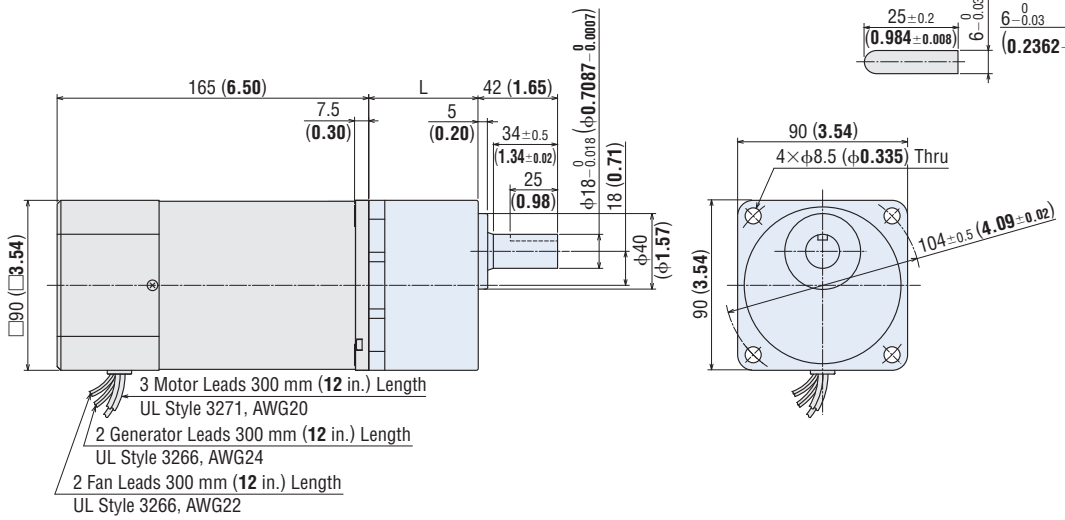
◇Motor/Gearhead (Combination type)

Model	Motor Model	Gearhead Model	Gear Ratio	L	DXF
VSI590A-□U **VSI590C-□E** **VSR590A-□U** **VSR590C-□E**	VSI590A-GVR VSI590C-GVR VSR590A-GVR VSR590C-GVR	GVR5G□	**5**～**15**	45 (1.77)	A396A
			18～**36**	58 (2.28)	A396B
			50～**180**	70 (2.76)	A396C

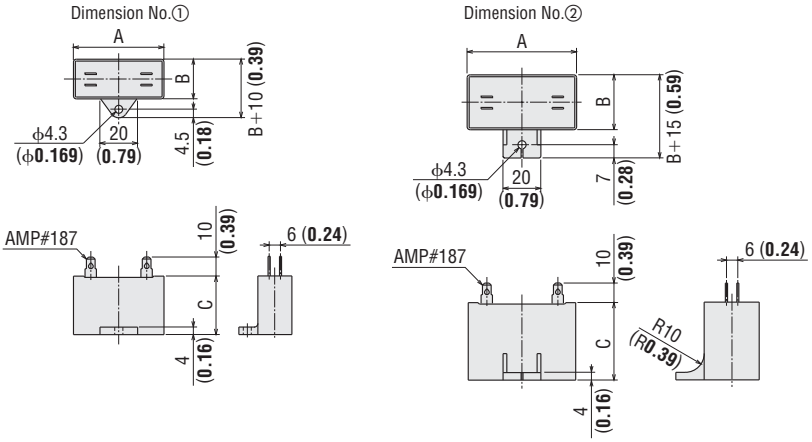
Mass: 4.8 kg (10.6 lb.) (Including gearhead)

◇Key and Key Slot
(The key is included with the gearhead)





●Capacitor Dimensions



●Capacitor (Included)

• Induction Motors

Model	Capacitor Model	A	B	C	Mass g (oz.)	Dimension No.
VSI206A2-□U	CH25FAUL2	31 (1.22)	17 (0.67)	27 (1.06)	21 (0.74)	①
VSI206C2-□E	CH06BFAUL	31 (1.22)	14.5 (0.57)	23.5 (0.93)	18 (0.64)	
VSI315A2-□U	CH45FAUL2	37 (1.46)	18 (0.71)	27 (1.06)	26 (0.92)	
VSI315C2-□E	CH10BFAUL	37 (1.46)	18 (0.71)	27 (1.06)	27 (0.95)	
VSI425A2-□U	CH65CFAUL2	48 (1.89)	19 (0.75)	29 (1.14)	35 (1.24)	
VSI425C2-□E	CH15BFAUL	38 (1.50)	21 (0.83)	31 (1.22)	37 (1.31)	
VSI540A2-□U	CH90CFAUL2	48 (1.89)	22.5 (0.89)	31.5 (1.24)	45 (1.59)	
VSI540C2-□E	CH23BFAUL	48 (1.89)	21 (0.83)	31 (1.22)	43 (1.52)	
VSI560A-□U	CH180CFAUL	58 (2.28)	23.5 (0.93)	37 (1.46)	70 (2.5)	②
VSI560C-□E	CH40BFAUL	58 (2.28)	23.5 (0.93)	37 (1.46)	73 (2.6)	
VSI590A-□U	CH200CFAUL	58 (2.28)	29 (1.14)	41 (1.61)	95 (3.4)	
VSI590C-□E	CH60BFAUL	58 (2.28)	29 (1.14)	41 (1.61)	92 (3.2)	

●A capacitor cap is included with a capacitor.

• Reversible Motors

Model	Capacitor Model	A	B	C	Mass g (oz.)	Dimension No.
VSR206A2-□U	CH35FAUL2	31 (1.22)	17 (0.67)	27 (1.06)	22 (0.78)	①
VSR206C2-□E	CH08BFAUL	31 (1.22)	17 (0.67)	27 (1.06)	23 (0.81)	
VSR315A2-□U	CH60CFAUL2	38 (1.50)	21 (0.83)	31 (1.22)	35 (1.24)	
VSR315C2-□E	CH15BFAUL	38 (1.50)	21 (0.83)	31 (1.22)	37 (1.31)	
VSR425A2-□U	CH80CFAUL2	48 (1.89)	21 (0.83)	31 (1.22)	41 (1.45)	
VSR425C2-□E	CH25BFAUL	48 (1.89)	21 (0.83)	31 (1.22)	42 (1.48)	
VSR540A2-□U	CH120CFAUL2	58 (2.28)	22 (0.87)	35 (1.38)	60 (2.1)	
VSR540C2-□E	CH35BFAUL	58 (2.28)	22 (0.87)	35 (1.38)	59 (2.1)	
VSR560A-□U	CH200CFAUL	58 (2.28)	29 (1.14)	41 (1.61)	95 (3.4)	②
VSR560C-□E	CH50BFAUL	58 (2.28)	29 (1.14)	41 (1.61)	93 (3.3)	
VSR590A-□U	CH300CFAUL	58 (2.28)	35 (1.38)	50 (1.97)	140 (4.9)	
VSR590C-□E	CH70BFAUL	58 (2.28)	35 (1.38)	50 (1.97)	138 (4.9)	

●A capacitor cap is included with a capacitor.

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