

MS-94BZA/BZB/BZC /BZD/BZE/BZF Instruction Manual



MS-94BZA
Geared Motor



MS-94BZB
Geared Motor
/with Brake



MS-94BZC
Geared Motor
/with Wheel, Bracket, Brake



MS-94BZD
Geared Motor



MS-94BZE
Geared Motor
/with Brake



MS-94BZF
Geared Motor
/with Wheel, Bracket, Brake

Notice to users

The unauthorized reproduction or replication in whole or in part of this operation manual is prohibited.

The product's performance, specifications, and appearance may be modified for improvements without advance notice.

Thank you for your understanding.

MABUCHI MOTOR CO., LTD.

- **For your safety**

Read the safety warnings for proper use of this product.

Mabuchi Motor Co., Ltd. has no liability to indemnify damages, including any malfunction of the motor resulting from failure to follow this operation manual. Thank you for your understanding.

Safety Precautions



Warning: May result in death or serious injury



Prohibition: Prohibited actions.



Caution: May result in injury or damage



Instruction: Required actions.



Warning



Prohibition

- Do not plug the lead wire or motor terminal into home electrical outlets. This may cause electrical shock, injury, or equipment damage.
- Do not touch conductive parts such as powered terminals when the power is on. This may result in electrical shock.
- Do not touch rotating parts, including attachments, with the hands or fingers while the power is on. This may result in injury.
- Do not lock the shaft while the motor is powered on. This will cause equipment damage.
- Do not activate the electromagnetic brake if the motor is rotating or if there is a running current, as it may damage the device.
- The motor operating conditions (installation condition, load, environmental temperature) may cause significant heat buildup in the motor, with the risk of burns.
- Do not disassemble the motor. This may cause equipment damage, injury, or electrical shock.
- Do not use in the presence of corrosive or flammable gas, or near combustibles. This may cause fire, injury, or equipment damage.

**Caution****Prohibition****Instruction**

- This product is a brushless motor. It cannot be used directly connected to an AC or battery power source. Connect a dedicated brushless motor drive circuit compatible with this product between the power source and the motor.
- This is a general purpose product. It cannot be used with special equipment for medical, military, aerospace, or vehicle mounted applications.
- Do not detach connectors while the motor is in operation under any circumstances. Always shut off power before inserting them. This will cause equipment damage.
- When inserting or detaching cable connectors, support the plug with your fingers while releasing the detachment prevention mechanism, and insert or detach it in the direction of the connector pin, making sure that the connector is not subject to excessive force.
- Using it with an excessive load on the output shaft will reduce service life. Handle the shaft carefully so that there is no impact load in the direction of thrust.
- When using lead wires, switches, relays, or controllers, etc., give careful consideration to their electrical capacity and heat tolerance. If they do not meet the appropriate standards, this will cause equipment damage due to fire, etc.
- Confirm set installation matching and service life, and perform quality assurance.

Example Checklist for Set Installation:

Laws and standards applicable to the mounting product.

Service life, electrical characteristics, mechanical characteristics, mechanical/electrical noise, storage environment, atmosphere gases, etc.

- The internal resistance and capacity of the motor drive power source (including the circuit) may affect starting performance and rotational stability. Confirm the actual operating conditions at high and low temperatures as well as room temperature.
- When using transmission systems which apply lateral pressure to the motor, such as a belt drive on the output shaft, the lateral pressure on the shaft bearing may reduce service life.
- Significant radial loads from eccentric cams, etc., during motor operation or outside vibrations may affect motor service life. Verify the actual usage conditions.
- Do not subject the motor output shaft to excessive impacts. This will cause equipment damage.

- When securing the motor, do not apply forces that would cause deformation of the motor. When securing with screws, avoid uneven tightening. This may negatively affect the flatness and other characteristics of the motor installation plate.
- Do not brake the electromagnetic brake while the motor is rotating. When starting the motor, apply voltage to the electromagnetic brake and release it before the motor starts. When stopping the motor, shut off the voltage of the electromagnetic brake after the motor has stopped rotating and operate the electromagnetic brake.
- The electromagnetic brake may make a rubbing noise while the motor is rotating, but this is not a problem due to the characteristics of the electromagnetic brake.
- When used for a long period of time, a small amount of grease may seep out from the gear part in rare cases. This will not change the characteristics of the motor, but inspect periodically that no problems have arisen with the equipment where the motor is installed.
- When using the motor in an environment where the ambient temperature is lower than room temperature, the load torque and motor current may increase due to changes in the viscosity of the grease used in the reducer. As the operation time progresses, the grease will become more fluid, and the load torque and motor current will decrease.
- Always use the designated components for extension cable connectors.
- If abnormalities occur, shut down power immediately.
- The temperature of the motor rises during operation and after immediately after shut down, so exercise caution.
- Do not apply excessive force to cables or connectors. Do not pull cables to reposition or transport the motor.
- Dispose of this product in accordance with local laws and government instructions.

● **Operating and Storage Environment**

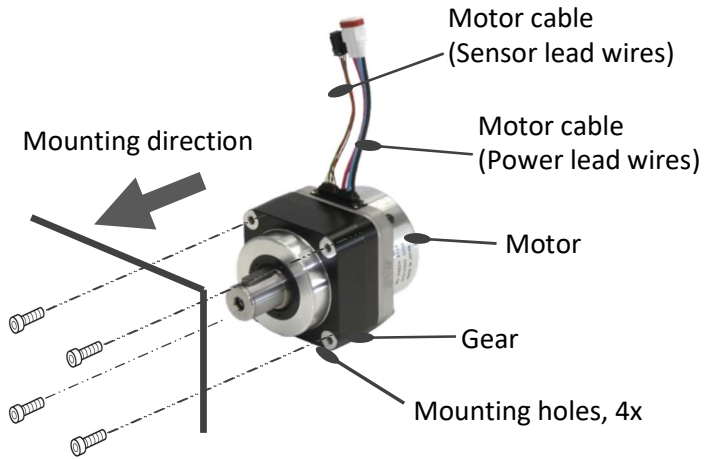
- Avoid storing the motor in high temperature or humidity areas, or in contact with corrosive gases. The recommended environment: +10 to +30°C temperature, 30 to 95% relative humidity.
- Chemicals used for fumigation may contaminate metal components of the motor. When fumigating packaging (pallets, etc.) for the motor itself or products into which the motor is integrated, make sure that the motor is not exposed to the fumigating material or gases.
- High ambient temperature while the motor is in use (motor temperature) will affect performance and service life. Exercise special caution in cases of high temperature and humidity.

Motor Parts and Features

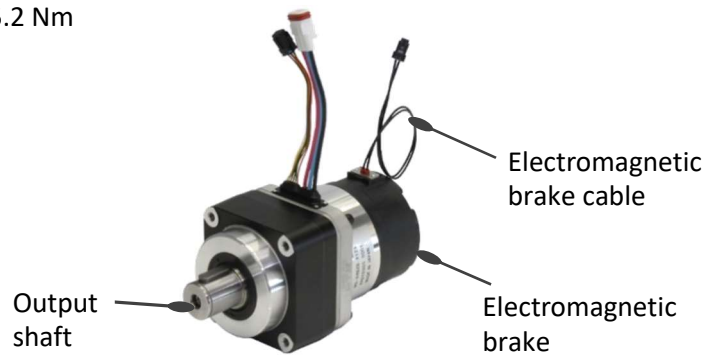
- Motor parts

- Type: MS-94BZA /BZD

M6 Screw 4 pcs.
(Sold Separately)
The standard tightening torque for the screws is 5.2 Nm (reference value)



- Type: MS-94BZB /BZE



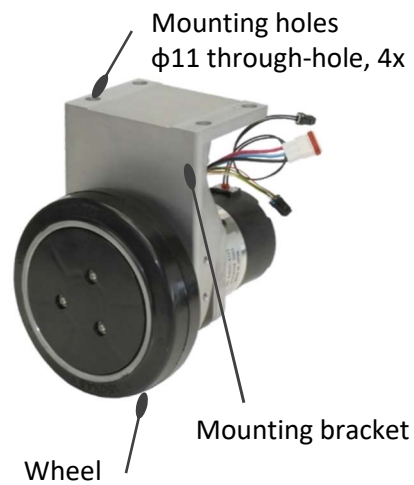
- Mounting holes dimensions

Type	Mounting holes dimensions
MS-94BZA/BZD MS-94BZB/BZE	M6 screw, effective depth: 14mm, 4x
MS-94BZC/BZF	$\phi 11 \pm 0.5$ through-hole, 4x

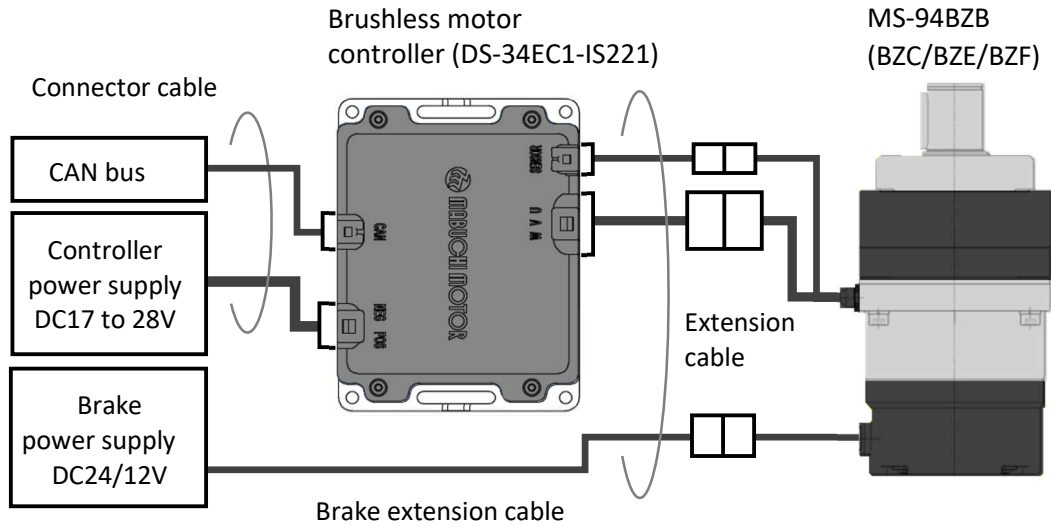
 **Caution**
 **Prohibition**
 **Instruction**

- Ensure there are no gaps on the mounting surface.
- Do not:
 - Separate or disassemble the motor or gear head
 - Separate or disassemble the wheel or mounting bracket
- Mount in a way that tension is not applied to the motor or brake cable.

- Type: MS-94BZC /BZF



- Connection diagram



- The example above shows an MS-94BZB(BZC/BZE/BZF) being connected with a Mabuchi Motor controller (DS-34EC1-IS221), power supply, etc.
- The Motor Controller (DS-34EC1-IS221) connection and extension cables are available as optional items.
- Read DS-34EC1 Operation Manual for details on connection cables and extension cables.

 Caution	 Instruction
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- The controller (DS-34EC1-IS221) cannot control electromagnetic brakes. Be sure to prepare the ON/OFF control circuit and a power supply for the brake. (MS-94BZB/BZC/BZE/BZF)
- The controller power supply has polarity. Be sure to connect it correctly.
- The brake power supply has no polarity, but be sure to use a DC (direct current) power supply.
- Applying current to the electromagnetic brake releases the brake. Be sure that the braking mechanism is not applied when starting the motor or during rotation. The electromagnetic brake is an inductive load. Provide a protection circuit if necessary.
- Use the designated extension cables (motor power, sensor, brake).
- Do not interconnect multiple extension cables, as it may reduce performance.
- Ensure that there is a sufficient safety margin for the current capacity of the power source and the current carrying capacity of distribution cables, etc.



- Using the Electromagnetic Brake

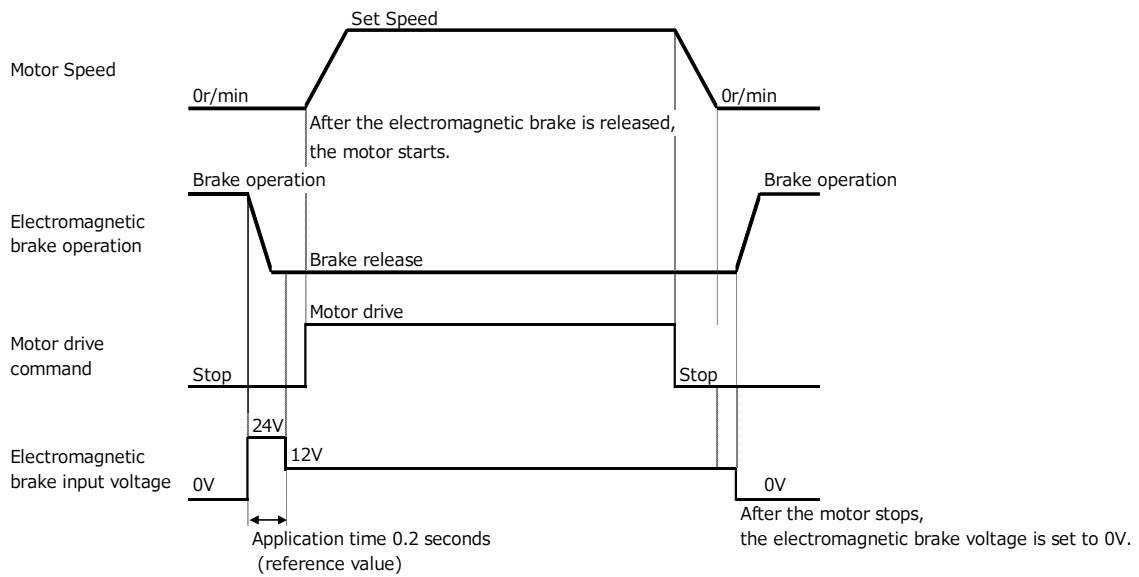
The electromagnetic brake installed in the MR-94BZB/BZC/BZE/BZF is used for holding the motor.

Activate the electromagnetic brake after the motor has stopped.

When starting the motor, release the brake before inputting the motor drive command.

When releasing the brake, apply 24V DC to the electromagnetic brake.

After releasing the brake, apply 12V DC.



- Extension cables

Extension cables are not included and must be purchased separately.

- Motor power line extension cable
Part number: 67-Q22AA
Cable length: 1m
Poles: 3
Terminals: Double ended connectors



- Motor sensor line extension cable
Part number: 67-Q23AA
Cable length: 1m
Poles: 6
Terminals: Double ended connectors



- Brake line extension cable
Part number: 41-L15XA
Cable length: 1m
Poles: 2
Terminals: Connector and stripping

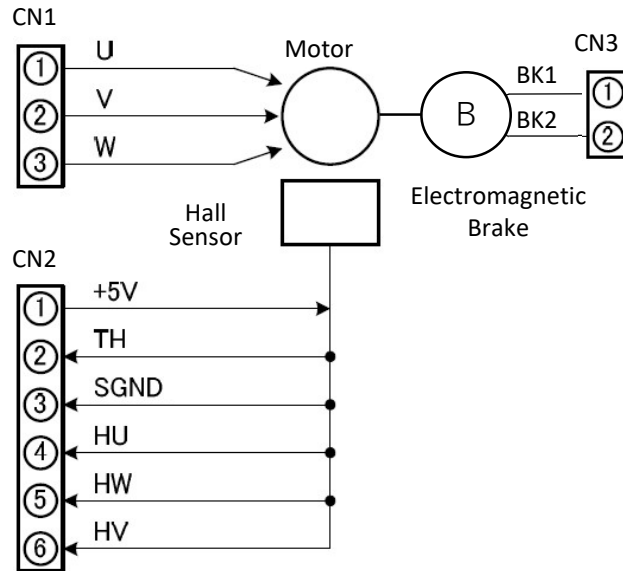


- Cable connector specification table

Cable type	Connector manufacturer	Connector type (Controller, Control device)		Connector type (Motor side)		Wire seal	Poles	Wire type (AWG)
		Housing (F)	Terminal (F)	Housing (M)	Terminal(M)			
Motor power line	Minebea connect	CL07D03A	215006-2M	CL07D03M	215005-2M	WS07MF-0D	3	AWG14
Motor sensor line	Minebea connect	CA01A6-06B0-01	CA01C6-010A	CA01A5-06B0-01	CA01C5-010A	01 (Light Blue)	6	AWG26
Brake line	Minebea connect	None: Stripped Tip	Stripped 12mm	CB01A5-02B0-02	CB01C5-020A	02 (Orange)	2	AWG22

For details on connector specifications, see the webpages of each connector manufacturer.

- Cable Connector Signal Explanation



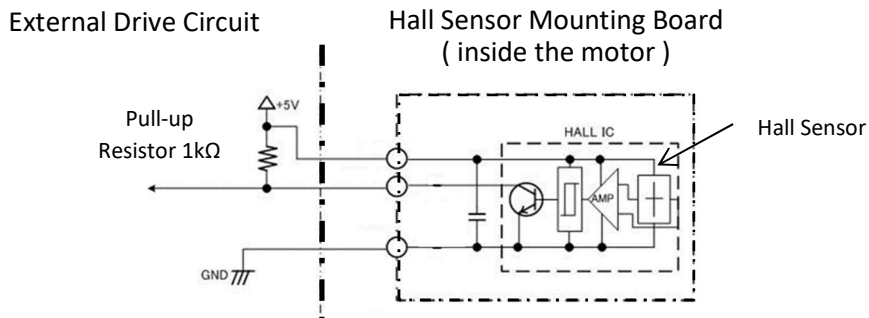
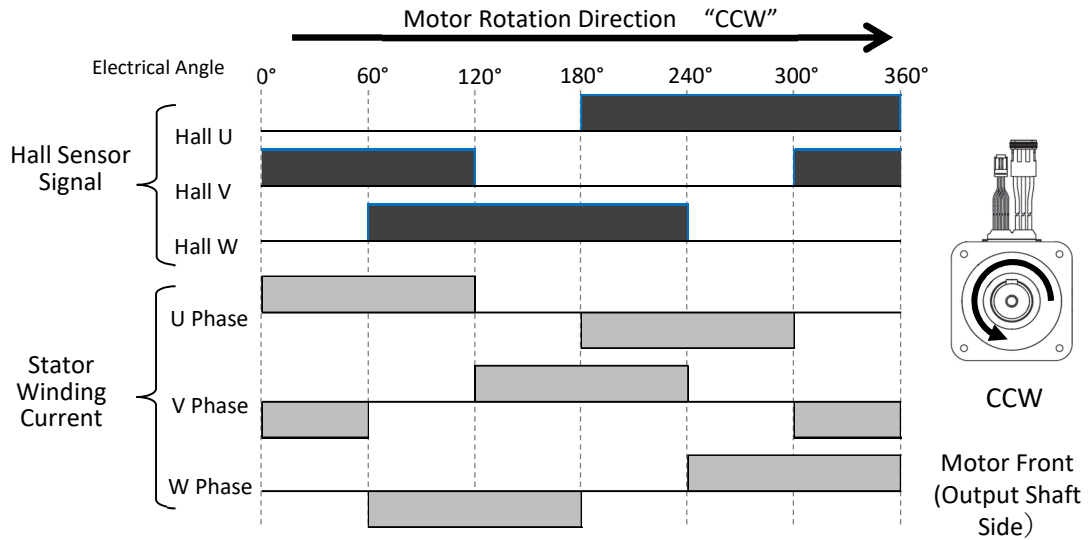
Connector	Pin #	Signal Name, Specification	Abbrev.
CN1	1	Stator Winding: U	U
	2	Stator Winding: V	V
	3	Stator Winding: W	W
CN2	1	Hall Sensor Power Supply: DC + 5V	+5V
	2	Temperature Monitoring Thermistor	TH
	3	Signal Ground: SGND	SGND
	4	Rotor Position Detection Hall Sensor Output: U Phase	HU
	5	Rotor Position Detection Hall Sensor Output: W Phase	HW
	6	Rotor Position Detection Hall Sensor Output: V Phase	HV
CN3	1	Electromagnetic Brake Winding *1	BK1
	2	Electromagnetic Brake Winding *1	BK2

*1 The electromagnetic brake winding has no polarity.

- Hall Sensor Output Signal

The relationship between the Hall sensor signal and the stator winding current is shown in the following chart.

Example: Motor driven by 120° square wave current



- The hall sensors in this motor are equipped with pull-up resistors. Connect pull-up resistors for each phase on the drive circuit end.
- If you are using the motor controller (DS-34EC1-IS221), pull-up resistors are not necessary.

• Specifications

Item		MS-94BZA	MS-94BZB	MS-94BZC
Components	Motor	●	●	●
	Gear	●	●	●
	Electromagnetic Brake	—	●	●
	Wheel	—	—	●
	Bracket	—	—	●
Mechanical Characteristics	Exterior	Refer to external drawings		
	Mass (Ref. Value)	2.2kg	2.8kg	4.5kg
	Reduction Ratio	10.33		
	Cable Length (Ref. Value)	Motor Power Supply /Sensor: 100mm	Motor Power Supply/Sensor: 100mm Brake: 220mm	
	Cable, Connector Tensile Strength	9.8N (min.)		
	Waterproofing	IPx4 (Use a Dedicated Connector) (Area around the output shaft is not subject to waterproofing)		
Standard Usage	Rated Voltage	24V (controller power supply voltage when using DS-34EC1)		
	Operating Voltage Range (* 1)	17 to 28V (controller power supply voltage when using DS-34EC1)		
	Operating Temperature Range	-10 to +50°C (*2)		
	Operating Humidity Range	20 to 95%RH (No condensation)		
	Direction of Rotation	CCW/CW viewed from the output shaft side.		
	Storage Temperature Range	+10 to +30°C		
	Storage Humidity Range	30 to 95%RH (No condensation)		
	Allowable Inertial Load	0.6kg·m ² (max.) (Applicable Acceleration Rate: 200r/min/s)		
	Allowable Radial Load	700N (15mm from the output shaft's tip)		
Motor Electrical Characteristics	No-Load Current	2.9A (max) (Reference, under 120° square wave current, 24V DC power)		
	No-Load Speed	270r/min (Reference, under 120° square wave current, 24V DC power)		
	Instantaneous Maximum Torque	17.2 Nm, 10sec (max) (Reference, under 120° square wave current, 24V DC power)		
	Maximum Output	342W (Reference, under 120° square wave current, 24V DC power)		
	Insulation Resistance	10MΩ (min.) (DC500V) (Between housing and electromagnetic brake winding/motor)		
	Withstand Voltage	AC500V, 1 minute (Between housing and electromagnetic brake winding/motor)		
	Thermistor	For motor winding temperature monitor (*2) (Reference, 100kΩ±10%, B constant (25/50°C), 4250K±10%)		
Electromagnetic Brake Characteristics	Electromagnetic Brake Type	—	Non-exciting actuation type. (Open operation when on)	
	Release voltage (Over-excitation)	—	DC24V±10% Application time 0.2sec(*3)	
	Holding voltage (After release)	—	DC12V ±10% (Continuous)	
	Coil resistance (For reference)	—	52Ω (Coil temperature 20°C)	
	Braking torque (Static friction)	—	17.2 Nm (Output shaft)	

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*1: If you are supplying your own controller, be careful that the controller power voltage does not exceed the maximum limit.

*2: The motor operating conditions (installation condition, load, environmental temperature) may cause significant heat buildup in the motor. Be careful that the detected temperature of the thermistor does not exceed 100°C. High ambient temperature while the motor is in use (motor temperature) will affect performance and service life.

*3: The application time is a reference value. It differs depending on the circuit used, so be sure to check it with the actual device before use.

• Specifications

Item		MS-94BZD	MS-94BZE	MS-94BZF
Components	Motor	•	•	•
	Gear	•	•	•
	Electromagnetic Brake	—	•	•
	Wheel	—	—	•
	Bracket	—	—	•
Mechanical Characteristics	Exterior	Refer to external drawings		
	Mass (Ref. Value)	2.8kg	3.4 kg	5.1kg
	Reduction Ratio	20		
	Cable Length (Ref. Value)	Motor Power Supply /Sensor: 100 mm	Motor Power Supply/Sensor: 100mm Brake: 220mm	
	Cable, Connector Tensile Strength	9.8N (min.)		
	Waterproofing	IPx4 (Use a Dedicated Connector) (Area around the output shaft is not subject to waterproofing)		
Standard Usage	Rated Voltage	24V (controller power supply voltage when using DS-34EC1)		
	Operating Voltage Range (* 1)	17 to 28V (controller power supply voltage when using DS-34EC1)		
	Operating Temperature Range	-10 to +50°C (*2)		
	Operating Humidity Range	20 to 95%RH (No condensation)		
	Direction of Rotation	CCW/CW viewed from the output shaft side.		
	Storage Temperature Range	+10 to +30°C		
	Storage Humidity Range	30 to 95%RH (No condensation)		
	Allowable Inertial Load	0.6kg·m ² (max.) (Applicable Acceleration Rate: 200r/min/s)		
	Allowable Radial Load	700N (15mm from the output shaft's tip)		
Motor Electrical Characteristics	No-Load Current	2.2A (max) (Reference, under 120° square wave current, 24V DC power)		
	No-Load Speed	142r/min (Reference, under 120° square wave current, 24V DC power)		
	Instantaneous Maximum Torque	30 Nm, 10sec (max) (Reference, under 120° square wave current, 24V DC power)		
	Maximum Output	327W (Reference, under 120° square wave current, 24V DC power)		
	Insulation Resistance	10MΩ (min.) (DC500V) (Between housing and electromagnetic brake winding/motor)		
	Withstand Voltage	AC500V, 1 minute (Between housing and electromagnetic brake winding/motor)		
	Thermistor	For motor winding temperature monitor (*2) (Reference, 100kΩ±10%, B constant (25/50°C), 4250K±10%)		
Electromagnetic Brake Characteristics	Electromagnetic Brake Type	—	Non-exciting actuation type. (Open operation when on)	
	Release Voltage (Over-excitation)	—	DC24V±10% Application time 0.2sec(*3)	
	Holding voltage (After release)	—	DC12V ±10% Continuous	
	Coil resistance (For reference)	—	52Ω (Coil temperature 20°C)	
	Braking Torque (Static Friction)	—	30 Nm (output shaft)	

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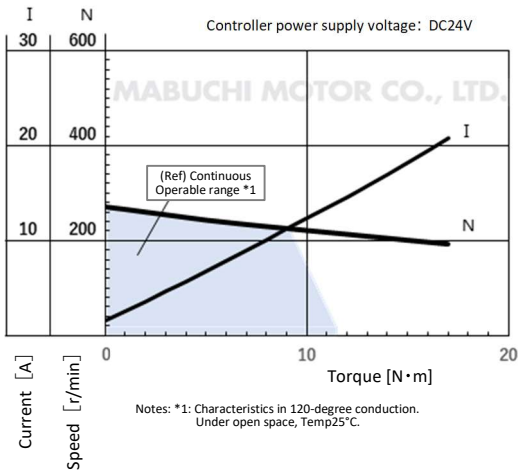
*1: If you are supplying your own controller, be careful that the controller power voltage does not exceed the maximum limit.

*2: The motor operating conditions (installation condition, load, environmental temperature) may cause significant heat buildup in the motor. Be careful that the detected temperature of the thermistor does not exceed 100°C. High ambient temperature while the motor is in use (motor temperature) will affect performance and service life.

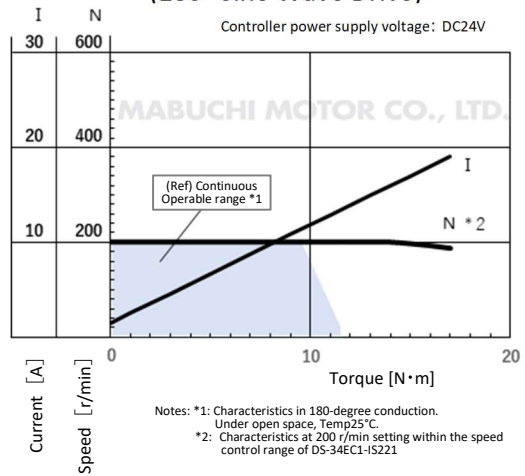
*3: The application time is a reference value. It differs depending on the circuit used, so be sure to check it with the actual device before use.

● Motor Characteristics : MS-94BZA

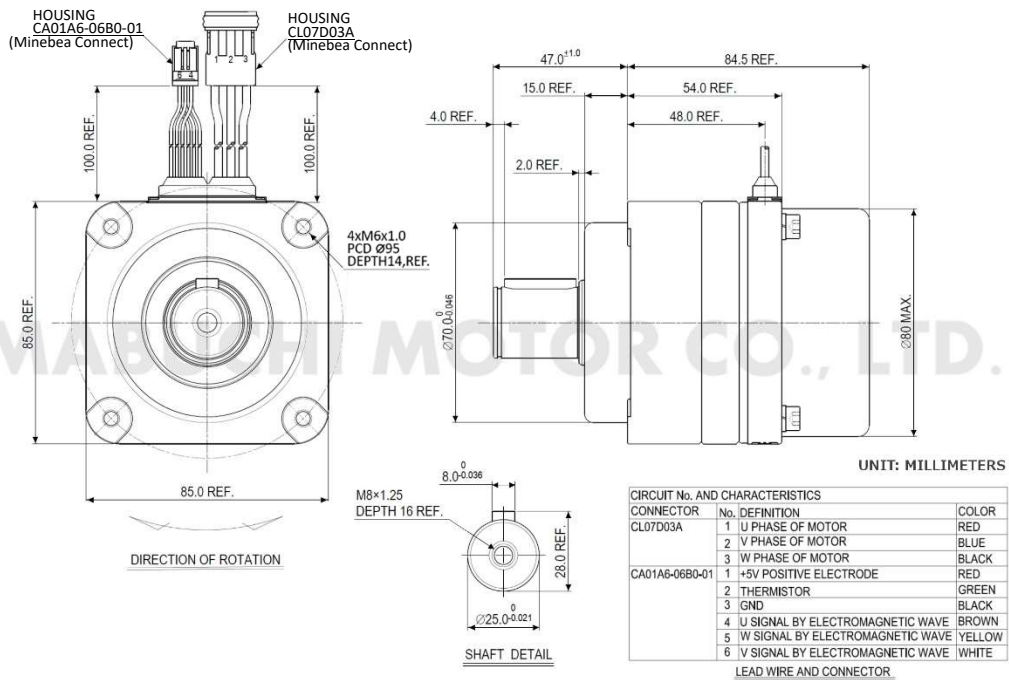
Applying 120° Square-wave Current



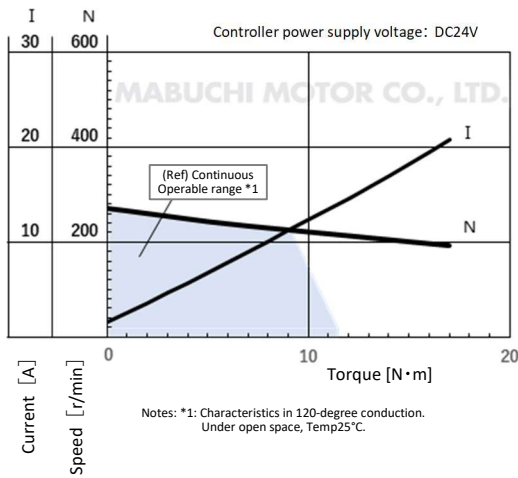
Connected to DS-34EC1-IS221
(180° Sine Wave Drive)



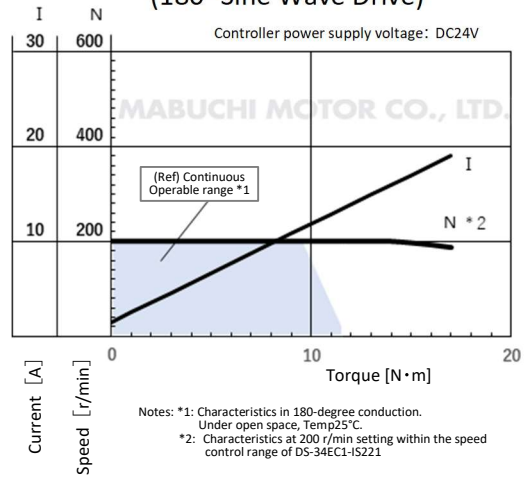
● Drawings : MS-94BZA



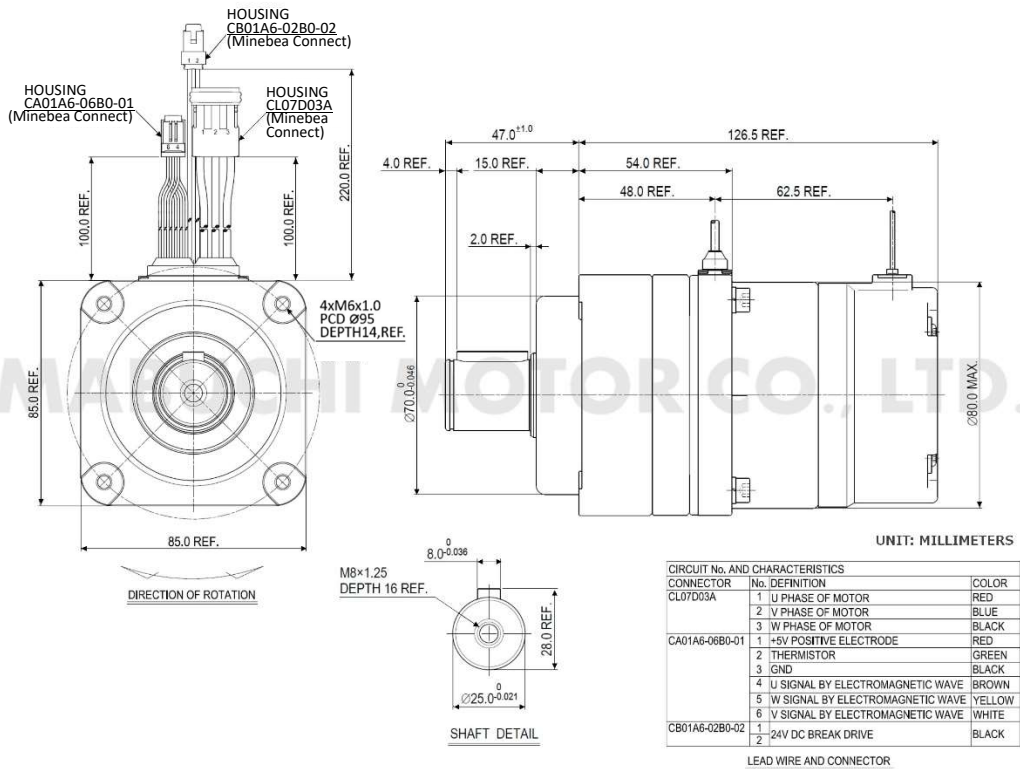
● Motor Characteristics : MS-94BZB
Applying 120° Square-wave



Connected to DS-34EC1-IS221
(180° Sine Wave Drive)

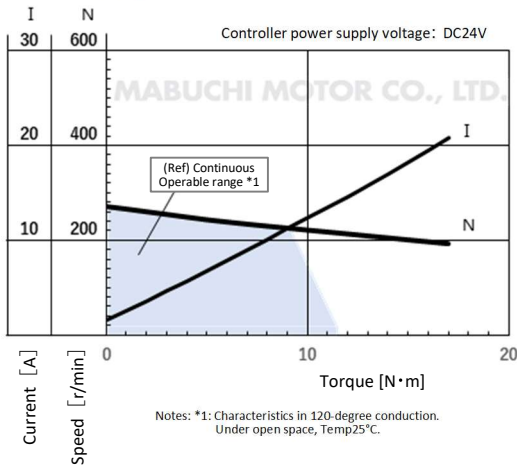


● Drawings : MS-94BZB

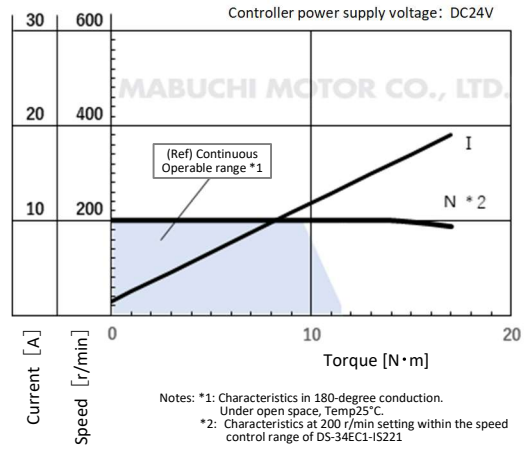


● Motor Characteristics : MS-94BZC

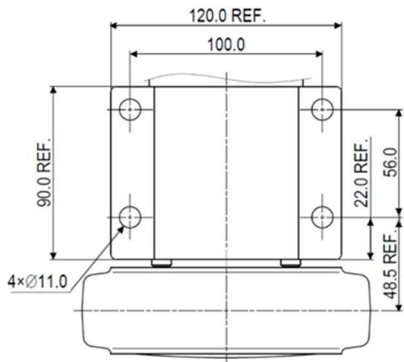
Applying 120° Square-wave



Connected to DS-34EC1-IS221
(180° Sine Wave Drive)



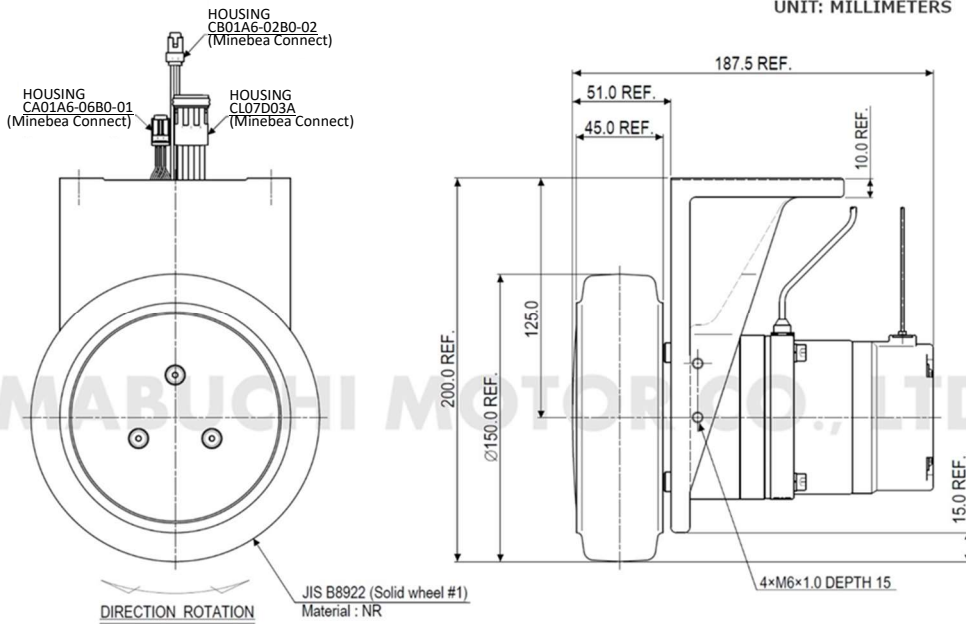
● Drawings : MS-94BZC



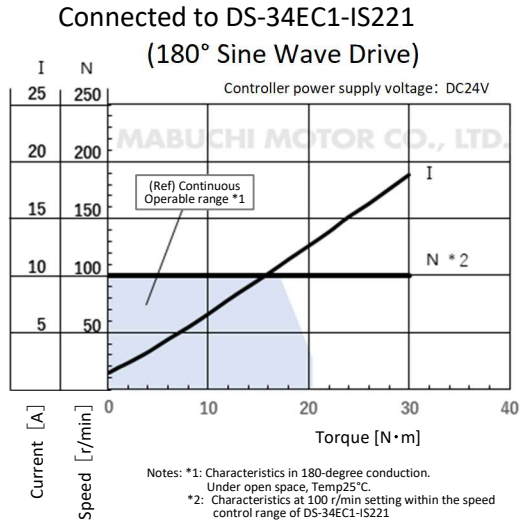
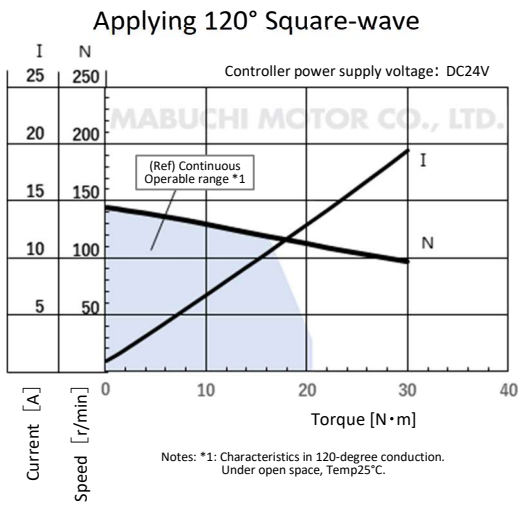
CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE	YELLOW
	6	V SIGNAL BY ELECTROMAGNETIC WAVE	WHITE
CB01A6-02B0-02	1	ELECTROMAGNETIC BRAKE DRIVE	BLACK
	2		

LEAD WIRE AND CONNECTOR

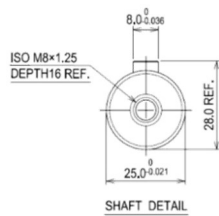
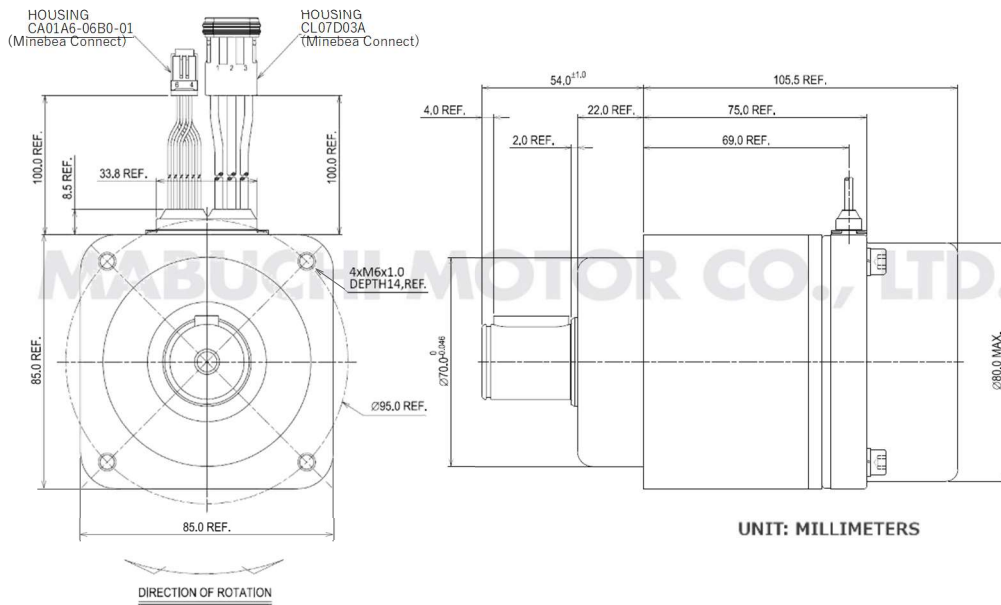
UNIT: MILLIMETERS



● Motor Characteristics : MS-94BZD



● Drawings : MS-94BZD

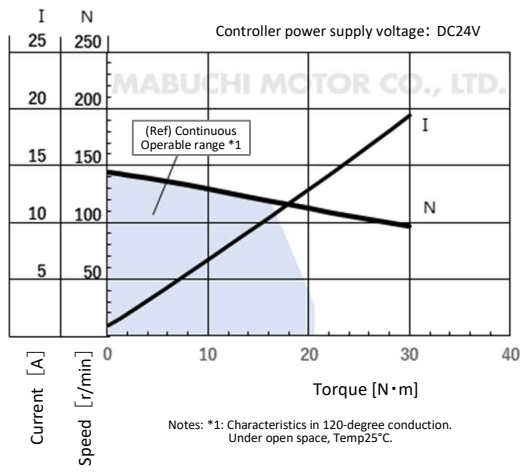


CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE	YELLOW
	6	V SIGNAL BY ELECTROMAGNETIC WAVE	WHITE

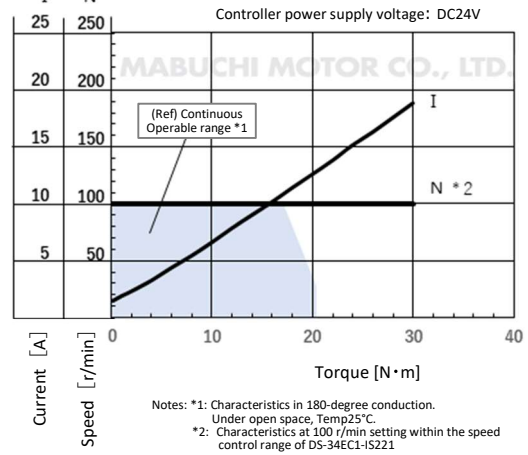
LEAD WIRE AND CONNECTOR

● Motor Characteristics : MS-94BZE

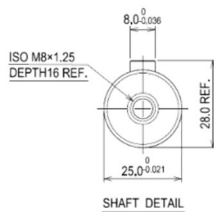
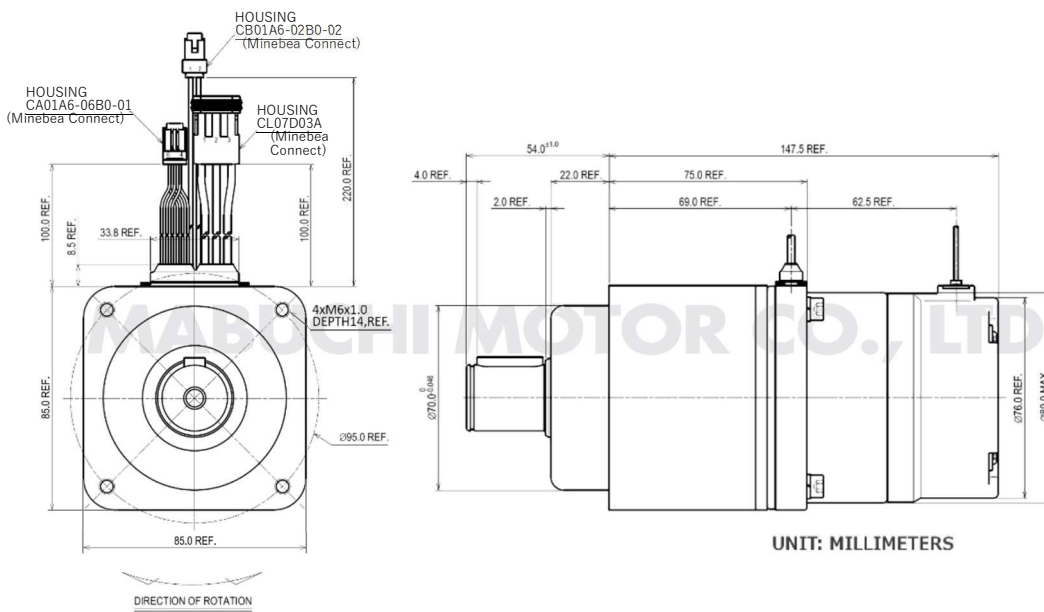
Applying 120° Square-wave



Connected to DS-34EC1-IS221
(180° Sine Wave Drive)



● Drawings : MS-94BZE

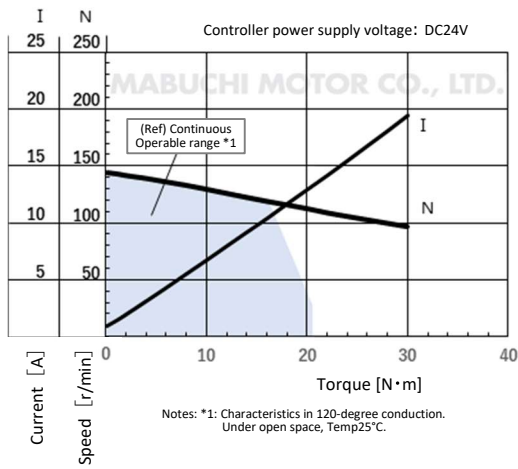


CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE	YELLOW
	6	V SIGNAL BY ELECTROMAGNETIC WAVE	WHITE
CB01A6-02B0-02	1	24V DC BREAK DRIVE	BLACK
	2		

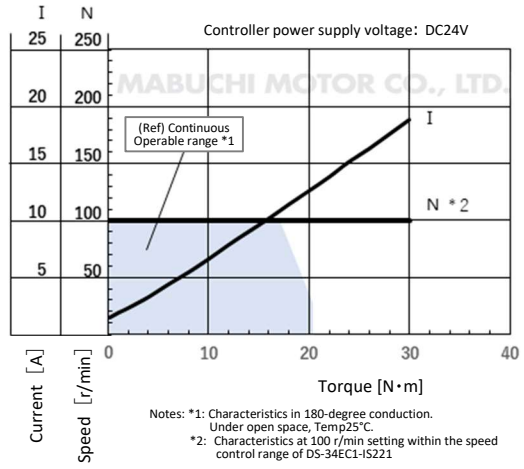
LEAD WIRE AND CONNECTOR

● Motor Characteristics : MS-94BZF

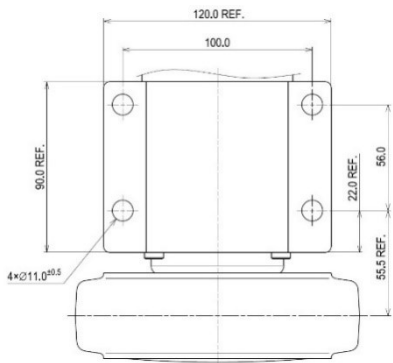
Applying 120° Square-wave



Connected to DS-34EC1 (180° Sine Wave Drive)

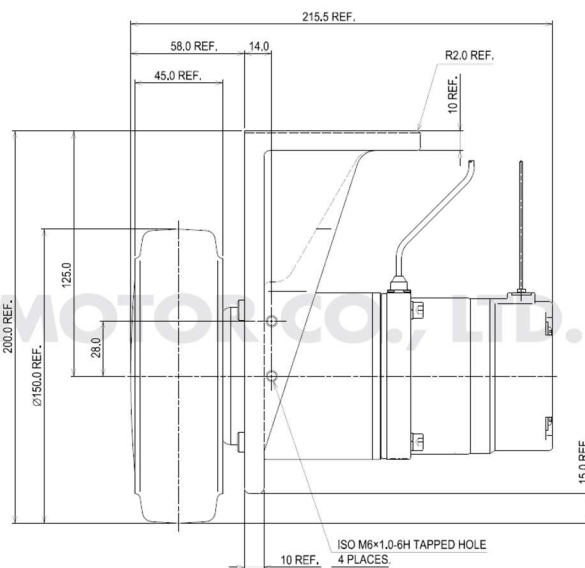
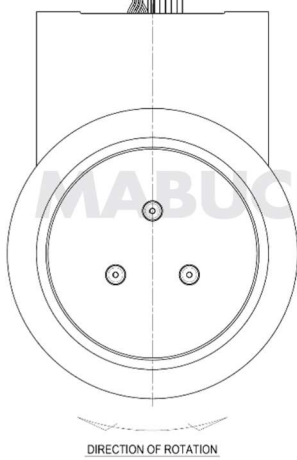
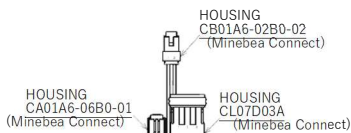


● Drawings : MS-94BZF



CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE	YELLOW
	6	V SIGNAL BY ELECTROMAGNETIC WAVE	WHITE
CB01A6-02B0-02	1	24V DC BREAK DRIVE	BLACK
	2		

LEAD WIRE AND CONNECTOR



UNIT: MILLIMETERS



Product Warranty, Inquiries

Please contact the retailer where you purchased this product.