Publication Number : TKS-A10-000183
Date of Publication : Feb. 8. 2021

MS-94BZA/BZB/BZC
Instruction Manual

MS-94BZA
Geared Motor

MS-94BZB
Geared Motor
/with Brake

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

MABUCHI MOTOR CO., LTD.

MABUCHI MOTOR

FOR YOUR SAFTY

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

⚠ Caution: May result in injury or damage

⃠ Prohibition: Prohibited actions.

❗ Instruction: Required actions.

⚠ Warning ⃠ Prohibition

・Do not plug the lead wire or motor terminal into home electrical outlets. This will cause electrical shock, injury, and 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, and electrical shock.

・Do not use in the presence of corrosive or flammable gas, or near combustibles. This may cause fire, injury, and equipment damage.

MABUCHI MOTOR

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.

・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～+30℃ temperature, 30～95% 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.

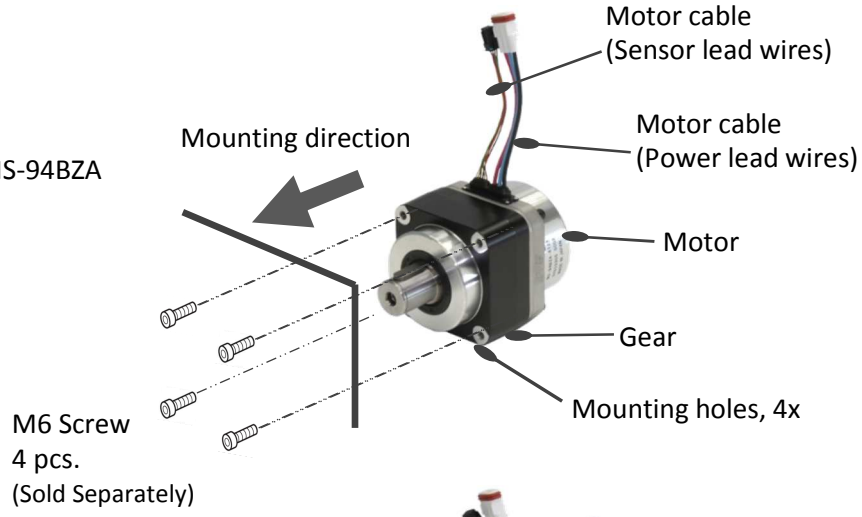
・High ambient temperature while the motor is in use (motor temperature) will affect performance and service life. Exercise special caution in cases of high temperature and humidity.

MABUCHI MOTOR

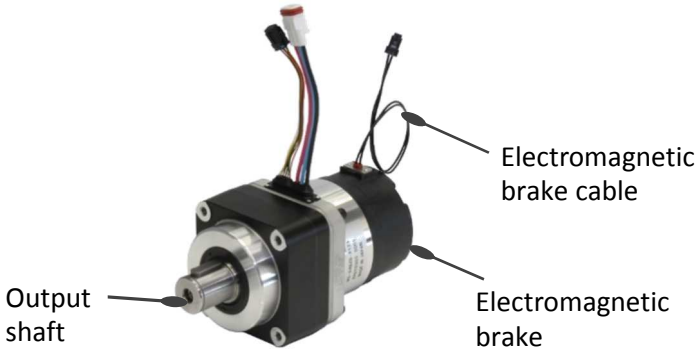
Motor Parts and Features

● Motor parts

・Type: MS-94BZA



・Type: MS-94BZB



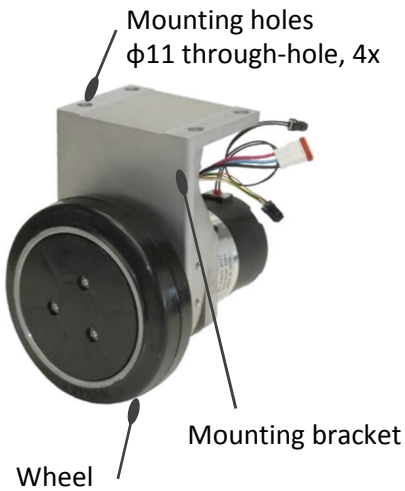
● Mounting holes dimensions

Type	Mounting holes dimensions
MS-94BZA MS-94BZB	M6 screw, effective depth: 14mm, 4x
MS-94BZC	ϕ11 ±0.5 through-hole, 4x

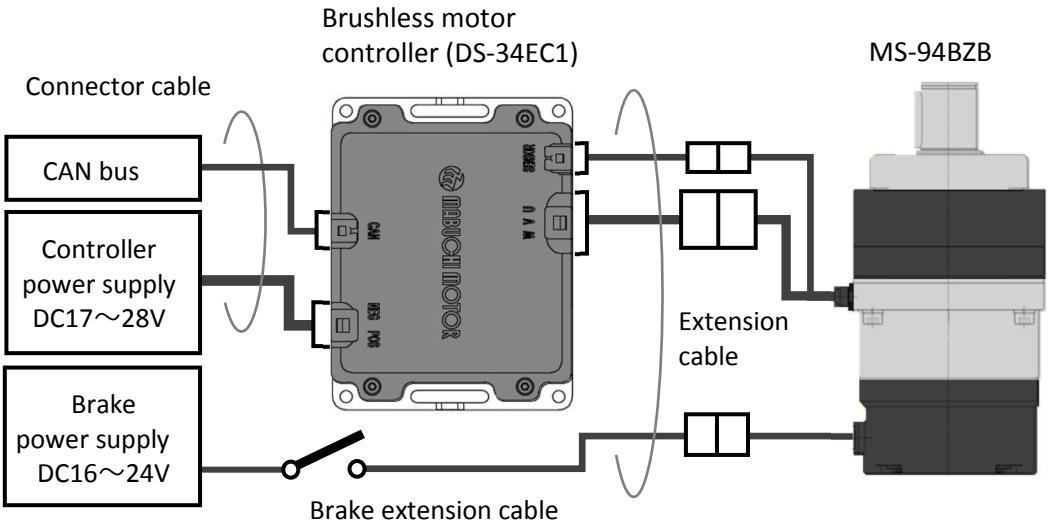
Caution **Prohibition** **Instruction**

・Ensure there are no gaps on the mounting surface.
・Do not:
  a) Separate or disassemble the motor or gear head
  b) 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



● Connection diagram



・The example above shows an MS-94BZB being connected with a Mabuchi motor controller (DS-34EC1), power supply, etc.

・The Motor Controller (DS-34EC1) connection and extension cables are available as optional items.
Read DS-34EC1 Operation Manual or IS/MS Series Product Guide for details on connection cables and extension cables.

⚠ Caution **❗ Instruction**

・The controller (DS-34EC1) cannot control electromagnetic brakes.
Be sure to prepare the ON/OFF control circuit and a power supply for the brake.
(MS-94BZB/BZC)

・The controller power supply has polarity. Be sure to connect it correctly.

・The brake power 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's load is inductive. 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.

MABUCHI MOTOR

● Extension cables

Extension cables are sold separately.
Please purchase these 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

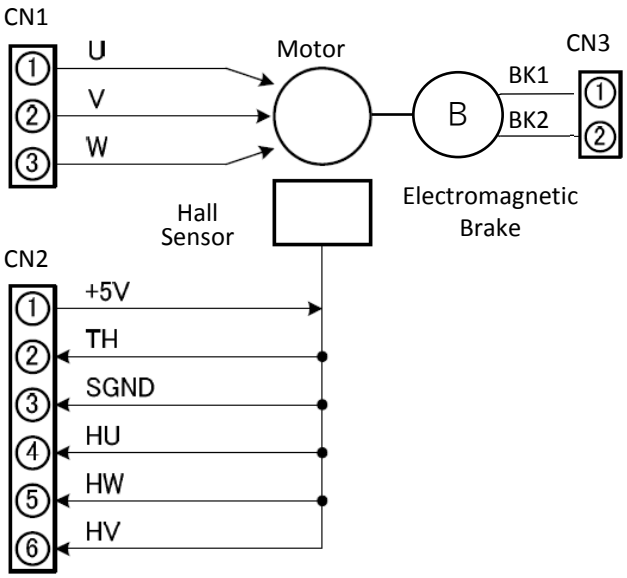
・Brake line extension cable
Part number: 41-L15XA
Cable length: 1m
Poles: 2
Terminals: Connector and stripping

● Cable connector specification table

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

For detailed connector specifications, please consult the connector maker’s website.

● Cable Connector Signal Explanation



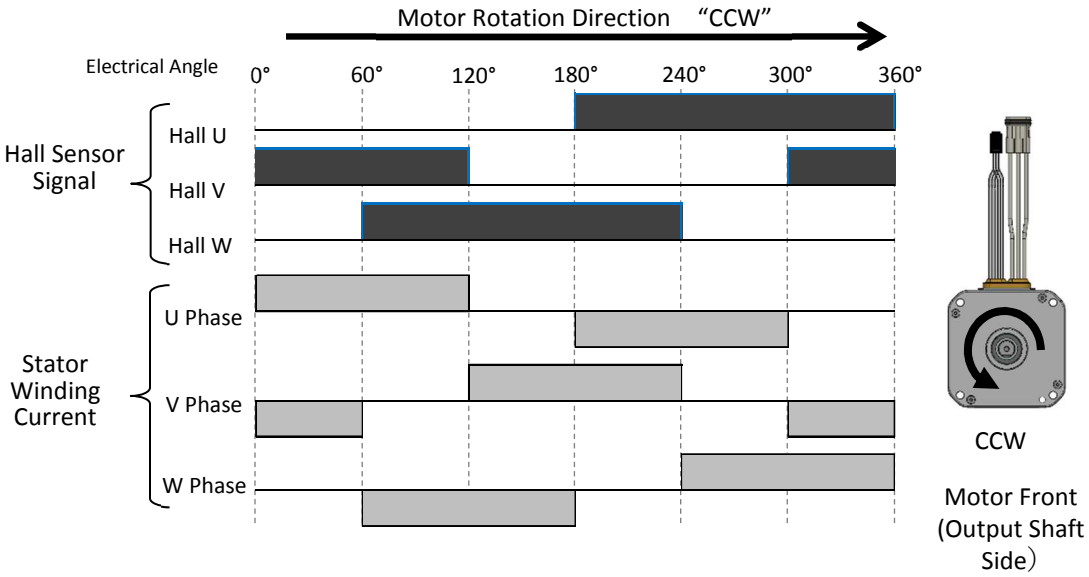
Connector	Pin #	Signal Name, Specification	Abbrev.
CN1	1	Stator Winding: U	U
	2	Stator Winding: V	V
	3	Stator Winding: W	W
CN2	1	Hall Sensor Power Supply: DC＋5V	+5V
	2	Temperature Monitoring Thermistor	TH
	3	Signal Ground: SGND	SGND
	4	Rotor Position Detection Hall Sensor Output: U Phase	HU
	5	Rotor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

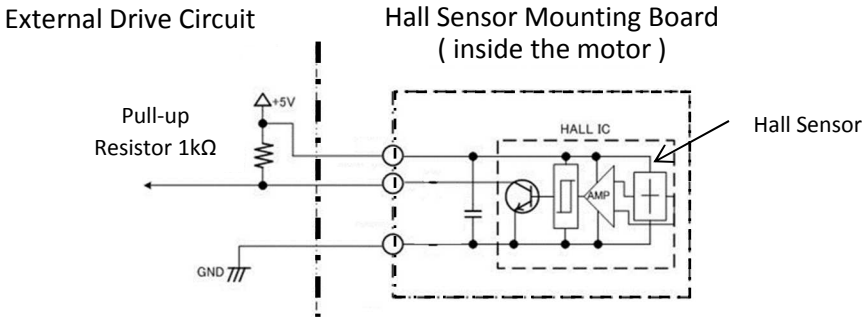
*1 Electromagnetic brake winding has no polarity.

● 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),
pull-up resistors are not necessary.

MABUCHI MOTOR

● Specifications

Item		MS-94BZA	MS-94BZB	MS-94BZC
Components	Motor	●	●	●
	Gear	●	●	●
	Electromagnetic Brake	–	●	●
	Wheel	–	–	●
	Bracket	–	–	●
Mechanical Characteristics	Exterior	Refer to External Diagram		
	Mass (Ref. Value)	2.2kg	2.8kg	4.5kg
	Reduction Ratio	1／10.33		
	Cable Length (Ref. Value)	Motor Power Supply /Sensor: 100 mm	Motor Power Supply/Sensor: 100mm, Brake: 220 mm	
	Cable, Connector Tensile Strength	9.8N (min.)		
	Waterproofing	IPx4 (Use a Dedicated Connector)		
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℃ (*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℃		
	Storage Humidity Range	30 to 95%RH (No condensation)		
	Allowable Inertial Load	0.6kg・m² (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 (Reference, under 120° square wave current, 24V DC power)		
	No-Load Speed	270rpm (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) 100kΩ±10%, B constant (25/50℃), 4250K±10% (ref. value)		
Electronic Brake Characteristics	Electromagnetic Brake Type	–	Power-off type (open operation when applying current)	
	Electromagnetic Brake Release Voltage	–	16 to 24V, continuous DC application	
	Electromagnetic Brake Release Current	–	0.45A (reference, power supply voltage DC24V)	
	Braking Torque (Static Friction)	–	20 Nm (output shaft)	

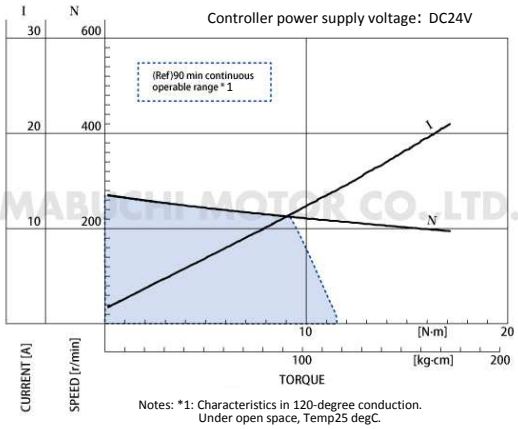
• The product's performance, specifications, and appearance may be modified for improvements without advance notice. Thank you for your understanding.

*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.

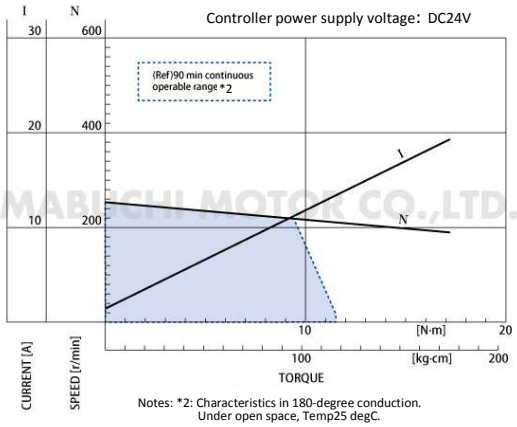
● Motor Characteristics：MS-94BZA

Applying 120° Square-wave Current



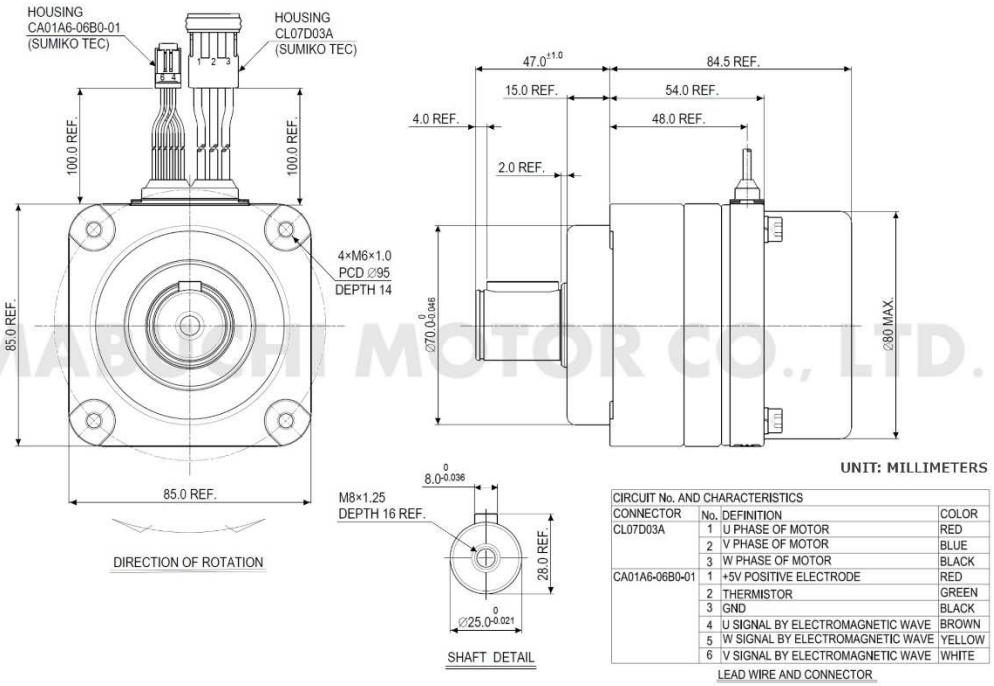
Notes: *1: Characteristics in 120-degree conduction.
Under open space, Temp25 degC.

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



Notes: *2: Characteristics in 180-degree conduction.
Under open space, Temp25 degC.

● Drawing：MS-94BZA



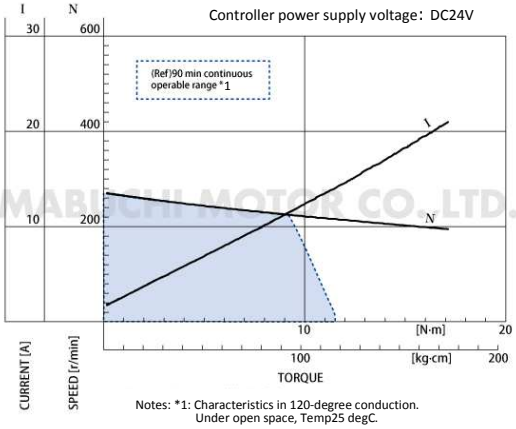
UNIT: MILLIMETERS

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

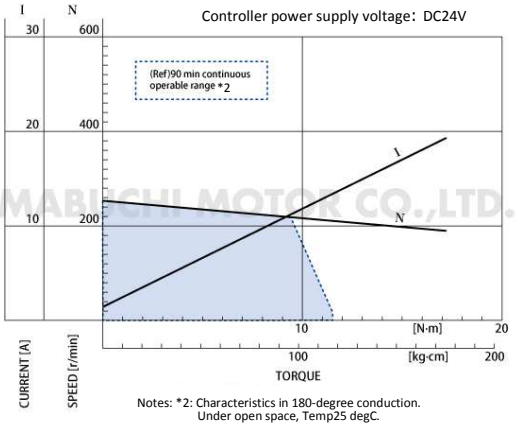
● Motor Characteristics：MS-94BZB

Applying 120° Square-wave



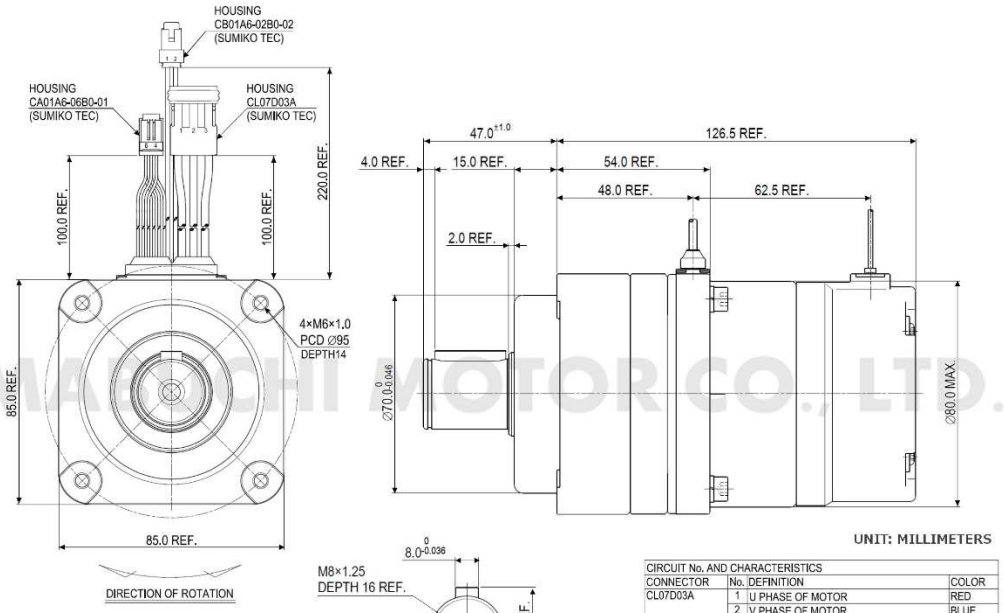
Notes: *1: Characteristics in 120-degree conduction.
Under open space, Temp25 degC.

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



Notes: *2: Characteristics in 180-degree conduction.
Under open space, Temp25 degC.

● Drawing：MS-94BZB

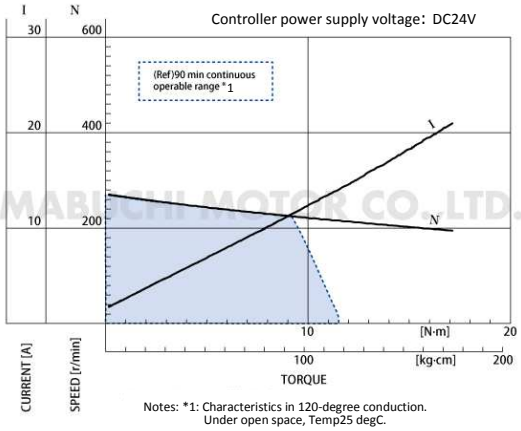


CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE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

LEAD WIRE AND CONNECTOR

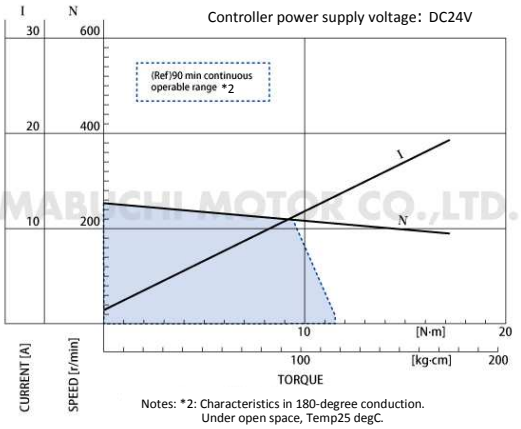
● Motor Characteristics：MS-94BZC

Applying 120° Square-wave



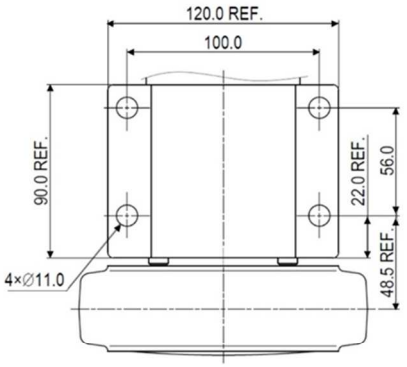
Notes: *1: Characteristics in 120-degree conduction.
Under open space, Temp25 degC.

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



Notes: *2: Characteristics in 180-degree conduction.
Under open space, Temp25 degC.

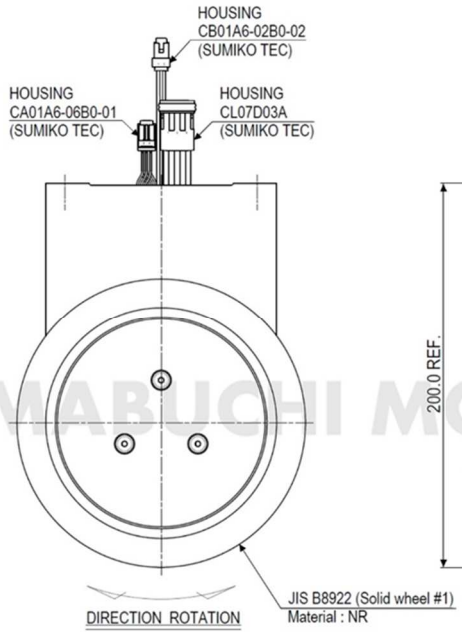
● Drawing：MS-94BZC

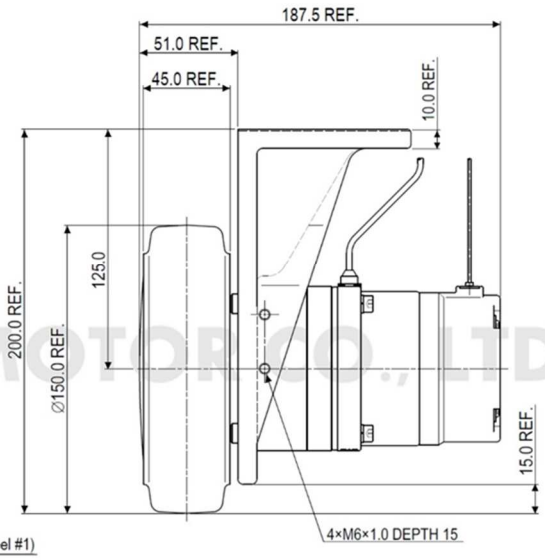


CIRCUIT No. AND CHARACTERISTICS			
CONNECTOR	No.	DEFINITION	COLOR
CL07D03A	1	U PHASE OF MOTOR	RED
	2	V PHASE OF MOTOR	BLUE
	3	W PHASE OF MOTOR	BLACK
CA01A6-06B0-01	1	+5V POSITIVE ELECTRODE	RED
	2	THERMISTOR	GREEN
	3	GND	BLACK
	4	U SIGNAL BY ELECTROMAGNETIC WAVE	BROWN
	5	W SIGNAL BY ELECTROMAGNETIC WAVE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

LEAD WIRE AND CONNECTOR

UNIT: MILLIMETERS





MABUCHI MOTOR

Product Warranty, Inquiries

Please contact the retailer where you purchased this product.