

5-phase Stepping Motor Driver

GDB-5K60

Instructions Manual

(For designers' use)

USER'S MANUAL

Please ensure to read and understand this Instructions Manual before using the product. Please keep this Instructions Manual at hand so that it is always available for reference.



MN0535

Introduction

This Instructions Manual describes the safe and proper method of handling "5-phase Stepping Motor Driver GDB-5K60" with emphasis on the specifications, assuming that our readers are engaged in designing of control devices incorporating stepping motors.

Please ensure to read and understand this Instructions Manual before using the product.

Please keep this Instructions Manual at hand so that it is always available for reference.

Descriptions in this manual on safety matters:

This product must be operated and used properly.

Otherwise, or when it is operated and used erroneously, unforeseen accidents may occur, causing physical injuries or property damages.

Majority of these accidents can be avoided if you are well informed of hazardous circumstances in advance.

Consequently, this instructions manual describes all the hazardous and dangerous circumstances and situations which can be foreseen and anticipated as well as necessary precautions.

All the above descriptions are being titled by the following symbol-marks and signal-words, namely:



Represents warnings ignorance of which can cause accidents involving fatal or serious physical injuries.



Represents cautions ignorance of which can cause accidents involving minor physical injuries or property damages.

Introduction

Descriptions in this manual on safety matters:

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The main parts which revised by this manual

1. Safety

1 – 1. Safety Precautions

 WARNING
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- (1) This product is not designed or manufactured for application for equipment requiring high level of reliability such as equipment related to nuclear energy, aeronautics-related equipment, automobiles, ships, medical appliances directly handling the human body and equipment that might seriously affect properties.
- (2) Do not use or keep the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, fine particles, soot, steam, or exposed to radiation or direct sunshine. Doing so may cause injury or fire.
- (3) For the driver's power supply, use a DC power supply with reinforced insulation on its primary and secondary sides. Failure to do so may cause electric shock.
- (4) This product is designed for use within machinery, so it should be installed within an enclosure. Failure to do so may cause injury.
- (5) Do not transport, move, install the product, perform connections or inspections when the power is on. Doing so may cause electric shock, injury or fire.
- (6) Only qualified personnel are allowed to transport, move, install the product, perform connections or inspections. Failure to do so may cause injury or fire.

 CAUTION
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- (7) Do not touch the driver during operation or immediately after stopping. Doing so may cause burn on the skin due to overheating of the driver.
- (8) Ensure to use this product according to the method specified in the Instructions Manual and within the specifications.
- (9) Depending on the operational conditions, the stepping motor may step out when it is on holding-state or driving-state. In particular, the load in transport may fall if the motor steps out on the vertical drive (such as the Z-axis). Start operation after test run for deliberate confirmation of operation.
- (10) Provide fail-safe measures so that the entire system may operate in a safe mode even in cases of the external power supply failure, disconnection of the signal line, or any failure on the driver.

1 – 2. Safety Information for Handling

●Overall:

**CAUTION**

Do not touch the driver during operation or immediately after stopping.
it may cause burn on the skin due to overheating of the driver.

●When setting up the MOTOR SELECT switch:

**CAUTION**

Erroneous setting may cause burn on the skin due to overheating of the motor.
Ensure correct setting.

●When setting up the STEP ANGLE SELECT switch:

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

●When setting up the HOLD CURRENT SELECT switch:

**CAUTION**

A high setting value may cause burn on the skin due to overheating of the motor.
Do not select a high value beyond the required.

●When setting up the DRIVE CURRENT SELECT switch:

**CAUTION**

A high setting value may cause burn on the skin due to overheating of the motor.
Do not select a high value beyond the required.

- When setting up the PULSE INPUT TYPE SELECT switch:

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

- When setting up the ROTATE MODE SELECT switch:

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

- When setting up the EXTEND FUNCTION SELECT switch:

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

- When installing:

**WARNING**

Overheating may cause fire.
Mount it on a noncombustible member.
Keep it away from combustibles.

- When connecting the DC Input/ Motor Output Connectors (J2, J3)

**CAUTION**

Erroneous connection may cause breakage of the motor or the driver.
Correctly connect the DC Input/Motor output connector.

●When inputting power:



CAUTION

Breakage of the machine or injury is apprehended due to unexpected behavior of the motor. Maintain the state where emergency stop is enabled at any time.

●When inputting the motor excitation stop (M.F) signal:



CAUTION

Deterioration of the holding power with the motor may cause breakage of the machine or injury.
Check safety before inputting.

●When the overheat alarm (O.H.A) signal is output:



WARNING

Overheating may cause fire.
Stop operation upon output of this signal.

●When the overheat alarm (O.H.A) LED comes on:



WARNING

Overheating may cause fire.
Stop operation when this LED comes on.

●When performing maintenance and checking:



WARNING

Injury or fire is apprehended due to unexpected behavior.
Do not replace fuse.
Do not disassemble, repair or modify.

2. Overview

2-1. Characteristics

GDB-5K60 is a driver for a 5-phase stepping motor with DC +24V input.
It can drive a 5-phase stepping motor with 1.8A/phase~2.8A/phase.
Step angles can be selected from eighteen step angles ranging from 1 division to 8000 division of the basic angle.
HOLD CURRENT and DRIVE CURRENT can be set up.

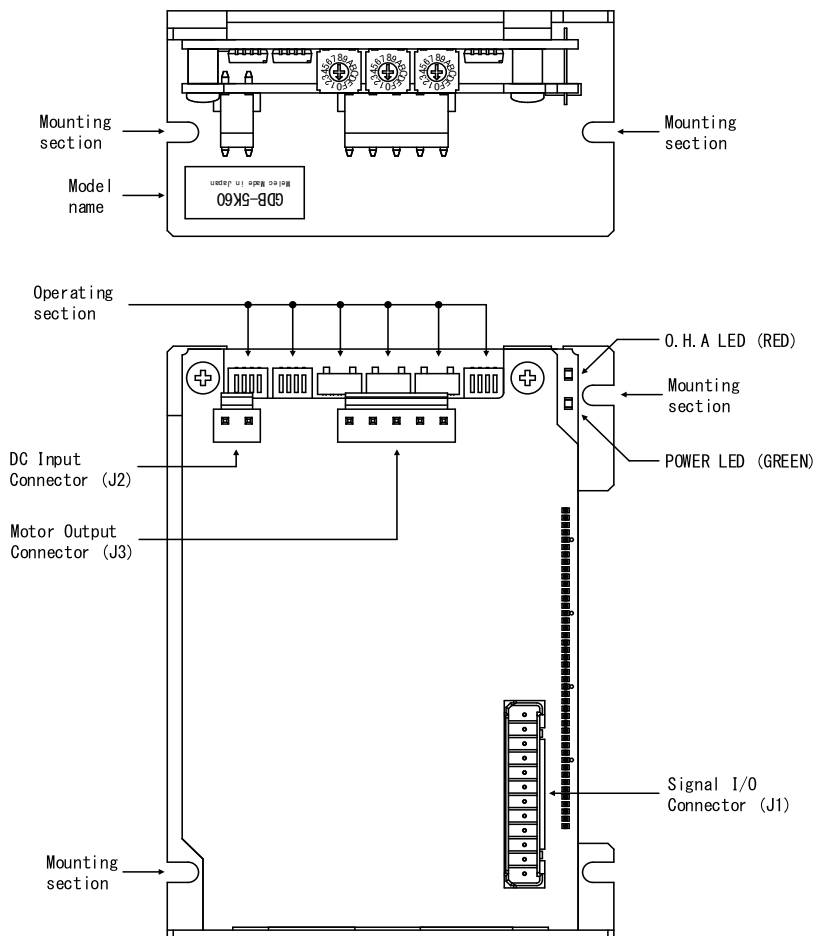
- Applicable motors and setting for each motor are given in the table "10-4. Applicable Motors".
- Use overheat alarm signal output (O.H.A) without fail.
Provide mechanical cooling, if this signal is output.

2-2. Product Configuration

- GDB-5K60 One unit(main frame)

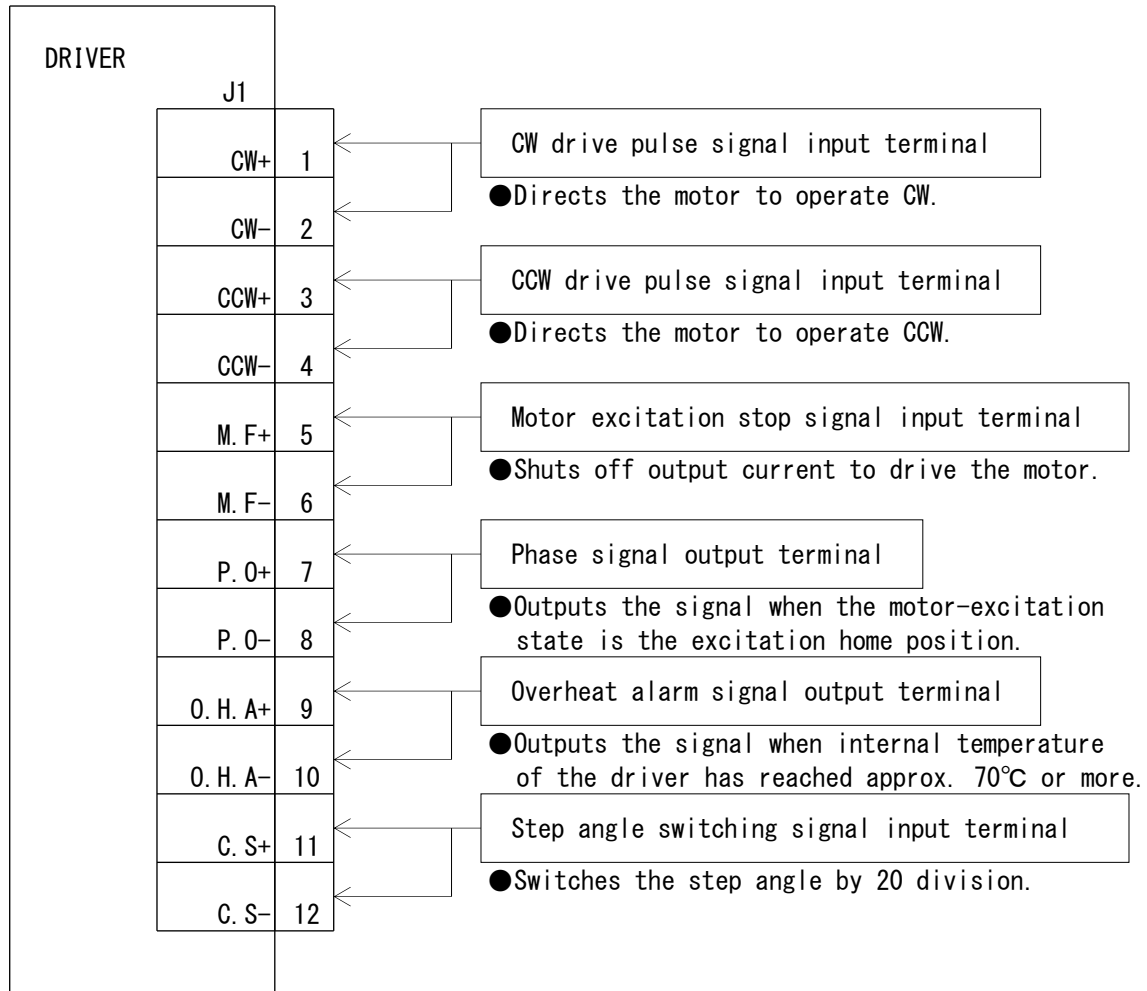
J1, J2, J3 of the housing and the contact is not in accessories.

2-3. Appearance

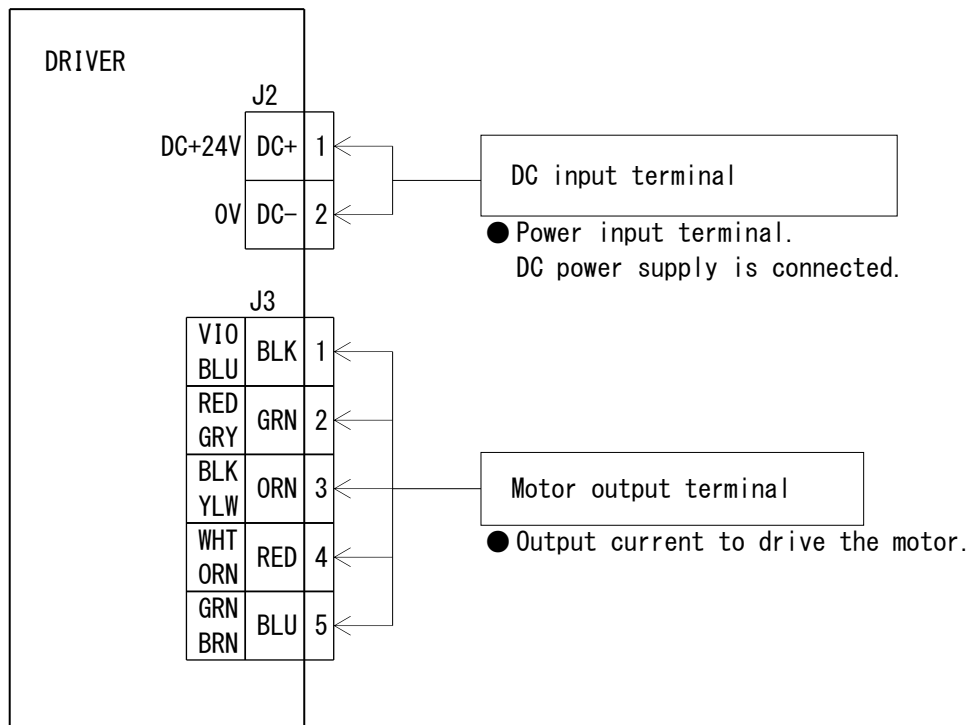


3. Name and Function of Each Section

3-1. Signal I/O Connector (J 1)



3 – 2. DC Input/Motor Output Connector (J 2, J 3)



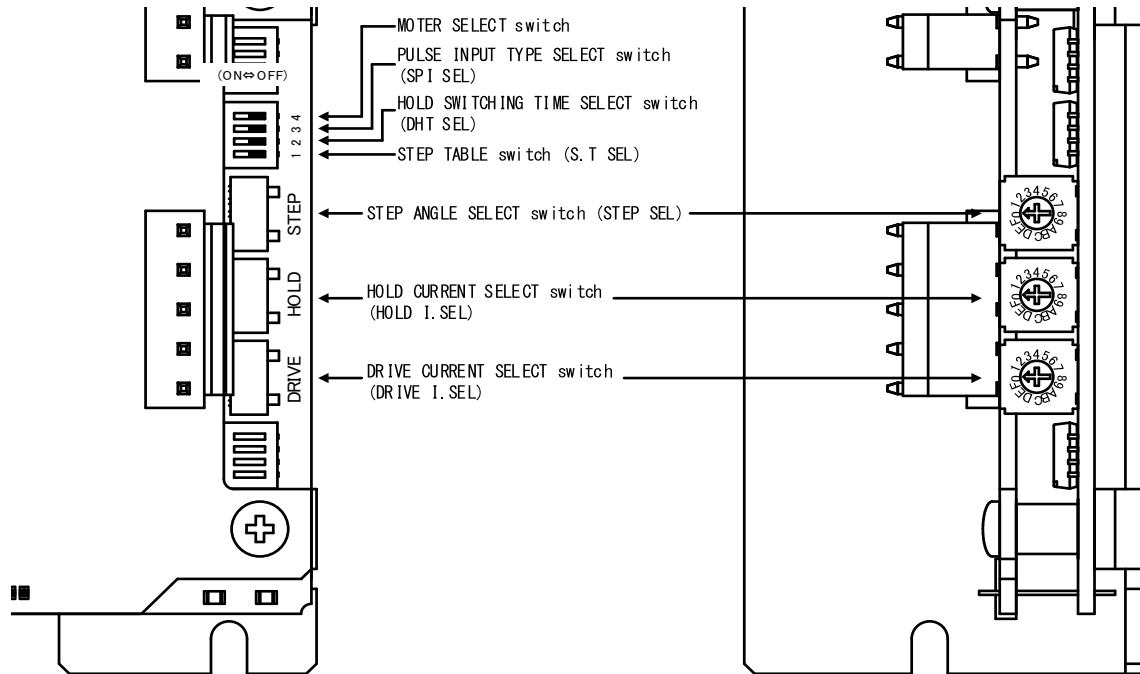
3 – 3. POWER LED

POWER LED (GREEN) comes on upon inputting power.

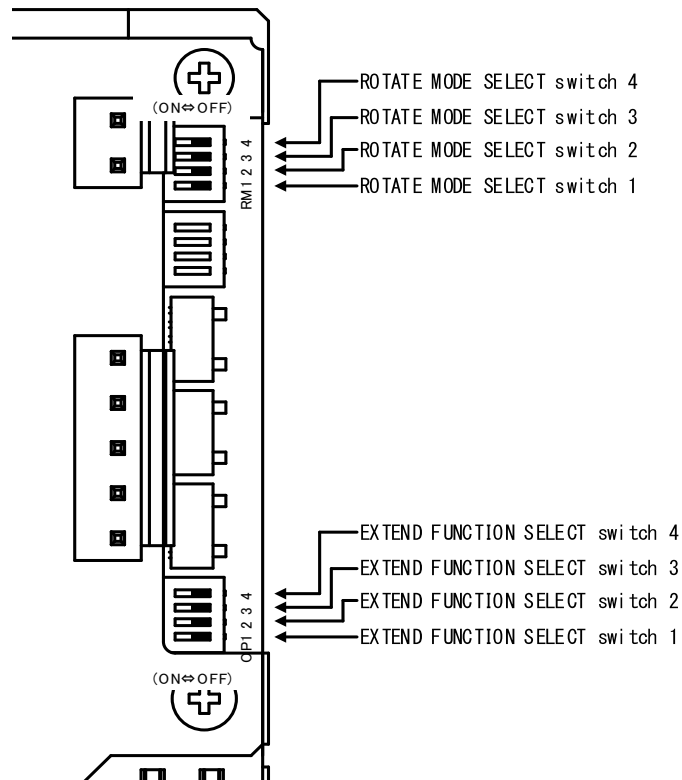
3 – 4. O. H. A LED

O. H. A LED (RED) comes on when internal temperature of the driver has reached approx. 70°C or more.

3 – 5. Operating Section



Name of Operating Section	Function	Factory Setting
4 MOTOR SELECT switch	Use it with OFF.	4: [OFF]
3 PULSE INPUT TYPE SELECT switch	Select a pulse input type.	3: [OFF (2P)]
2 HOLD SWITCHING TIME SELECT switch	DRIVE/HOLD CURRENT automatic switching time is selected.	2: [OFF (DH1)]
1 STEP TABLE switch	Select STEP TABLE.	1: [OFF (S. T1)]
STEP ANGLE SELECT switch	Select a step angle.	[No. 1]
HOLD CURRENT SELECT switch	Select HOLD CURRENT.	[No. 8]
DRIVE CURRENT SELECT switch	Select DRIVE CURRENT.	[No. D]



Name of Operating Section		Function	Factory Setting
4	ROTATE MODE SELECT switch 4	Select ROTATE MODE	RM4: [OFF]
3	ROTATE MODE SELECT switch 3	Select ROTATE MODE	RM3: [OFF]
2	ROTATE MODE SELECT switch 2	Select ROTATE MODE	RM2: [OFF]
1	ROTATE MODE SELECT switch 1	Select ROTATE MODE	RM1: [OFF]
4	EXTEND FUNCTION SELECT switch 4	Select EXTEND FUNCTION	OP4: [OFF]
3	EXTEND FUNCTION SELECT switch 3	Select EXTEND FUNCTION	OP3: [OFF]
2	EXTEND FUNCTION SELECT switch 2	Select EXTEND FUNCTION	OP2: [OFF]
1	EXTEND FUNCTION SELECT switch 1	Select EXTEND FUNCTION	OP1: [OFF]

4. Setting

4 – 1. Setting MOTOR SELECT switch

**CAUTION**

Erroneous setting may cause burn on the skin due to overheating of the motor.

Ensure correct setting.

Set this switch with power OFF.

(1) Use it with [OFF].

4 – 2. Setting STEP TABLE switch and STEP ANGLE SELECT switch



CAUTION

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of motor.
Ensure correct setting.

The step angle is set up with the S.T SEL switch and the STEP SEL switch.
The step angle can be selected from eighteen different types of step angles.
Set S.T SEL switch with power OFF.

- (1) Turn power [OFF].
- (2) Set the step angle required by combining the S.T SEL switch and the STEP SEL switch No.

● Relationship between the S.T SEL switch, the STEP SEL switch No. and the step angle.

S.T SEL switch [OFF : S.T1]			S.T SEL switch [ON : S.T2]		
STEP SEL No.	1/ Divisions	step angle(°)	STEP SEL No.	1/ Divisions	step angle(°)
		0.72° motor			0.72° motor
0	1/1	0.72	0	1/1	0.72
1	1/2	0.36 (Factory setting)	1	1/2	0.36
2	1/4	0.18	2	1/4	0.18
3	1/8	0.09	3	1/8	0.09
4	1/10	0.072	4	1/10	0.072
5	1/20	0.036	5	1/20	0.036
6	1/40	0.018	6	1/40	0.018
7	1/80	0.009	7	1/80	0.009
8	1/100	0.0072	8	1/100	0.0072
9	1/200	0.0036	9	1/200	0.0036
A	1/400	0.0018	A	1/400	0.0018
B	1/800	0.0009	B	1/800	0.0009
C	1/1000	0.00072	C	1/1000	0.00072
D	1/2000	0.00036	D	1/2000	0.00036
E	1/4000	0.00018	E	1/16	0.045
F	1/8000	0.00009	F	1/160	0.0045

- Step angles are theoretical values.
- Drive with two types of step angles are provided by combining the C.S signal.
- When the step angle is switched from the setting of 1000, 2000, 4000 or 8000 divisions to other number of divisions(1~800), change of the excitation position may be caused.

4 – 3. Setting HOLD CURRENT SELECT switch

⚠ CAUTION

A high setting value may cause burn on the skin due to overheating of the motor.
Do not select a high value beyond the required.

HOLD CURRENT is set up with the HOLD I. SEL switch.
The ratio of HOLD CURRENT to DRIVE CURRENT can be selected.

- (1) Set the HOLD I. SEL switch No. to the ratio of HOLD CURRENT to DRIVE CURRENT required.

●Ratio of HOLD CURRENT.

$$\text{Ratio of HOLD CURRENT (\%)} = \frac{\text{HOLD CURRENT}}{\text{DRIVE CURRENT}} \times 100$$

DRIVE I. SEL [No. 0~No. 9]		DRIVE I. SEL [No. A~No. F]	
HOLD I. SEL No.	Ratio of HOLD CURRENT (%)	HOLD I. SEL No.	Ratio of HOLD CURRENT (%)
0	0	0	0
1	5	1	5
2	10	2	10
3	15	3	15
4	20	4	20
5	25	5	25
6	30	6	30
7	35	7	35
8	40	8	40 (Factory setting)
9	45	9	45
A	50	A	50
B	60	B	60
C	70	C	70
D	80	D	–
E	90	E	–
F	100	F	–

●HOLD CURRENT changes relative to DRIVE CURRENT setting.

The ratio of HOLD CURRENT [100%] represents the same as the setting for DRIVE CURRE

●The greater the ratio of HOLD CURRENT grows, the more heat the motor generates when is on holding-state.

4 — 4. Setting DRIVE CURRENT SELECT switch



CAUTION

A high setting value may cause burn on the skin due to overheating of the motor.
Do not select a high value beyond the required.

DRIVE CURRENT is set up with the DRIVE I. SEL switch.

- (1) Set the switch No. to the setting specified in the table "10-4. Applicable Motors."

● Relationship between the DRIVE I. SEL switch No. and DRIVE CURRENT.

DRIVE I. SEL No.	A/phase
0	1.5
1	1.6
2	1.7
3	1.8
4	1.9
5	2.0
6	2.1
7	2.2
8	2.3
9	2.4
A	2.5
B	2.6
C	2.7
D	2.8
E	2.9
F	3.0

(Factory setting)

4 – 5. Setting PULSE INPUT TYPE SELECT switch

⚠ CAUTION

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of the motor.
Ensure correct setting.

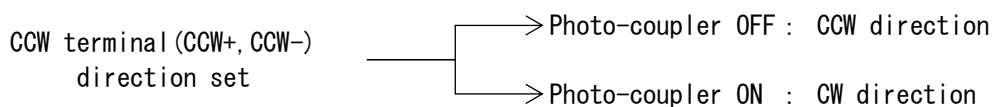
Pulse input method is set up with the SPI SEL switch.
Set this switch with power OFF.

- (1) Turn power [OFF].
- (2) Set the SPI SEL [2P/1P] switch.

SPI SEL	Input type
ON	1 PULSE (1P)
OFF	2 PULSE (2P)

(Factory setting)

- When the motor is operated with two pulse signal inputs of CW and CCW, set the SPI SEL switch to [OFF(2P)].
- When the motor is operated with the pulse signal and direction signal input, set the SPI SEL switch to [ON(1P)].
- In the case that 1-pulse input method is selected, the CCW terminal becomes direction signal input designating the direction of the motor rotation. Drive pulse set to the CW terminal (CW+, CW-).



- The input timing is same with 2-pulse input method and 1-pulse input method. As for input timing, refer to "10-2. (2) Drive pulse input (CW, CCW)"

4 — 6. Setting HOLD SWITCHING TIME SELECT switch

DRIVE/ HOLD CURRENT automatic switching time is set up with the DHT SEL switch.

- (1) Set the DHT SEL [DH1/DH2] switch.

DHT SEL	DRIVE/ HOLD Switching Time
ON	DH2 (16ms)
OFF	DH1 (150ms)

(Factory setting)

4 — 7. Setting ROTATE MODE SELECT switch

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of motor.
Ensure correct setting.

ROTATE MODE is set up with the RM SEL switch.
Set this switch with power OFF.

- (1) Turn power [OFF].
- (2) Set the switch to the setting specified in the table "10-4. Applicable Motors."

RM SEL switch			
4	3	2	1
OFF	OFF	OFF	OFF
OFF	OFF	OFF	ON
OFF	OFF	ON	OFF
OFF	OFF	ON	ON
OFF	ON	OFF	OFF
OFF	ON	OFF	ON
OFF	ON	ON	OFF
OFF	ON	ON	ON
ON	OFF	OFF	OFF
ON	OFF	OFF	ON
ON	OFF	ON	OFF
ON	OFF	ON	ON
ON	ON	OFF	OFF
ON	ON	OFF	ON
ON	ON	ON	OFF
ON	ON	ON	ON

(Factory setting)

Sub adjustment (Not available)

4 – 8. Setting of the EXTEND FUNCTION SELECT switch

**CAUTION**

Erroneous setting may cause breakage of the machine or injury due to unexpected rotation of motor.
Ensure correct setting.

Set this switch with power OFF.

- (1) Turn power [OFF].
- (2) Set the functions required by the OP SEL switch.

OP SEL switch				Function allocation
4	3	2	1	
OFF	OFF	OFF	OFF	–
OFF	OFF	OFF	ON	–
OFF	OFF	ON	OFF	–
OFF	OFF	ON	ON	–
OFF	ON	OFF	OFF	–
OFF	ON	OFF	ON	–
OFF	ON	ON	OFF	–
OFF	ON	ON	ON	–
ON	OFF	OFF	OFF	–
ON	OFF	OFF	ON	–
ON	OFF	ON	OFF	–
ON	OFF	ON	ON	–
ON	ON	OFF	OFF	–
ON	ON	OFF	ON	–
ON	ON	ON	OFF	–
ON	ON	ON	ON	Sub adjustment (Not available)

(Factory setting)

5. Installation

5-1. Conditions for Installation

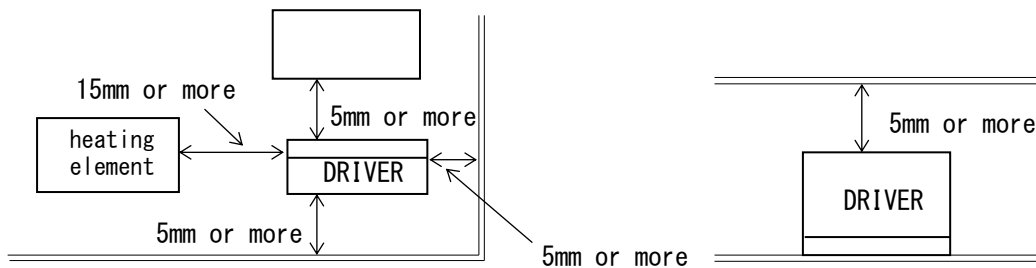
⚠ WARNING

Overheating may cause fire.
Mount it on a noncombustible member.
Keep it away from combustibles.

- (1) Designed for incorporating into equipment used indoors, this product requires to be installed in the following environment:

- Indoors (where it is not exposed to direct sun).
- Where ambient temperature and humidity are controlled within the range set out in the specifications.
- Where there is no explosive, corrosive or inflammable gas.
- Where it can be protected from dust, salt or iron powder.
- Where the product main frame is not exposed to direct vibration or shock.
- Where it is not exposed to splashes of water, oil or chemicals.

- (2) Install the driver at least 5mm away from other equipment.
However, please be installed to a distance of at least 15mm from the heating element.



- Please contact us if you are not installed to a distance of at least 15mm from the heating element.

- (3) Take measures against accumulation of heat such as allowing generous space around the driver or installing a fan so that heat release is taken care of.
- (4) In the case that the overheat alarm signal is output, perform the cooling measure of compulsion air cooling etc.
Use the driver on the condition that the overheat alarm signal is not output.
- (5) Do not allow standing or placing anything heavy on the product.

5 – 2. Mounting Method

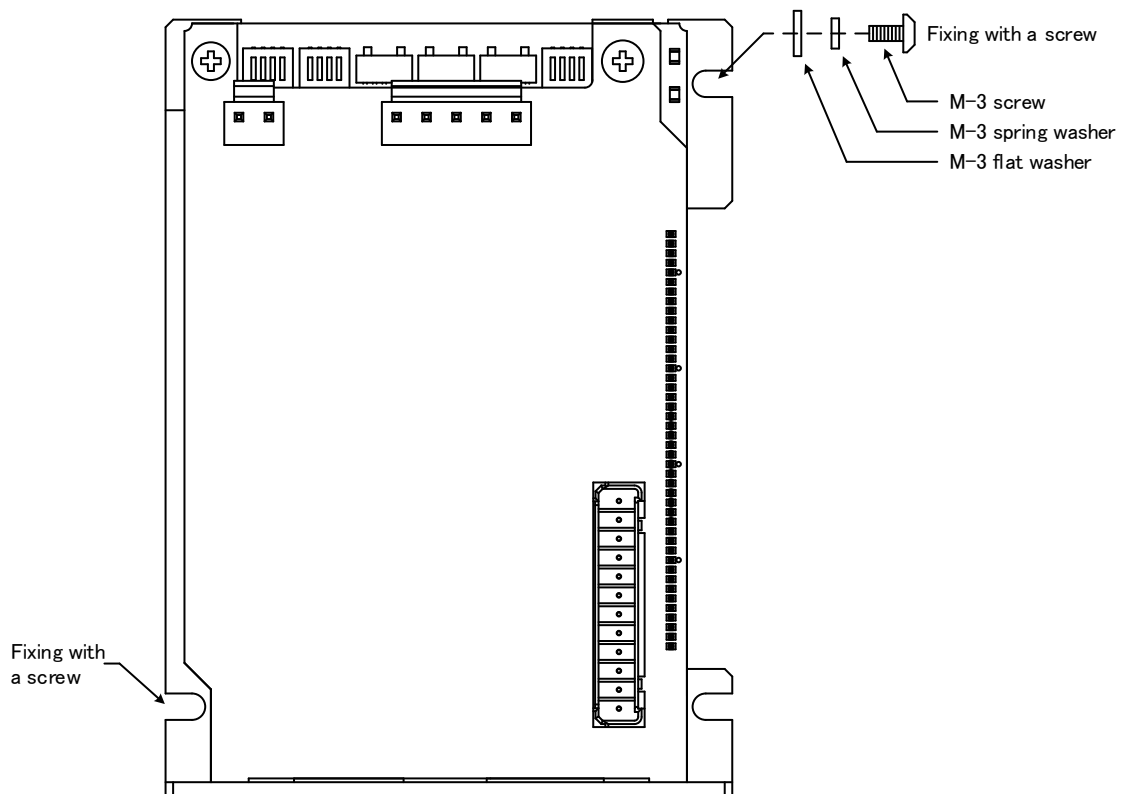
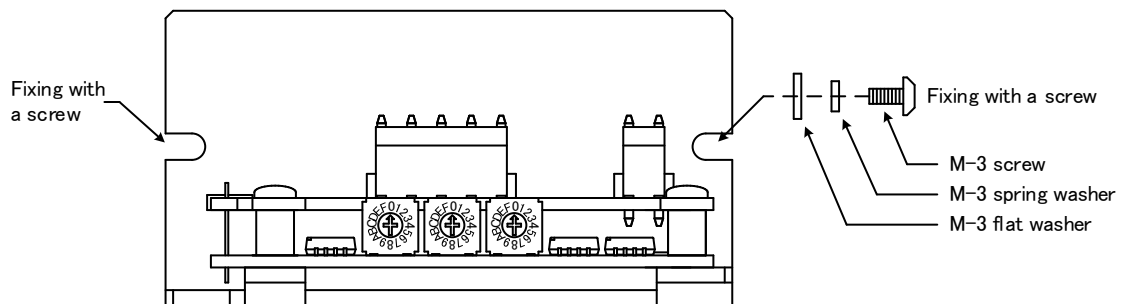
The round holes on the main frame are used.

The following items are required:

- M-3 screw (8mm or more in length): ----- 2
- M-3 spring washer: ----- 2
- M-3 flat washer: ----- 2

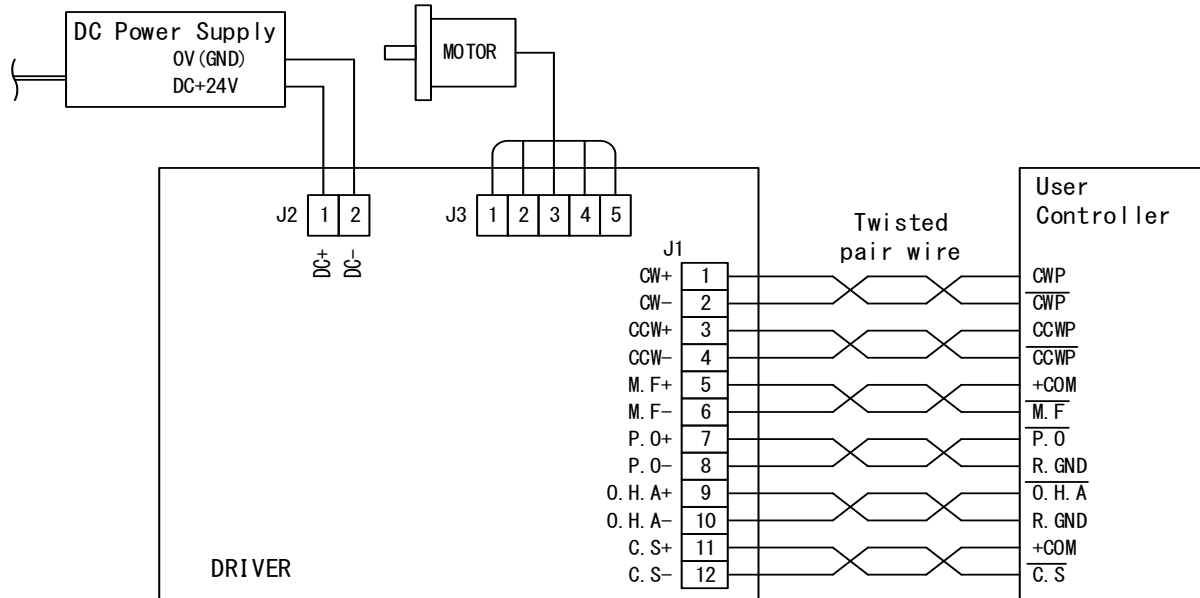
(1) Fix the product at the two round holes on the main frame.

● Mounting example



6. Connection

6-1. Overview of Connection Configuration



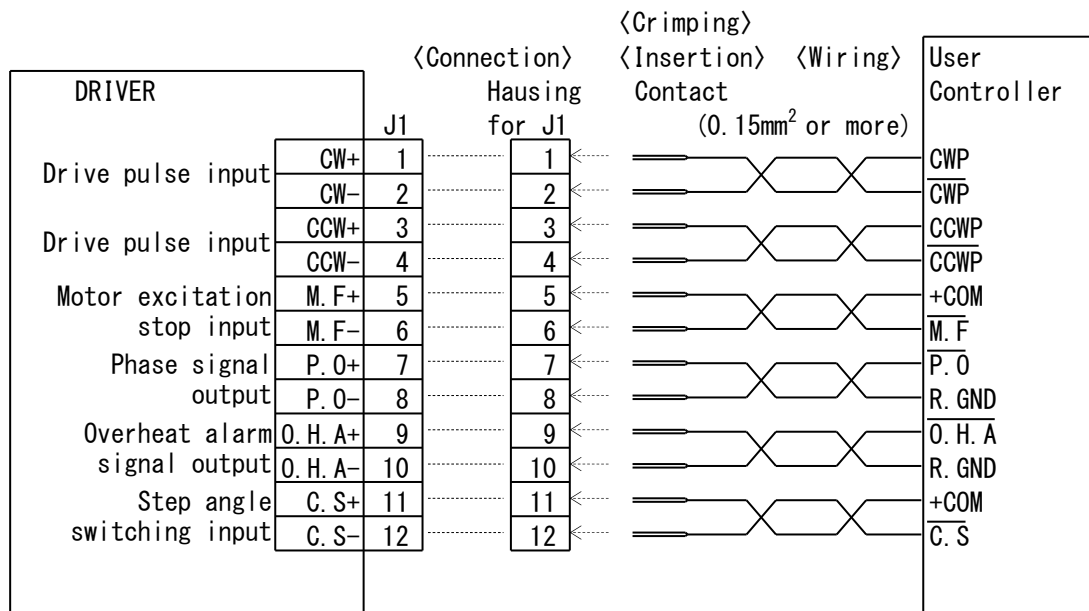
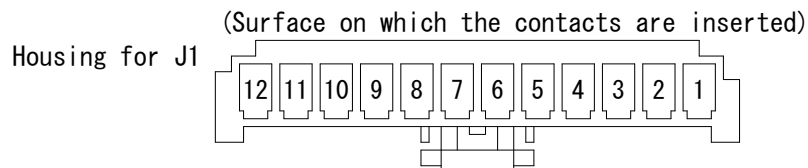
- Connect only one motor to one driver.
- Use twisted pair wire for the CW/CCW input signal line.
- Provide shielding for the signal line where considerable noise is generated.
- Use the wire material of the characteristic that is difficult to burn.
- Provide shielding for the motor line if it generates significant noise.
- For the driver's power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.

6 – 2. Connecting Signal I/O Connector (J 1)

The following items are required:

●Housing for J1 (51103-1200 or 51163-1200:Molex)	One unit
●Contact for J1 (50351-8100:Molex)	12 contacts
●Manually operated crimping tool for AWG28-22 (57295-5000:Molex)	One unit

- (1) Crimp the contact to the cable used for wiring.
- (2) Insert the contact into the housing.
Make sure that the housing No. and the connector No. on the main frame are matched before inserting the contacts.
- (3) Connect the housings to the connectors on the main frame.
 - The contacts for J1 are 12 pieces.
 - When inserting, keep pushing J1 housing into the connectors until it is locked.
Also, check if the contacts are not displaced from the housing.
 - In wiring, isolate the J1 signal lines from equipment that may be a source of noise, the power line and the motor line.



6 – 3. Connecting DC Input/Motor Output Connector (J 2, J 3)

CAUTION

Erroneous connection may cause breakage of the motor or the driver. Correctly connect the DC Input/Motor output connector.

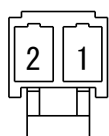
The following items are required:

●Housing for J2 (VHR-2N: J. S. T)	One unit
●Housing for J3 (VHR-5N: J. S. T)	One unit
●Contact for J2, J3 (BVH-21T-P1.1: J. S. T)	7 contacts
●Manually operated crimping tool for AWG22-18 (YC-160R: J. S. T)	One unit

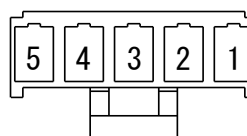
- (1) Crimp the contact to the cable used for wiring.
- (2) Insert the contact into the housing.
Make sure that the housing No. and the connector No. on the main frame are matched before inserting the contacts.
- (3) Connect the housings to the connectors on the main frame.
 - The contacts for J2(for DC input) are 2 pieces, and for J3(motor output) are 5 pieces.
 - When inserting, keep pushing J2, J3 housings into the connectors until it is locked. Also, check if the contacts are not displaced from the housing.

(Surface on which the contacts are inserted)

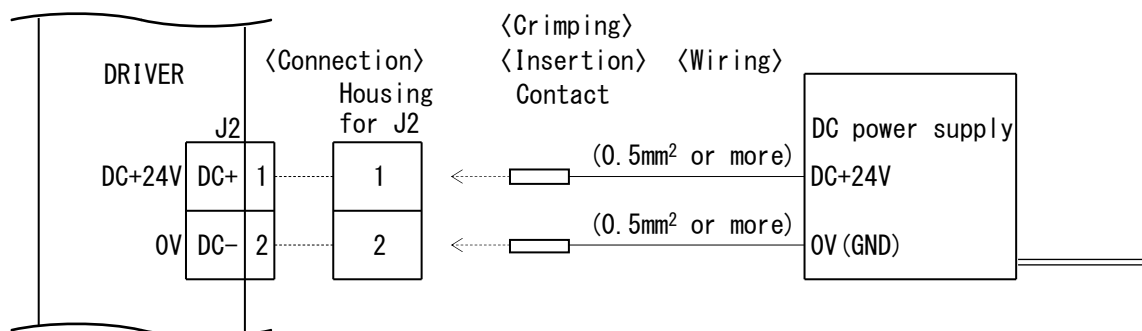
Housing for J2



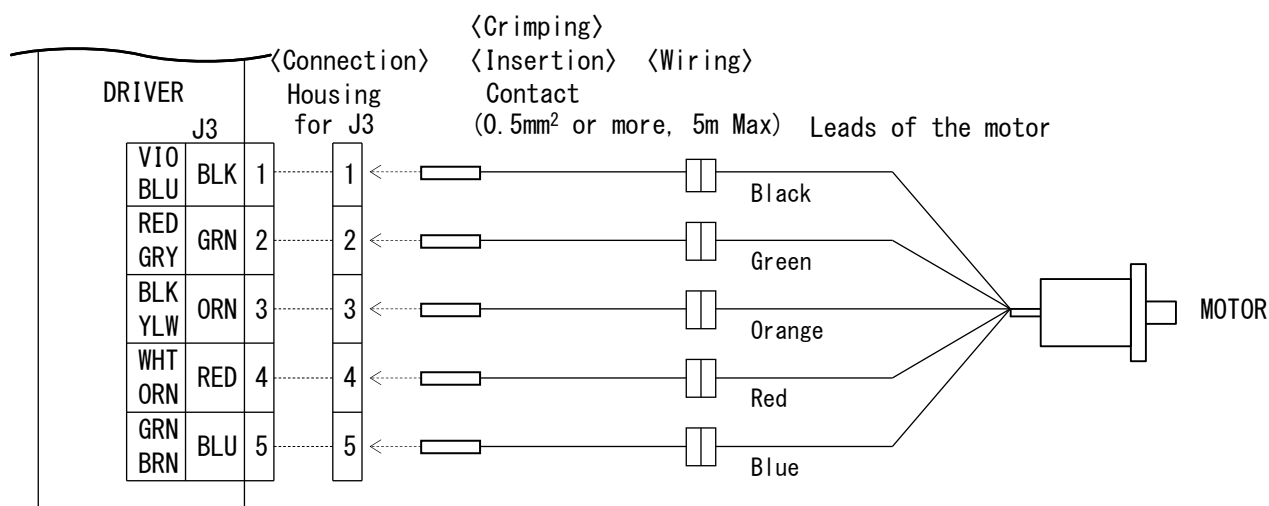
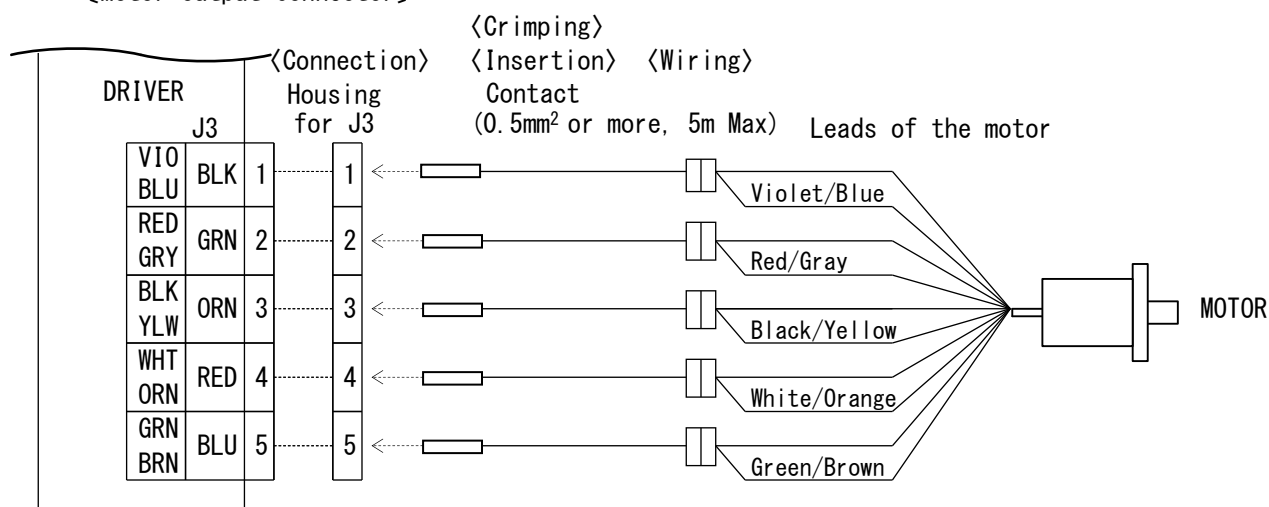
Housing for J3



[DC input Connector]



[Motor output Connector]



●The color indications for the motor crimping J3 represent color of the leads of the motor.

●Use a cable of 5m or less for the motor cable .

6 – 4. Inputting Power

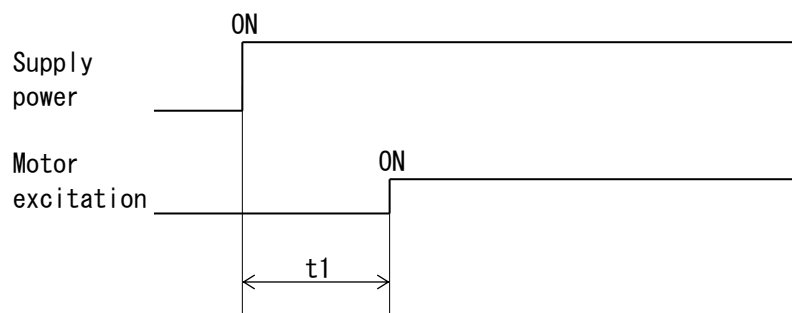


CAUTION

Breakage of the machine or injury is apprehended due to unexpected behavior of the motor. Maintain the state where emergency stop is enabled at any time.

- (1) Input the DC power supply (DC+24V) in the cable that connected to No.1 and No. 2 terminals of J2.

① Timing chart



$t1 \leq 300\text{ms}$ ($t1$: Time required for the motor to be enabled.)

7. Confirmation of Setting and Connection

7 – 1. Check Points

This product requires different switch setting and motor wiring depending on the motor used.

Check if the switch setting and the motor wiring are correctly performed.

Check Points		Check	Remarks
Setting of MOTOR SELECT switch	MOTOR SEL (OFF)		
Setting of PULSE INPUT TYPE SELECT switch	SPI SEL (1P/2P)		
Setting of HOLD SWITCHING TIME SELECT switch	DHT SEL (DH1/DH2)		
Setting of STEP TABLE switch	S. T SEL (S. T1/S. T2)		
Setting of STEP ANGLE SELECT switch	STEP SEL (switch No.)		
Setting of DRIVE CURRENT SELECT switch	DRIVE I. SEL (switch No.)		
Setting of HOLD CURRENT SELECT switch	HOLD I. SEL (switch No.)		
Setting of ROTATE MODE SELECT switch	RM SEL (4 3 2 1)		
Setting of EXTEND FUNCTION SELECT switch	OP SEL (4 3 2 1)		
Connection of J1			
Connection of J2	DC+, DC–		
Connection of J3	MOTOR		

8. Maintenance and Check-up

8 – 1. Maintenance and Check-up

**WARNING**

Injury or fire is apprehended due to unexpected behavior.
Do not replace fuse.
Do not disassemble, repair or modify.

- (1) As for maintenance inspections the engineer of the specialty shall do it.
- (2) We recommend that the following check-ups should be performed periodically:
 - Checking for any loosened contact on the connectors.
 - Checking for any flaw and crack on the cabling.
- (3) In case of failure, return the driver to us and have it repaired.

8 – 2. Troubleshooting

Trouble	Check Item	Assumed Cause
1. POWER LED does not come on.	<ul style="list-style-type: none"> • Connection of power supply. • Value of power voltage. 	<ul style="list-style-type: none"> • Wiring error with power supply. • Power voltage failure. • Driver failure.
2. The motor is not excited. (It can be easily rotated by hand.)	<ul style="list-style-type: none"> • Connection of the motor to the driver. • ON/OFF status of the M.F signal. • Setting of the HOLD CURRENT SELECT switch. 	<ul style="list-style-type: none"> • Wiring error with the motor and the driver. • The M.F signal is input. • The setting for HOLD CURRENT is too low. • Driver failure.
3. The motor does not rotate. The motor behaves abnormally. The motor steps out.	<ul style="list-style-type: none"> • The same check items as those under item 2 above. • Setting of the MOTOR SELECT switch. • Setting of the PULSE INPUT TYPE SELECT switch. • Connection of the pulse signal. • Voltage and wave form of the pulse signal. • Setting of the DRIVE CURRENT SELECT switch. • Setting of the STEP ANGLE SELECT switch. • ON/OFF status of the C.S signal. • Setting of the ROTATE MODE SELECT switch. • Setting of the EXTEND FUNCTION SELECT switch. • Status of the O.H.A signal. • Status of the O.H.A LED. 	<ul style="list-style-type: none"> • Wrong setting for the MOTOR selection. • Wrong setting for the pulse input type. • Wiring error with the pulse signal line. • Pulse signal of wrong specifications. • DRIVE CURRENT is too low. • Wrong setting for the step angle. • The C.S signal is input. • Wrong setting for the ROTATE MODE selection. • Wrong setting for the EXTEND FUNCTION selection. • Reduction of output current by O.H.C • Reduction of output current by O.H.C • Driver failure. • Motor failure.

Trouble	Check Item	Assumed Cause
4. The motor steps out during acceleration.	<ul style="list-style-type: none"> • Starting pulse speed. • Acceleration time. • Status of the O.H.A signal. • Status of the O.H.A LED. 	<ul style="list-style-type: none"> • Starting pulse signal speed is too high. • Acceleration time is too short. • Reduction of output current by O.H.C • Reduction of output current by O.H.C
5. The motor generates excessive heat.	<ul style="list-style-type: none"> • Setting of the MOTOR SELECT switch. • Setting of the DRIVE CURRENT SELECT switch. • Setting of the HOLD CURRENT SELECT switch. 	<ul style="list-style-type: none"> • Wrong setting for the MOTOR selection. • DRIVE CURRENT is higher than the setting for the applicable motor. • The setting for HOLD CURRENT is too high.

Short-circuiting of the motor output connector may cause the driver to fail.

- The motor output connector and the power line.
- The motor output connector and the motor output connector.

When the failure phenomenon cannot be remedied, contact our office.

9. Storing and Disposal

9 – 1. Storing

(1) Keep the product in the following environment:

- Indoors (where it is not exposed to direct sun).
- Where ambient temperature and humidity are controlled within the range set out in the specifications.
- Where there is no explosive, corrosive or inflammable gas.
- Where it can be protected from dust, salt or iron powder.
- Where the product main frame is not exposed to direct vibration or shock.
- Where it is not exposed to splashes of water, oil or chemicals.

(2) Do not allow standing or placing anything heavy on the product.

9 – 2. Disposal

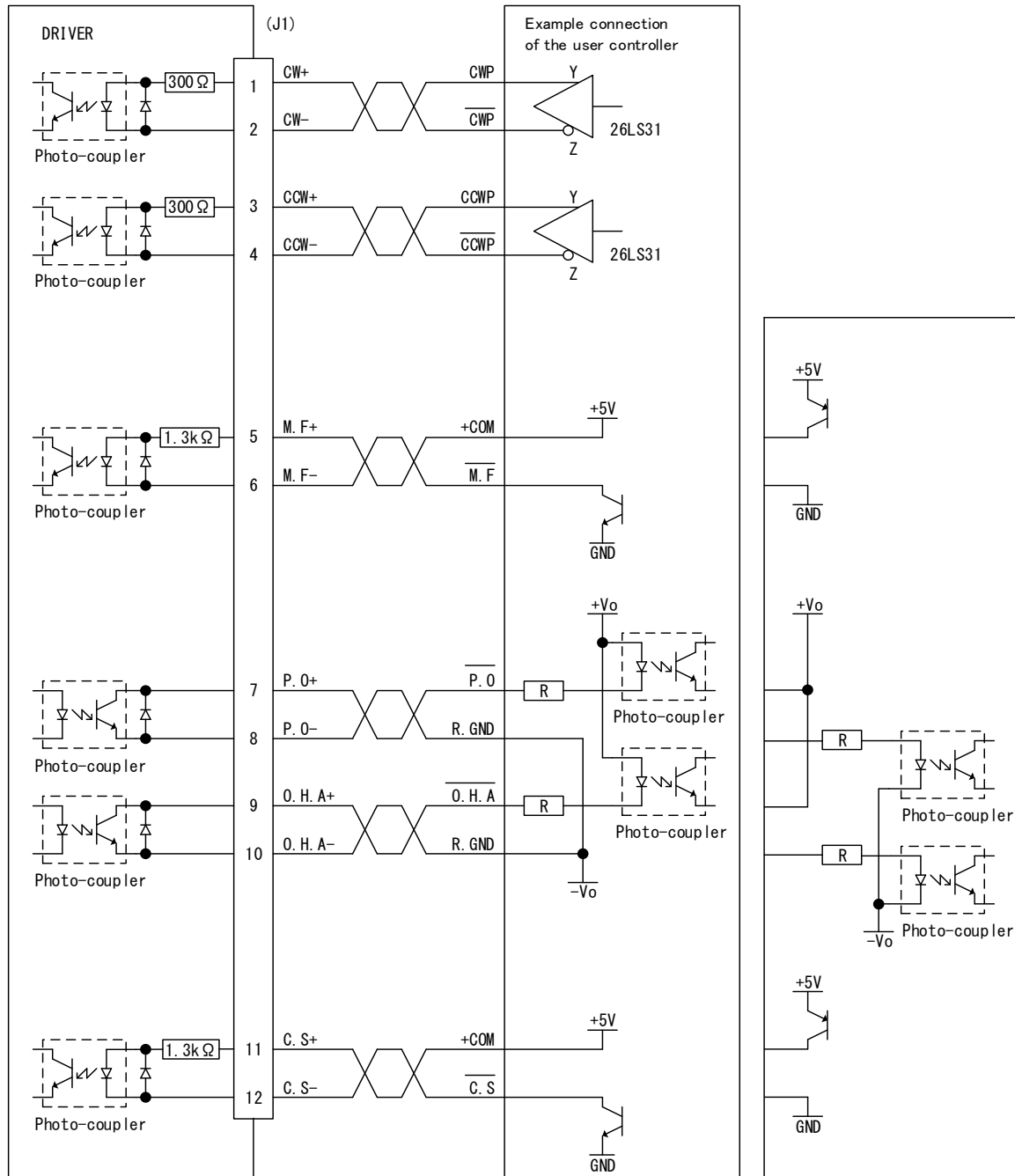
(1) Dispose of the product as industrial waste.

10-1. General Specifications

- *1 Input voltage range is $DC+24V \pm 10\%$.
- *2 Use a power supply that provides sufficient input current.

1 0 – 2. I/O Signal

(1) Example Circuit Connection

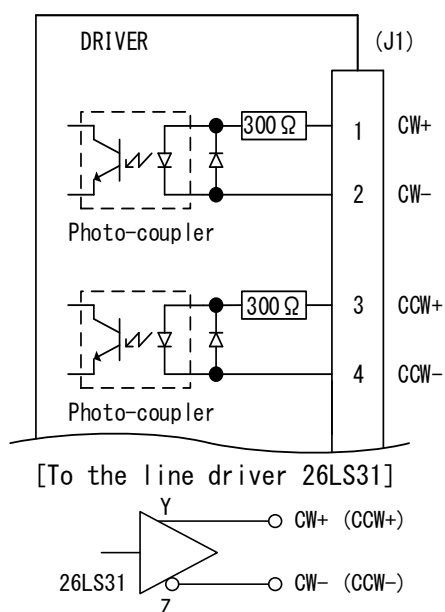
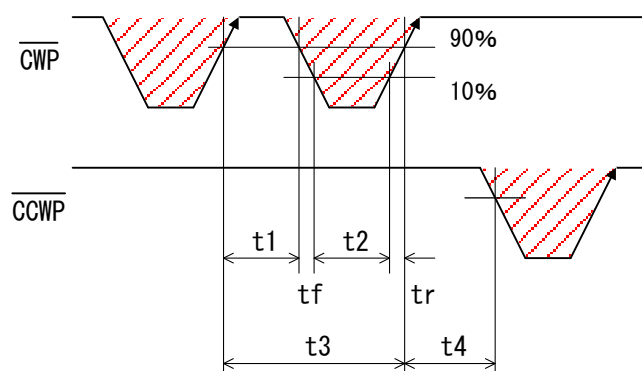


(2) Drive pulse input (CW, CCW)

① Operating current range : 5mA~14mA

The photo-coupler turns on with inter-terminal voltage of 3.1V~5.5V.
(Photo-coupler diode $V_F \doteq 1.5V$)

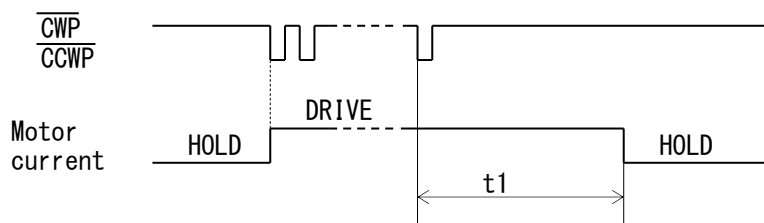
② Timing chart



1/ Divisions	t1, t2, tf, tr, t3, t4	Maximum response frequency (at 50% duty)
1/1, 1/2	$t1 \geq 5\mu s$, $t2 \geq 5\mu s$, $t_f, t_r \leq 1\mu s$, $t3 \geq 10\mu s$, $t4 > 10\mu s$	100kHz
Other setting	$t1 \geq 0.5\mu s$, $t2 \geq 0.5\mu s$, $t_f, t_r \leq 1\mu s$, $t3 \geq 1\mu s$, $t4 > 1\mu s$	1MHz

- The shaded area (/ /) indicates light emission from the photo-coupler, and the motor is driven at the rising edge (↗).
"t4" greatly varies according to the inertial moment including that of the motor.

③ Automatic switching for DRIVE/HOLD

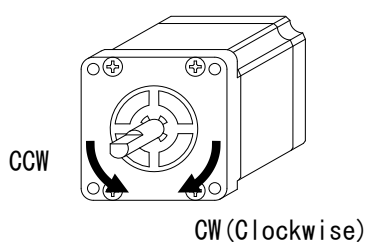


$t1 \doteq 16ms$ (HOLD SWITCHING TIME SELECT switch : ON • DH2)

$t1 \doteq 150ms$ (HOLD SWITCHING TIME SELECT switch : OFF • DH1)

- Inputting drive pulse causes the current output to the motor to change from HOLD CURRENT to DRIVE CURRENT, which returns to HOLD CURRENT in about "t1".
DRIVE CURRENT continues if pulse is input on driving-state.

④ Direction of rotation

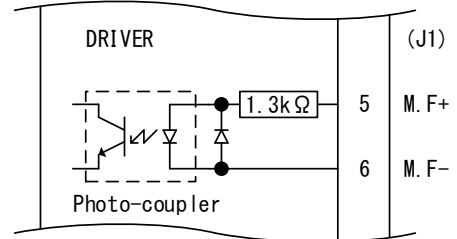


(3) Motor excitation stop input (M.F)

CAUTION

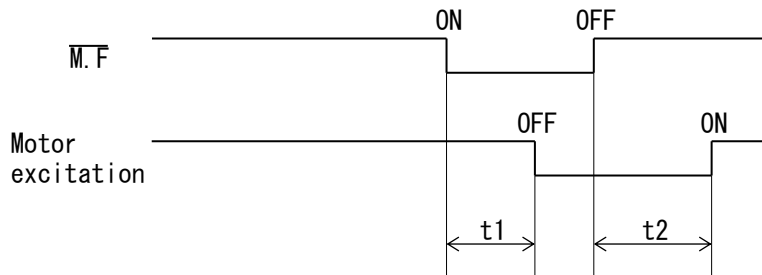
Deterioration of the holding power with the motor may cause breakage of the machine or injury.
 Check safety before inputting.

- ① Operating current range : 2.6mA~19.5mA
 The photo-coupler turns on with inter-terminal voltage of 4.5 V~26.4 V.
 (Photo-coupler diode $V_F \doteq 1.1$ V)



- Motor output current is shut off with the photo-coupler ON.
 At this time, motor torque changes to detent torque.
- When this signal is input, motor torque may be lost, resulting in failure to retain the load transported.
 In particular, this risk is high with the vertical drive (such as the Z-axis).

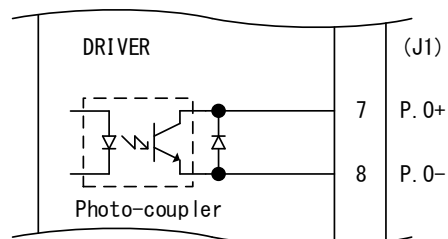
② Timing chart



$t1 \leq 5\text{ms}$ ($t1$: Time required for the motor output current to be shut off.)
 $t2 \leq 100\text{ms}$ ($t2$: Time required for the motor to be enabled.)

(4) Phase signal output (P.0)

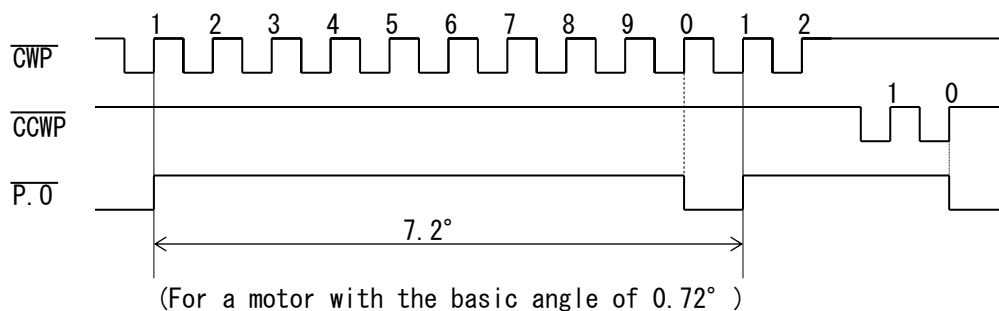
- ① Output current
- a. $I_C \leq 6\text{mA}$, $V_{CE(sat)} < 2\text{V}$
 - b. $I_C \leq 2\text{mA}$, $V_{CE(sat)} < 0.6\text{V}$
 $V_{CE0} \leq 30\text{V}$



- In case of the excitation home position, the signal is output.
(photo-coupler ON)
- In case of simultaneously using P.0 signal and C.S signal,
input C.S signal while P.0 signal is being output to switch the step angle.
Otherwise, P.0 signal may not be output.

② Timing chart

- P.0 output timing (for 1/1 STEP)



- P.0 output time

1/1 STEP: once in 10 pulses	1/8 STEP: once in 80 pulses
1/2 STEP: once in 20 pulses	1/16 STEP: once in 160 pulses
1/4 STEP: once in 40 pulses	1/80 STEP: once in 800 pulses
1/10 STEP: once in 100 pulses	1/160 STEP: once in 1600 pulses
1/20 STEP: once in 200 pulses	
1/40 STEP: once in 400 pulses	
1/100 STEP: once in 1000 pulses	
1/200 STEP: once in 2000 pulses	
1/400 STEP: once in 4000 pulses	
1/800 STEP: once in 8000 pulses	
1/1000 STEP: once in 10000 pulses	
1/2000 STEP: once in 20000 pulses	
1/4000 STEP: once in 40000 pulses	
1/8000 STEP: once in 80000 pulses	

- (5) Overheat alarm signal output, overheat alarm LED (O.H.A) and overheat control (O.H.C)

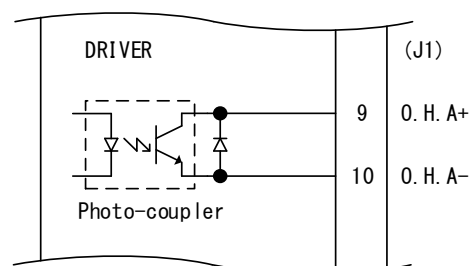
WARNING

Overheating may cause fire.
Stop operation upon output of this signal.

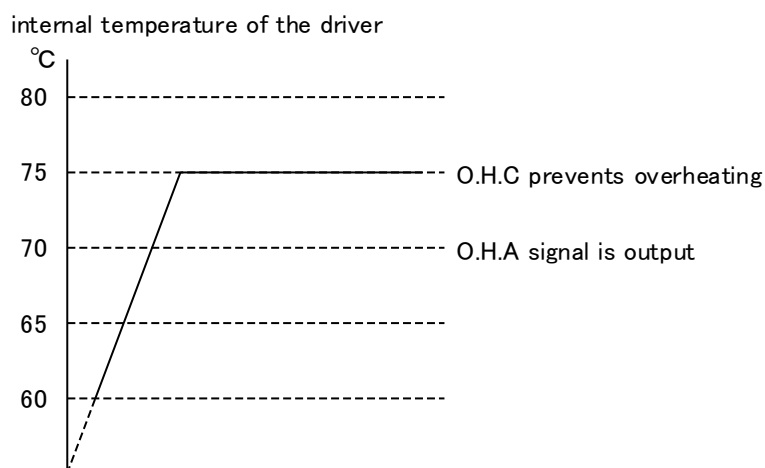
WARNING

Overheating may cause fire.
Stop operation when this LED comes on.

- ① Output current
- a. $I_c \leq 6\text{mA}$, $V_{CE(sat)} < 2\text{V}$
 - b. $I_c \leq 2\text{mA}$, $V_{CE(sat)} < 0.6\text{V}$
 $V_{CE0} \leq 30\text{V}$



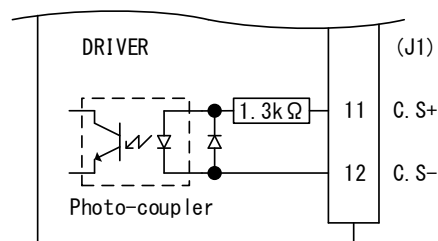
- Use overheat alarm signal output (O.H.A) without fail.
- In case of internal temperature of the driver reaches approx. 70°C or more, the signal is output (photo-coupler ON) and O.H.A LED comes on. At this time the motor output current is not blocked.
- When this signal is output, stop operation and check if there is any abnormality occurring with the motor and the driver.
- Provide mechanical cooling, for example, if this signal is output while no abnormality is detected.
- Continuous operation is possible unless this signal is output.
- When the internal temperature reaches approximately 75°C or more, the output current decreases due to overheat control (O.H.C) and overheating is prevented. Even if it becomes the O.H.C, the output current will not drop below 1.8A/phase.



(6) Step angle switch input (C.S)

① Operating current range : 2.6mA~19.5mA

The photo-coupler turns on with inter-terminal voltage of 4.5 V~26.4 V.
(Photo-coupler diode $V_F \doteq 1.1$ V)

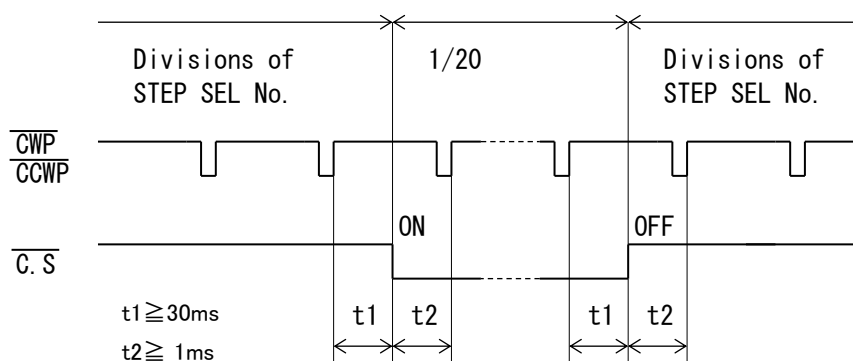


● Step angle division is switched to 20 divisions of the basic angle with the photo-coupler ON.

The setting for the STEP ANGLE SELECT switch is ignored.

● When the step angle is set 1000, 2000, 4000 or 8000 divisions of the basic angle, change of the excitation position may be caused by inputting C.S signal.

② Timing chart



● Switching the step angle by the C.S signal requires time "t1" and "t2" before and after inputting drive pulse.

③ STEP ANGLE SELECT switch and C.S signal

[STEP ANGLE SELECT switch]

S.T SEL switch [OFF : S.T1]		
STEP SEL No.	1/ Divisions	step angle(°) 0.72° motor
0	1/1	0.72
1	1/2	0.36
2	1/4	0.18
3	1/8	0.09
4	1/10	0.072
5	1/20	0.036
6	1/40	0.018
7	1/80	0.009
8	1/100	0.0072
9	1/200	0.0036
A	1/400	0.0018
B	1/800	0.0009
C	1/1000	0.00072
D	1/2000	0.00036
E	1/4000	0.00018
F	1/8000	0.00009

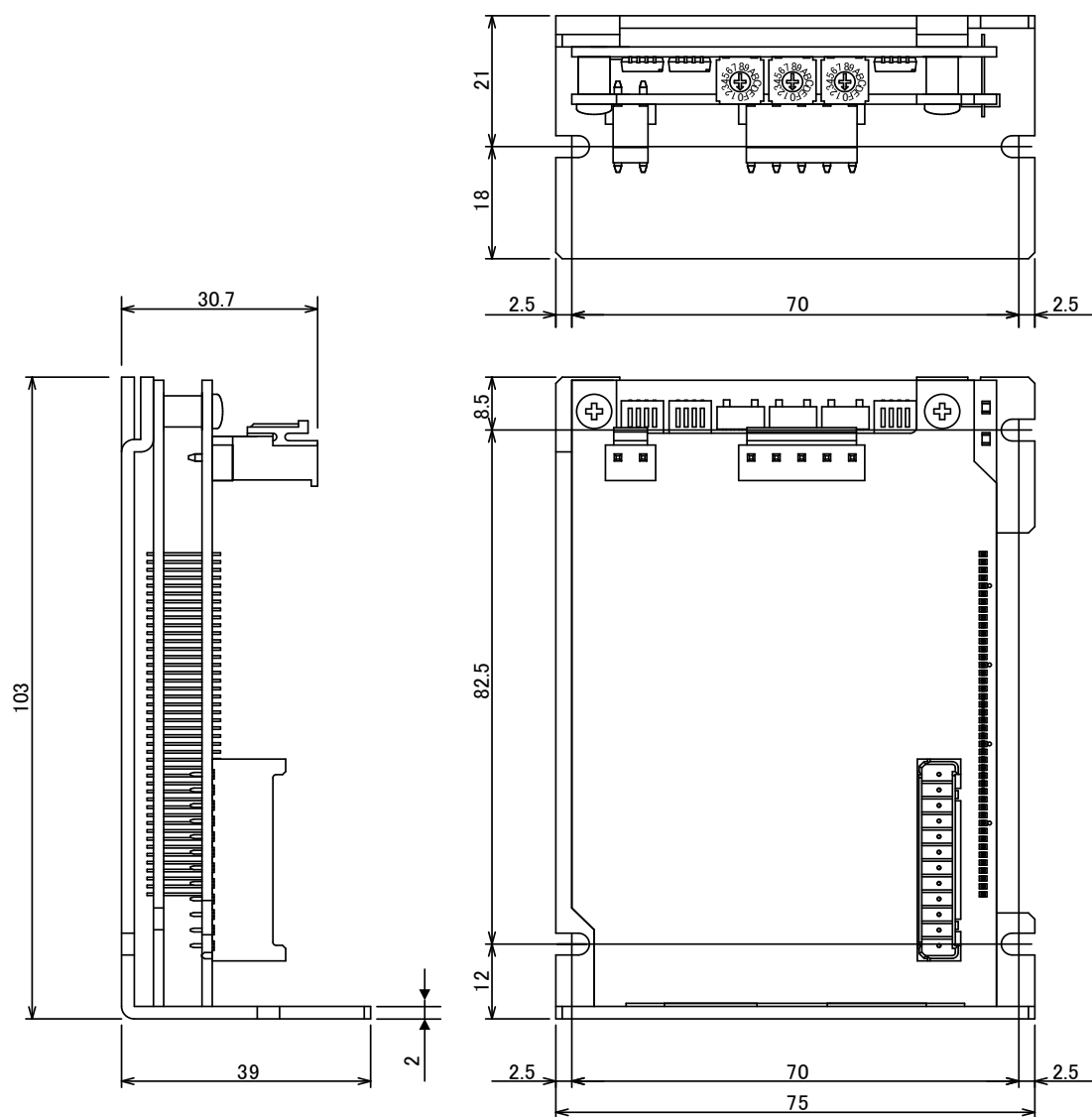
S.T SEL switch [ON : S.T2]		
STEP SEL No.	1/ Divisions	step angle(°) 0.72° motor
0	1/1	0.72
1	1/2	0.36
2	1/4	0.18
3	1/8	0.09
4	1/10	0.072
5	1/20	0.036
6	1/40	0.018
7	1/80	0.009
8	1/100	0.0072
9	1/200	0.0036
A	1/400	0.0018
B	1/800	0.0009
C	1/1000	0.00072
D	1/2000	0.00036
E	1/16	0.045
F	1/160	0.0045

[When the C.S signal is input]

1/20
(0.036°)

1 0 – 3. Dimensions

(Unit : mm)



10-4. Applicable Motors

(1) GDB-5K60 can drive a 5-phase stepping motor with 1.8A/phase~2.8A/phase.

① Examples of applicable motors

SANYO DENKI Co., LTD.		Current (A/phase)	Setting DRIVE I. SEL switch No.	Setting MOTOR SEL switch	Setting RM SEL switch 4 3 2 1	Torque Data Fig. No.
□60mm	SF5601-9251	2.8	D	OFF	OFF ON OFF ON	Fig. 1
	SF5602-9251	2.8	D	OFF	OFF ON ON OFF	Fig. 2
	SF5603-9251	2.8	D	OFF	OFF ON ON ON	Fig. 3
ORIENTAL MOTOR Co., Ltd.		Current (A/phase)	Setting DRIVE I. SEL switch No.	Setting MOTOR SEL switch	Setting RM SEL switch 4 3 2 1	Torque Data Fig. No.
□42mm	PKP543N18A (B) 2	1.8	3	OFF	OFF OFF ON OFF	Fig. 4
	PKP544N18A (B) 2	1.8	3	OFF	OFF OFF ON OFF	Fig. 5
	PKP545N18A (B) 2	1.8	3	OFF	OFF OFF ON OFF	Fig. 6
	PKP546N18A (B) 2	1.8	3	OFF	OFF OFF ON OFF	Fig. 7
□60mm	PKP564FN24A (B) 2	2.4	9	OFF	OFF ON OFF ON	Fig. 8
	PKP566FN24A (B) 2	2.4	9	OFF	OFF ON ON OFF	Fig. 9
	PKP569FN24A (B) 2	2.4	9	OFF	OFF ON ON ON	Fig. 10
	PK569H-A (B)	2.8	D	OFF	OFF ON ON ON	Fig. 11
□90mm	PK596H-A (B)	2.8	D	OFF	ON OFF OFF OFF	Fig. 12
	PK599H-A (B)	2.8	D	OFF	ON OFF OFF OFF	Fig. 13
Factory Setting			D	OFF	OFF OFF OFF OFF	—

() : Both axes

●Please contact us if you want to use the motor other than the above to our office.

10-5. Torque Characteristics

- (1) Representations in the torque characteristics table are made in terms of the motor rotation (s^{-1}) vs. torque ($N \cdot m$).

Motor rotation (s^{-1}) and drive pulse frequency (Hz) are converted as follows:

$$\text{Motor rotation}(s^{-1}) \times \frac{360^{\circ}}{\text{Step angle}} = \text{Drive pulse input frequency(Hz)}$$

Motor rotation (s^{-1}) and motor rotation (r/min) are converted as follows:

$$\text{Motor rotation}(s^{-1}) \times 60 = \text{Motor rotation(r/min)}$$

● Use the Motor rotation at $100s^{-1}$ (6000r/min) or less.

- (2) The Maximum Starting Pulse Rate is represented as "fs" by the value at zero inertial load.
- (3) Upon operation, provide adequate allowance for torque.
- (4) The stepping motor may attain high temperature, depending on the operational conditions.
Use the stepping motor according to the Instructions Manual produced by motormakers.

Fig. 1

GDB-5K60
SF5601-9251
2.8A/PHASE

DRIVE 1. SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = ON, OFF, ON, OFF
DC24V

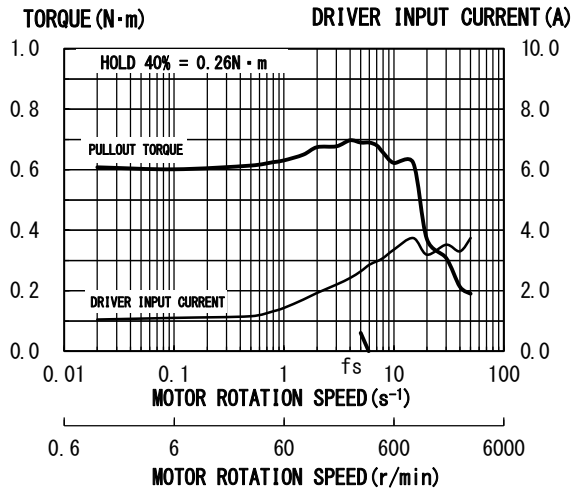


Fig. 2

GDB-5K60
SF5602-9251
2.8A/PHASE

DRIVE 1. SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = OFF, ON, ON, OFF
DC24V

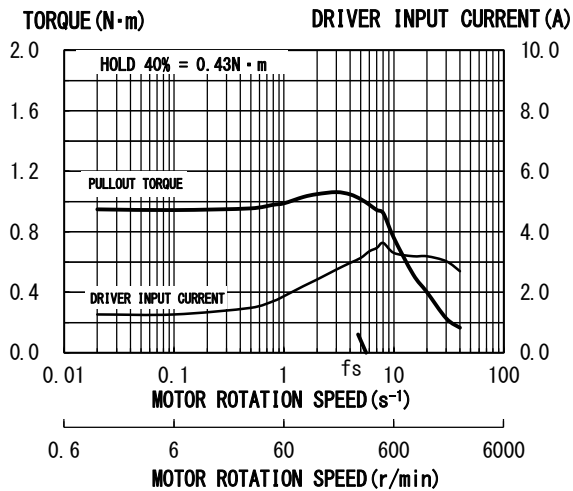


Fig. 3

GDB-5K60
SF5603-9251
2.8A/PHASE

DRIVE 1. SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = ON, ON, ON, OFF
DC24V

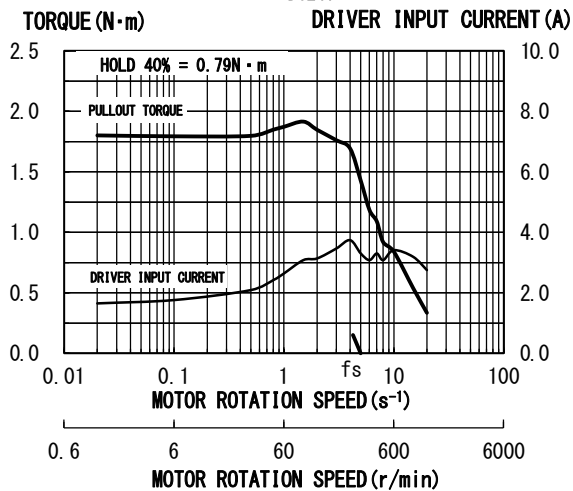


Fig. 4

GDB-5K60
 PKP543N18A(B) 2
 1.8A/PHASE

DRIVE 1.SEL = No3
 MOTOR SEL = OFF
 RM1, RM2, RM3, RM4 = OFF, ON, OFF, OFF
 DC24V

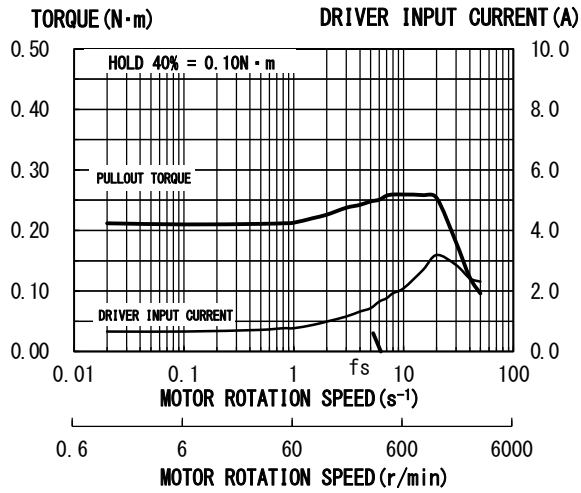


Fig. 5

GDB-5K60
 PKP544N18A(B) 2
 1.8A/PHASE

DRIVE 1.SEL = No3
 MOTOR SEL = OFF
 RM1, RM2, RM3, RM4 = OFF, ON, OFF, OFF
 DC24V

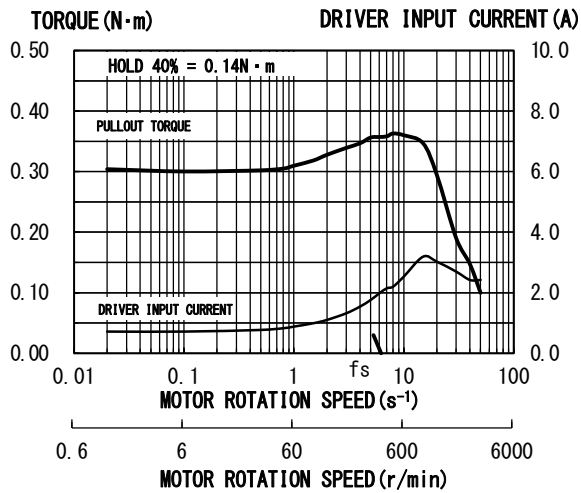


Fig. 6

GDB-5K60
 PKP545N18A(B) 2
 1.8A/PHASE

DRIVE 1.SEL = No3
 MOTOR SEL = OFF
 RM1, RM2, RM3, RM4 = OFF, ON, OFF, OFF
 DC24V

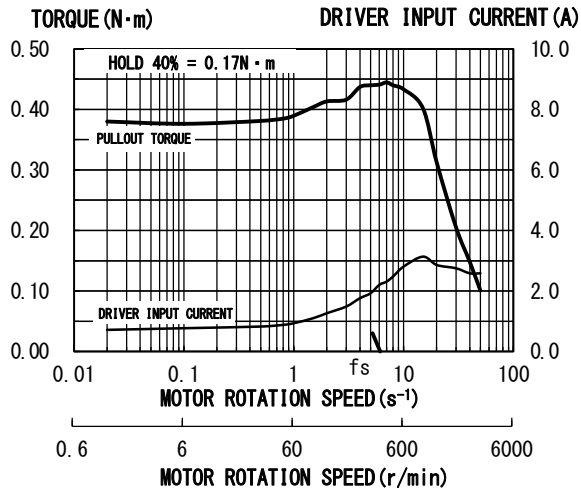


Fig. 7

GDB-5K60
 PKP546N18A(B) 2
 1.8A/PHASE

DRIVE 1.SEL = No3
 MOTOR SEL = OFF
 RM1, RM2, RM3, RM4 = OFF, ON, OFF, OFF
 DC24V

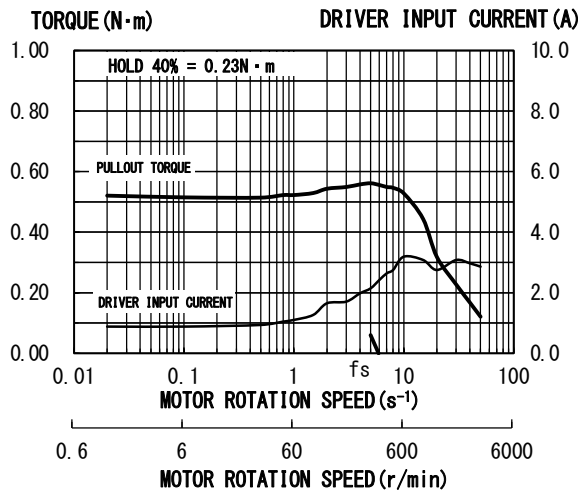


Fig. 8

GDB-5K60
PKP564FN24A (B) 2
2.4A/PHASE

DRIVE 1. SEL = No9
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = ON, OFF, ON, OFF
DC24V

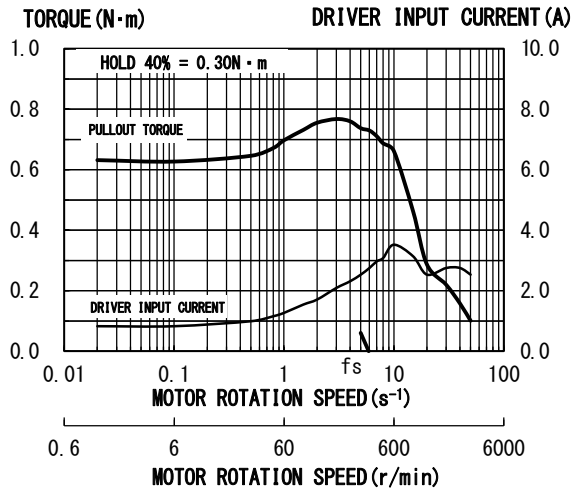


Fig. 9

GDB-5K60
PKP566FN24A (B) 2
2.4A/PHASE

DRIVE 1. SEL = No9
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = OFF, ON, ON, OFF
DC24V

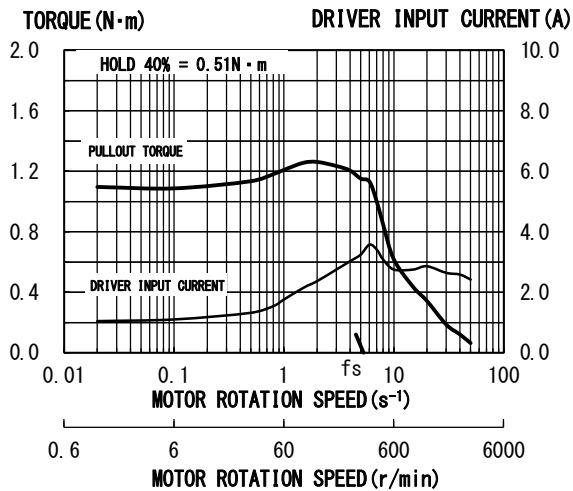


Fig. 10

GDB-5K60
PKP569FN24A (B) 2
2.4A/PHASE

DRIVE 1. SEL = No9
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = ON, ON, ON, OFF
DC24V

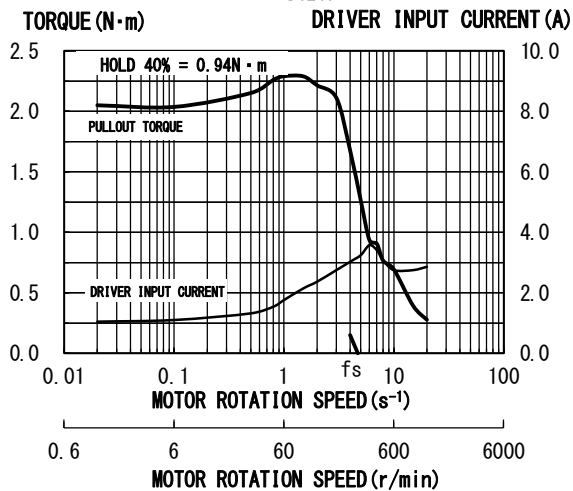


Fig. 11

GDB-5K60
PK569H-A (B) 2
2.8A/PHASE

DRIVE 1.SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = ON, ON, ON, OFF
DC24V

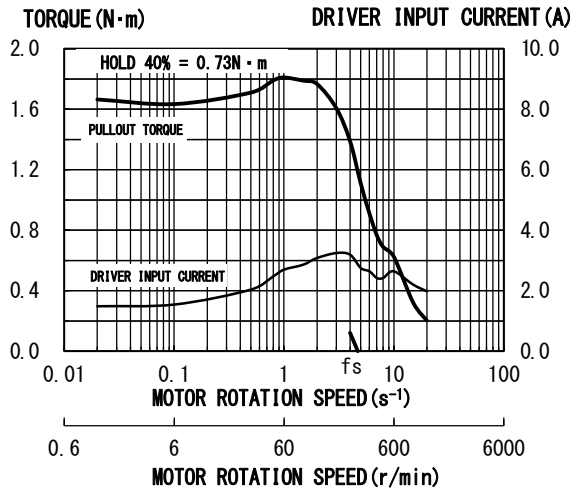


Fig. 12

GDB-5K60
PK596H-A (B)
2.8A/PHASE

DRIVE 1.SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = OFF, OFF, OFF, ON
DC24V

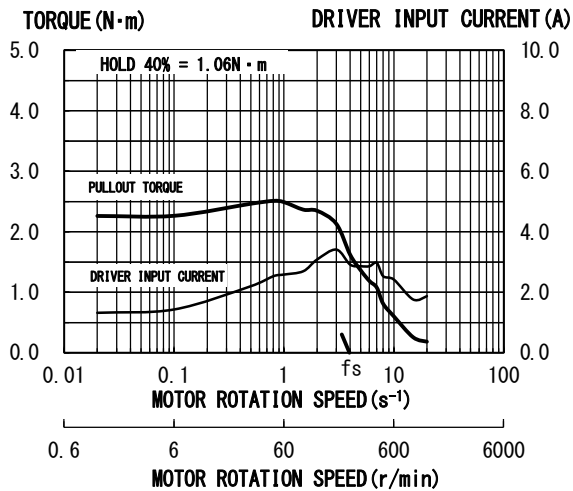
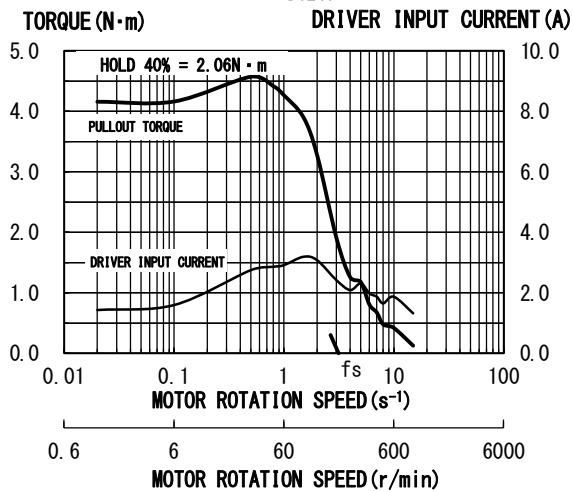


Fig. 13

GDB-5K60
PK599H-A (B)
2.8A/PHASE

DRIVE 1.SEL = NoD
MOTOR SEL = OFF
RM1, RM2, RM3, RM4 = OFF, OFF, OFF, ON
DC24V



10-6. Conforming to Europe standards

(1) Low voltage directive

This product is not subject to the EC's Low Voltage Directive by the following.

- This product should be installed within an enclosure.
- For the driver's power supply, use a DC power supply with reinforced insulation on its primary and secondary sides.

(2) EMC directive

This product declares the CE marking based on the EMC Directive by oneself.

● Applicable Standards

EN61000-6-4

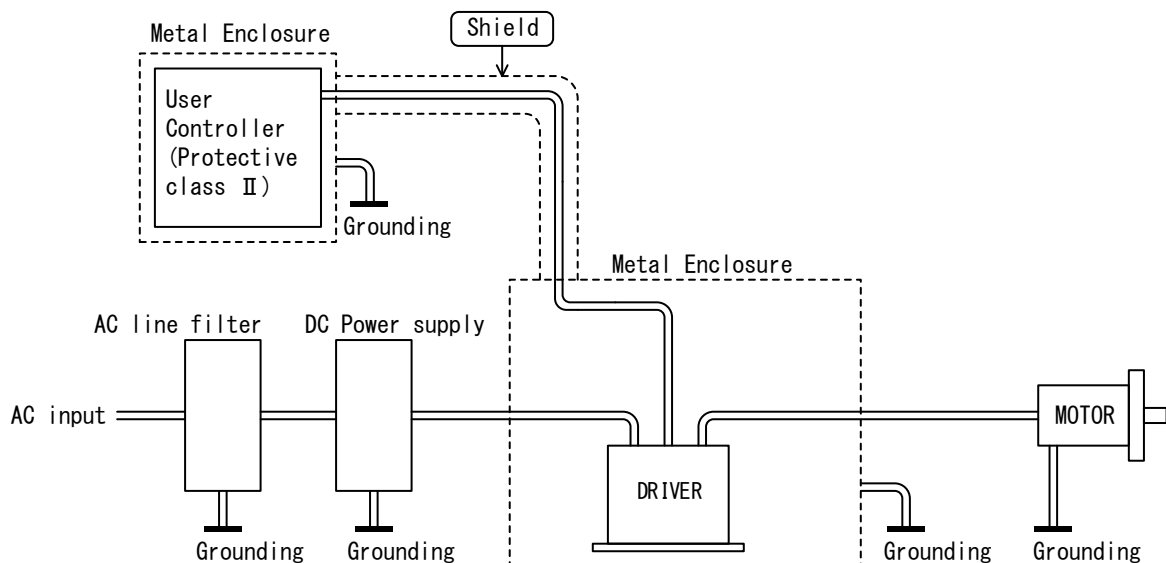
EN61000-6-2

● This product conducted EMC measurement with the system configuration for EMC.

- EMC characteristic may vary depending on the configuration of the equipment that contains the driver or stepping motor. Be sure to conduct EMC measurement with the product assembled in your equipment.

Configuration

The metallic enclosure and shielded wires work to shield noise.



(3) RoHS directive

This product does not contain the substances exceeding the restriction values.

The main parts which revised by this manual

Parts	Content

Technical Service
Sales and Service

TEL. (042) 664-5384 FAX. (042) 666-2031
E-mail s-support@melec-inc.com

Melec Inc.

516-10, Higashiasakawa-cho, Hachioji-shi, Tokyo 193-0834, Japan
www.melec-inc.com

This Operating Manual is subject to change without prior notice
for the purpose of product improvement.

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