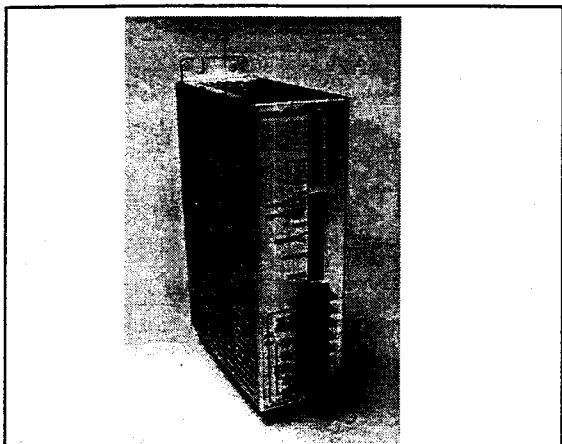


# Melec



**5-phase Stepping Motor Driver**

## **AD-5410**

## **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.



PR0620-6



## Introduction

This Instructions Manual describes the safe and proper method of handling "5-phase Stepping Motor Driver AD-5410" 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:

®5

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.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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

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# 1 . Safety

## 1 – 1 . Safety Precautions

- (1) Since this product uses commercial power (100VAC or 115VAC), erroneous handling may cause electrification accidents.
- (2) 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.
- (3) Ensure to use this product according to the method specified in the Instructions Manual and within the specifications.
- (4) Depending on the operational conditions, the stepping motor may step out when it is not operating or during operation.  
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.
- (5) The stepping motor may attain high temperature, depending on the operational conditions.  
If the surface temperature exceeds 100°C, provide cooling measures to control it to operate at 100°C at the highest.
- (6) 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 main frame.



## 1 – 2 . Safety Information for Handling

- 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 HOLD CURRENT ADJUSTMENT trimmer:

### 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

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 installing:

### WARNING

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




● When connecting the AC Input/Motor Output Terminal Block (J3):

**⚠ WARNING**

Potential electrical shock is apprehended.  
Turn the main power OFF.

**⚠ WARNING**

Potential electrical shock is apprehended.  
Securely ground the protection earth terminal .

**⚠ WARNING**

Potential electrical shock or fire is apprehended.  
Do not force the power line or the motor line to be bent or pulled or pinched.

**⚠ CAUTION**



Erroneous connection may result in breakage of the motor.  
Correctly connect the motor wiring.

● When inputting power:

**⚠ WARNING**

Potential electrical shock is apprehended.  
Do not contact with a wet hand.

**⚠ WARNING**

Potential electrical shock is apprehended.  
The marks,  and , on the front panel indicate terminals on which power voltage is applied.  
Do not touch such terminals while inputting power and while POWER LED is on.

**⚠ 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 performing maintenance and checking:

**⚠ WARNING**

Potential electrical shock is apprehended.  
Only specialized engineers are allowed to perform maintenance and checking.

**⚠ WARNING**

Potential electrical shock is apprehended.  
Do not contact with a wet hand.

**⚠ WARNING**

Potential electrical shock is apprehended.  
The marks, ⚠ and ⚠, on the front panel indicate terminals on which power voltage is applied.  
Do not touch such terminals while inputting power and while POWER LED is on.

**⚠ WARNING**

Potential electrical shock, injury or fire is apprehended.  
Do not replace fuse.  
Do not disassemble, repair or modify.

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

**⚠ CAUTION**

Deterioration of the holding power with the motor may cause breakage of 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.



## 2. Overview

### 2-1. Characteristics

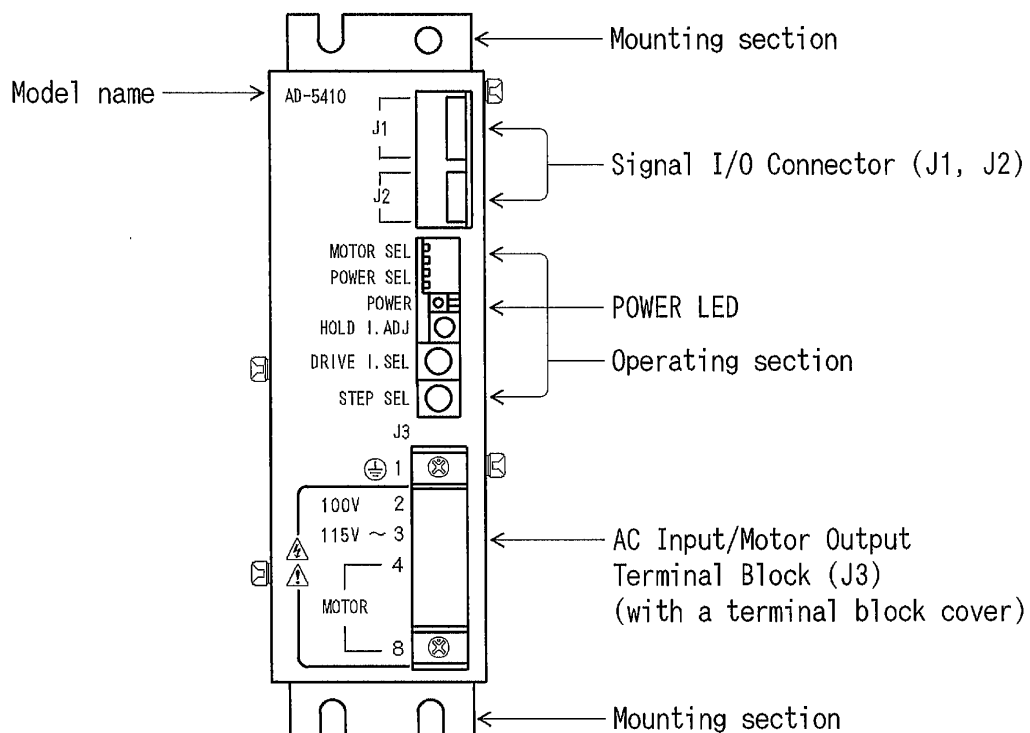
AD-5410 is a driver for a 5-phase stepping motor with 100VAC/115V input.  
It can drive a 5-phase stepping motor ranging from 0.75A/phase ~ 1.4A/phase.  
Ten step angles can be selected from angles ranging from a 1/1 division to a 1/160 division of the basic angle.  
HOLD current and DRIVE current can be set up.  
High-speed torque can be selected for the motor.

### 2-2. Product Configuration

The product consists of the main frame and the accessories.

- AD-5410: -----One unit (Main frame)  
(complete with a terminal block cover)
- Housing for J1 (171822-6: AMP): -----One unit (accessory)
- Housing for J2 (171822-5: AMP): -----One unit (accessory)
- Contact (170204-4: AMP): -----13 contacts (accessories, 2 for spares)

### 2-3. Appearance



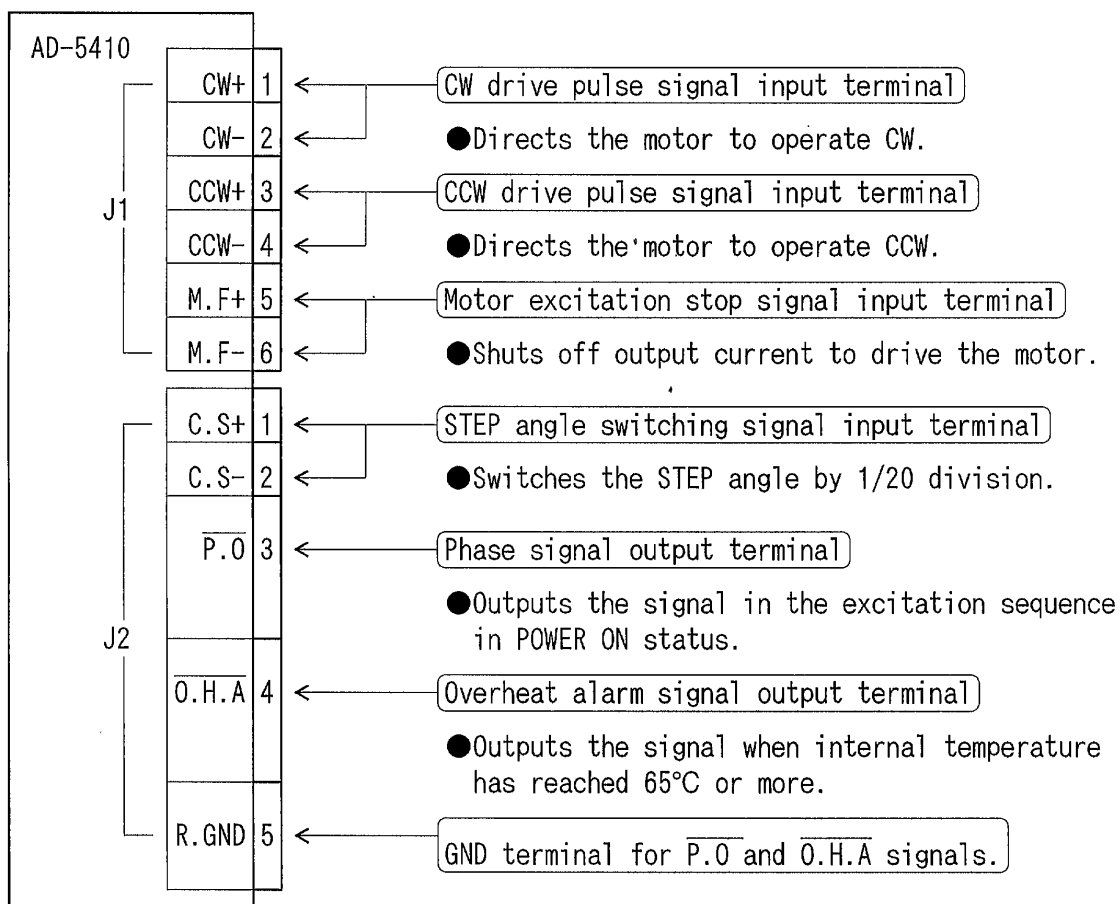
⚡: Caution, risk of electric shock

⚠: Caution (refer to accompanying documents)

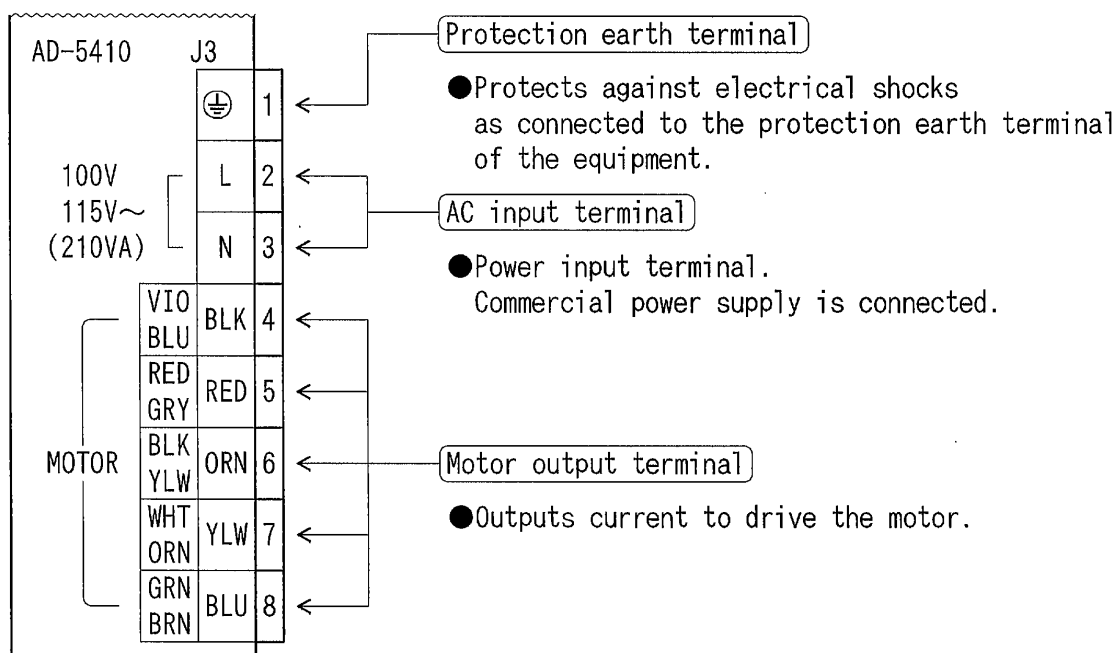


### 3. Name and Function of Each Section

#### 3 - 1. Signal I/O Connector (J1, J2)

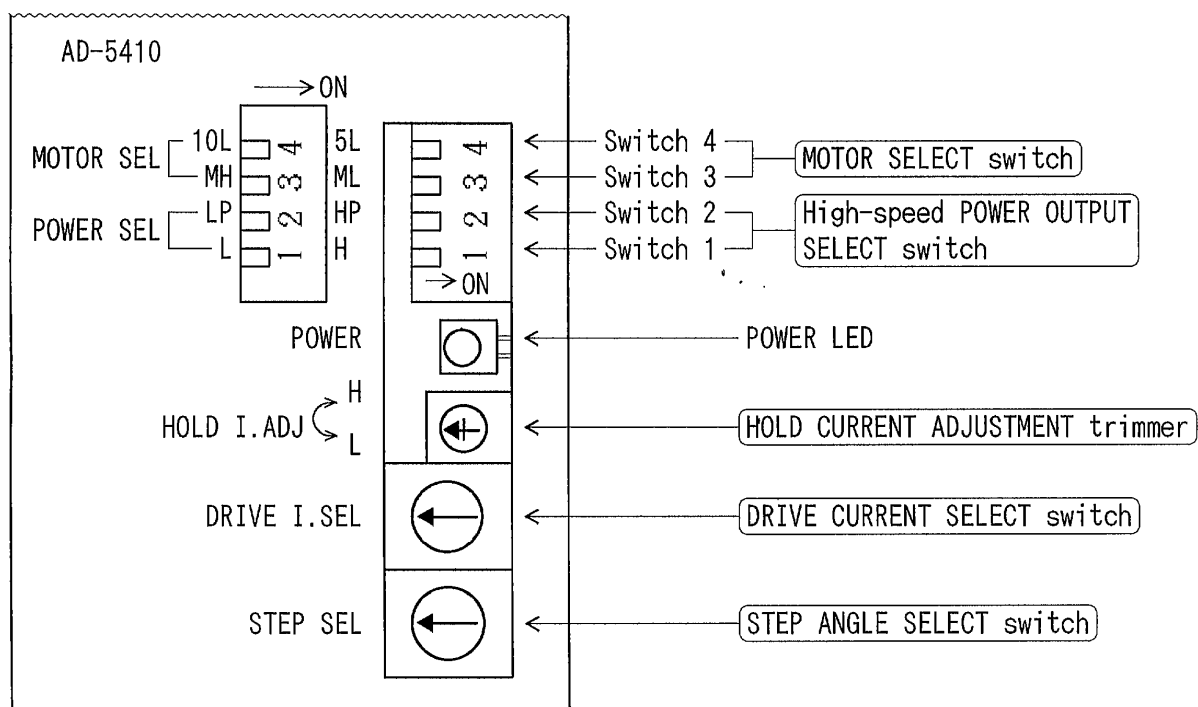


#### 3 - 2. AC Input/Motor Output Terminal Block (J3)





### 3 - 3 . Operating Section



Name of Operating Section	Function	Setting upon Shipping
MOTOR SELECT switch	Selects the applicable switch.	[MH · 5L]
High-speed POWER OUTPUT SELECT switch	Selects high-speed torque for the motor.	[HP · H]
HOLD CURRENT ADJUSTMENT trimmer	Adjusts HOLD current.	[40%]
DRIVE CURRENT SELECT switch	Selects DRIVE current.	[No. F]
STEP ANGLE SELECT switch	Selects a STEP angle.	[No. 6]

### 3 - 4 . POWER LED

POWER LED comes on upon inputting power.

POWER LED goes off when internal voltage drops to 40 V or lower after turning off power.



## 4 . Function Set-up by Use

### 4 – 1 . Setting MOTOR SELECT switch

#### ⚠ CAUTION

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

The MOTOR SEL switch is turned to the setting corresponding to the motor in use.  
Set this switch with power OFF.  
It is set to [MH · 5L] upon shipping.

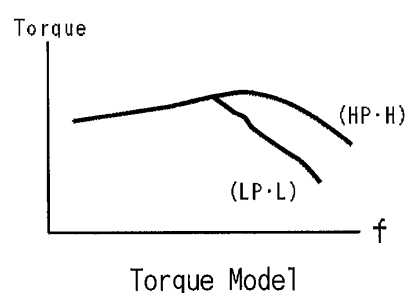
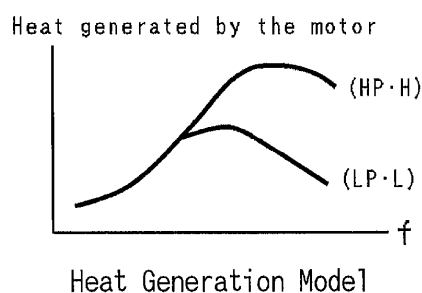
- (1) Turn power [OFF].
- (2) Turn switches 3 (MH/ML) and 4 (10L/5L) to the settings specified in the table "10-5. Applicable Motors."

### 4 – 2 . Setting High-speed POWER OUTPUT SELECT switch

Output by high-speed torque can be selected with the POWER SEL switch.  
There are four types of high-speed torque options.  
It is set to [HP · H] upon shipping.

- (1) Turn the switches 1 (L/H) and 2 (LP/HP) to the setting for high-speed torque required.

- Relationships of the switch setting and heat generation by the motor and high-speed torque:



- Select the switch (HP · H) if high-speed torque is required, and one from the switches (HP · L) through (LP · L) if not, in order to control heat generation by the motor.
- Selecting one of the switches leads to power demand as shown below:

Switch setting	HP · H	HP · L	LP · H	LP · L
Power Demand (with DRIVE I. SEL No. F set up)	210VA	170VA	140VA	110VA



#### 4 – 3 . Setting HOLD CURRENT ADJUSTMENT trimmer

##### CAUTION

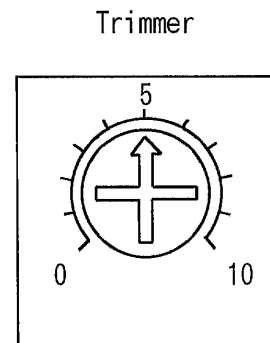
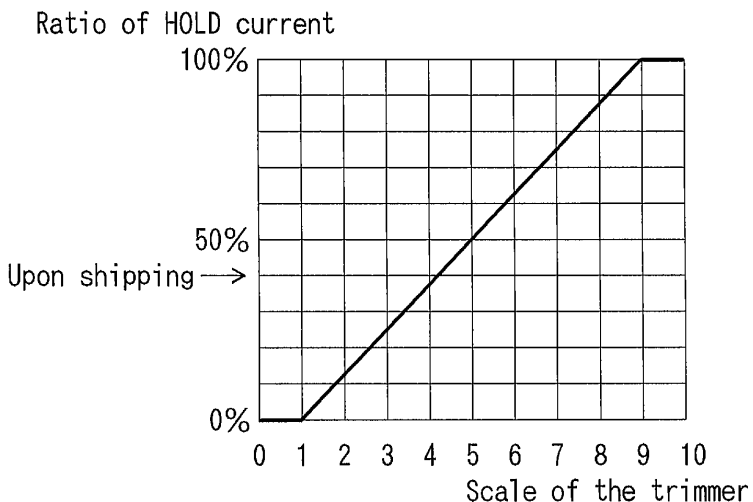
A high setting value may cause burn on the skin due to overheating of the motor.  
Do not select a high value beyond the required.

HOLD current is set up with the HOLD I. ADJ trimmer.  
This sets the ratio of HOLD current to DRIVE current.  
The ratio is adjustable between 0 to 100%.  
It is set to 40% upon shipping.

(1) Set the gauge of the trimmer to the required value.

● Relationship between the trimmer scales and HOLD current:

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



- HOLD current changes relative to the DRIVE current setting.  
The ratio of HOLD current of 100% represents the same as the setting for DRIVE current.
- The greater the ratio of HOLD current grows, the more heat the motor generates when turned off.



#### 4 – 4 . Setting DRIVE CURENT SELECT switch

##### CAUTION

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

DRIVE current is set up with the DRIVE I. SEL switch.  
It is set to [No. F] upon shipping.

- (1) Set the switch No. to the setting specified in the table  
"10-5. Applicable Motors."

● Relationship between the DRIVE I. SEL switch and DRIVE current:

MOTOR SEL switch is set to [5L]	
Switch No.	A/phase
0	0.17
1	0.20
2	0.24
3	0.27
4	0.31
5	0.34
6	0.37
7	0.41
8	0.44
9	0.48
A	0.51
B	0.54
C	0.58
D	0.61
E	0.64
F	0.68

(Upon shipping)

MOTOR SEL switch is set to [10L]	
Switch No.	A/phase
0	0.34
1	0.40
2	0.47
3	0.54
4	0.61
5	0.67
6	0.74
7	0.81
8	0.88
9	0.95
A	1.01
B	1.08
C	1.15
D	1.21
E	1.28
F	1.35

(Upon shipping)



#### 4 – 5 . Setting 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.

The STEP angle is set up with the STEP SEL switch.  
The STEP angle can be selected from ten different types of STEP angles.

Set this switch with power OFF.

It is set to [No. 6] upon shipping.

(1) Turn power [OFF].

(2) Set the switch No. to the STEP angle required.

● Relationship between the STEP SEL switch No. and the STEP angle:

Switch No.	Number of Divisions	STEP angle(° )	
		0.72° motor	0.36° motor
0	1/1	0.72	0.36
1	1/2	0.36	0.18
2	1/4	0.18	0.09
3	1/8	0.09	0.045
4	1/10	0.072	0.036
5	1/16	0.045	0.0225
6	1/20	0.036	0.018
7	1/40	0.018	0.009
8	1/80	0.009	0.0045
9	1/160	0.0045	0.00225

(Upon shipping)

● Two types of STEP drive are provided by combining the STEP SEL switch setting and the C.S signal.



## 5 . Installation

### 5 – 1 . Conditions for Installation

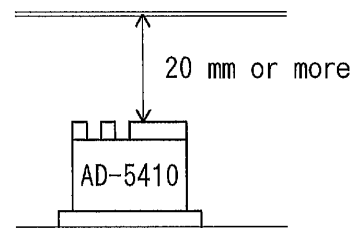
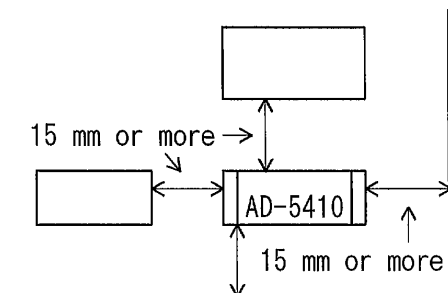
#### **⚠ WARNING**

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 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 15 mm away from other equipment.



(3) Considering heat release, control the ambient temperature around the driver within the specified value.

- 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 by convection.
- Install the driver securely in contact with metal or other substance with adequate heat conductivity.

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

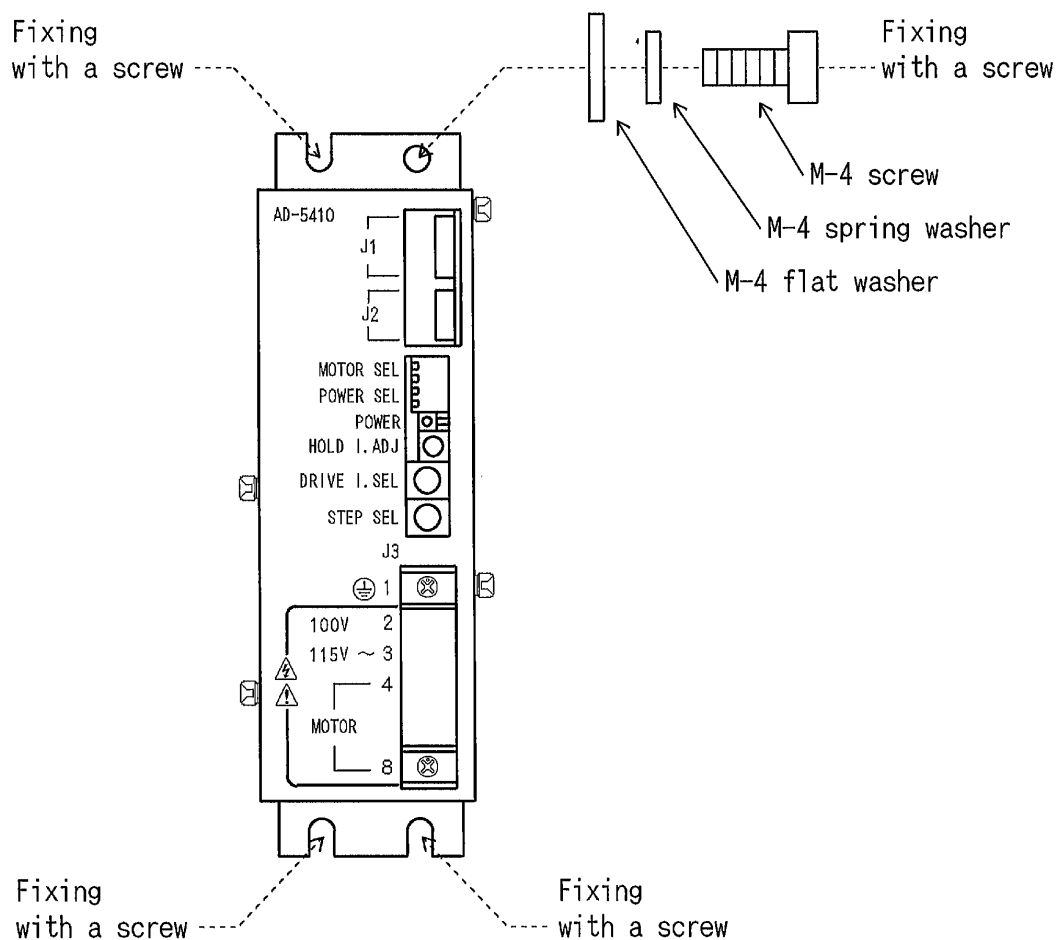


## 5 - 2 . Mounting Method

The following items are required:

- M-4 screw (8 mm or more in length):----- 4
- M-4 spring washer:----- 4
- M-4 flat washer:----- 4

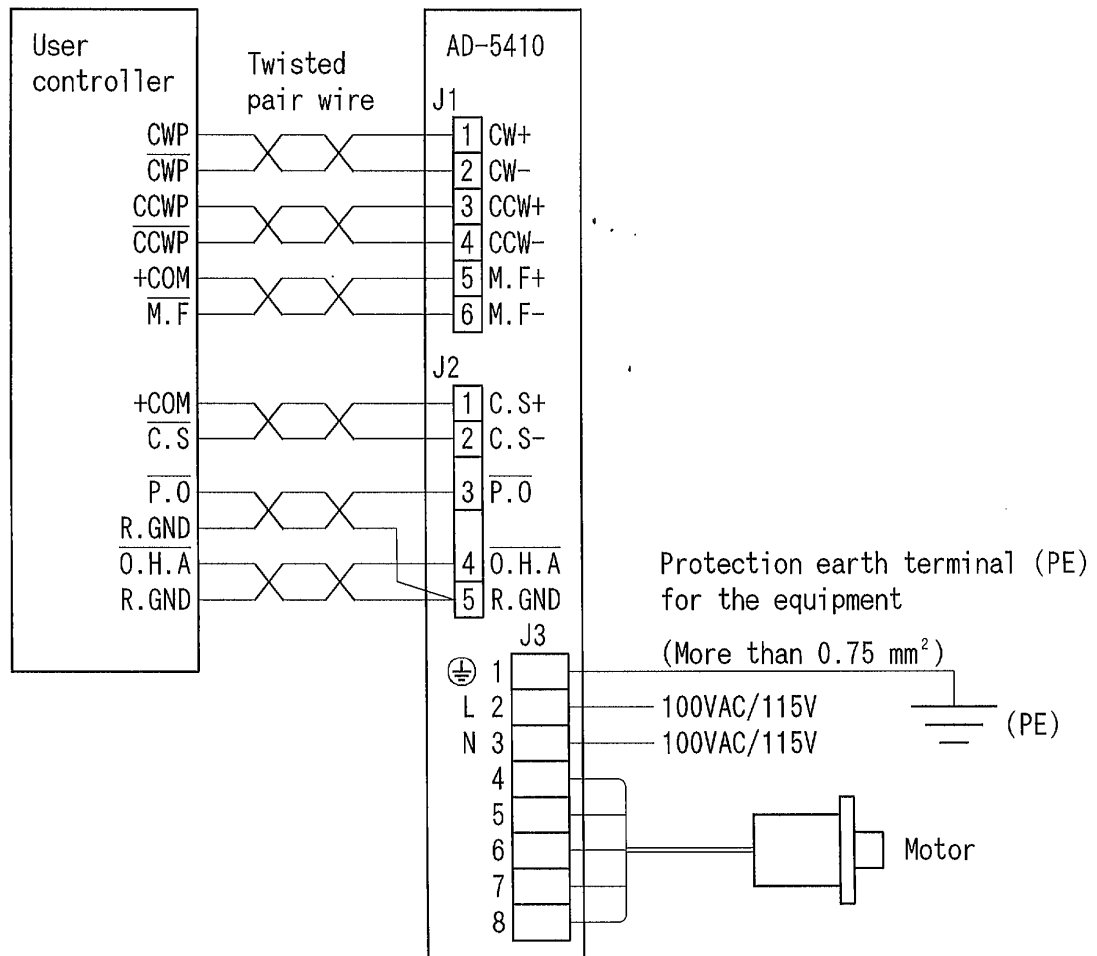
- (1) Temporarily fix the product at the round hole.
- (2) Fix the product at the three cutouts.
- (3) Fasten the screw in the round hole.





## 6 . Connection

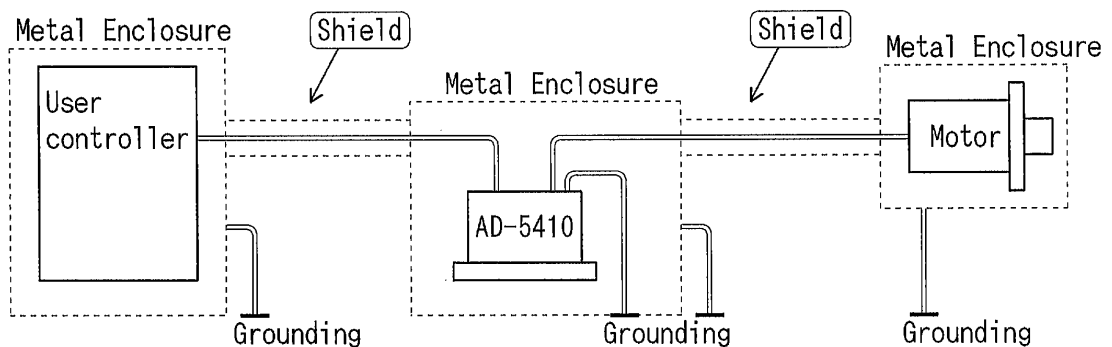
### 6 – 1 . Overview of Connection Configuration



- 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.
- Provide shielding for the motor line if it generates significant noise.

[Example configuration]

The metallic enclosure and shielded wires work to shield noise.





## 6 – 2 . Connecting Signal I/O Connector (J1, J2)

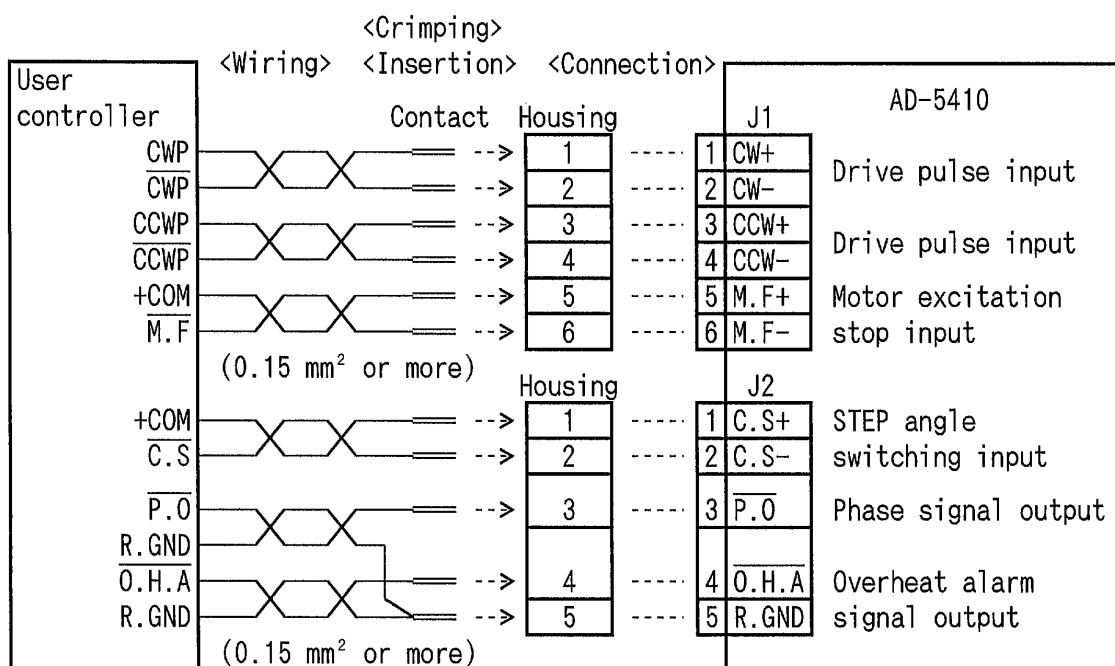
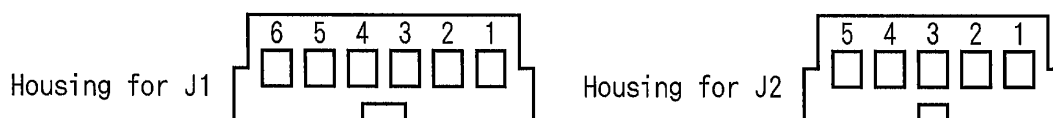
®1

The following items are required:

- Housing for J1 (171822-6: AMP): --- 1 (accessory)
- Housing for J2 (171822-5: AMP): --- 1 (accessory)
- Contact (170204-4: AMP): --- 11 (accessories)
- Manually operated crimping tool for AWG26-20 (189509-1 or 722560-1: AMP): --- 1

- (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.

(Surface on which the contacts are inserted)



- When inserting, keep pushing J1 and J2 housings into the connectors until they are locked.  
Also, check if the contacts are not displaced from the housing.
- In wiring, isolate the J1 and J2 signal lines from equipment that may be a source of noise, the power line and the motor line.




### 6 – 3 . Connecting AC Input/Motor Output Terminal Block (J3)

#### WARNING

Potential electrical shock is apprehended.  
Turn the main power OFF.

#### WARNING

Potential electrical shock is apprehended.  
Securely ground the protection earth terminal .

#### WARNING

Potential electrical shock or fire is apprehended.  
Do not force the power line or the motor line to be bent or pulled or pinched.

#### CAUTION

Erroneous connection may result in breakage of the motor.  
Correctly connect the motor wiring.

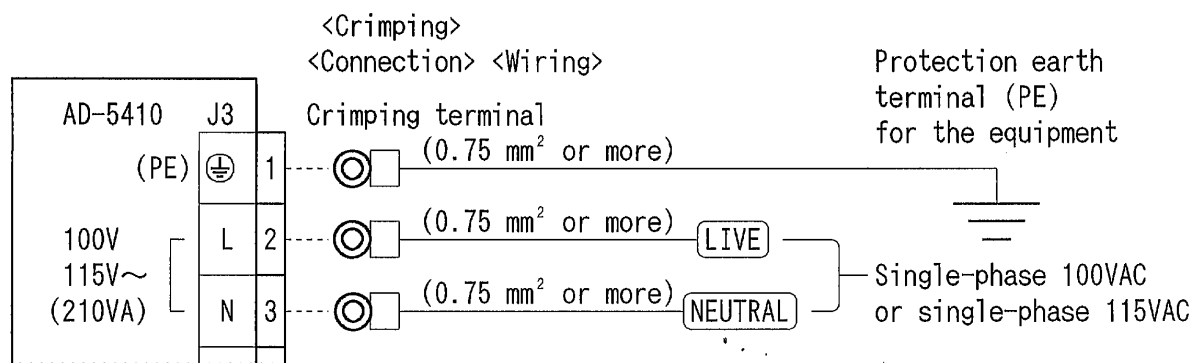
The following items are required:

- Crimping terminal  
(TMEV1.25-3: Nichifu or the equivalent):-----8
- Manually operated crimping tool for AWG22-16  
(NH-11: Nichifu or the equivalent):-----1

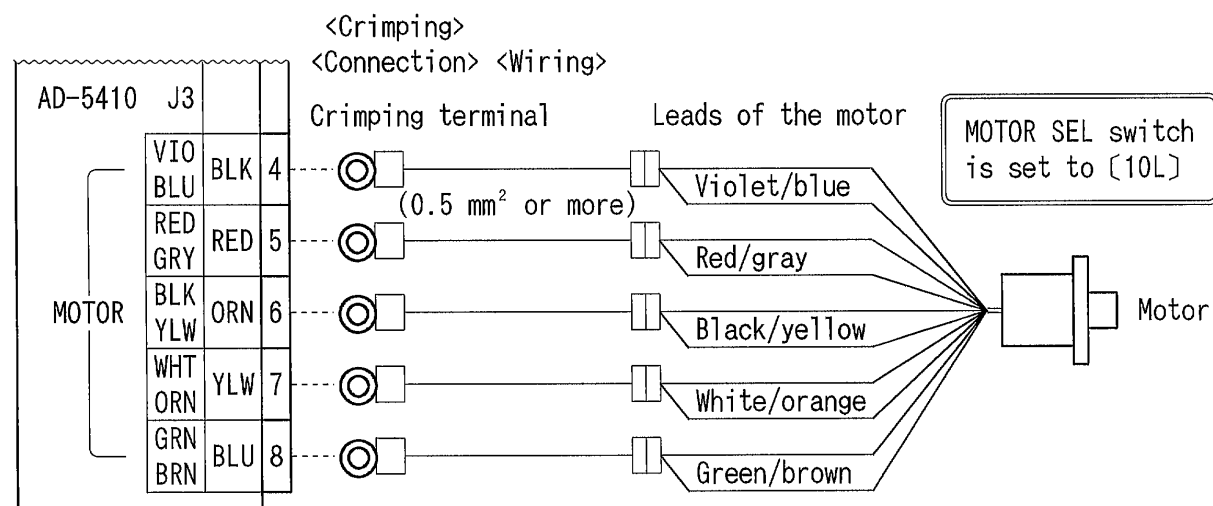
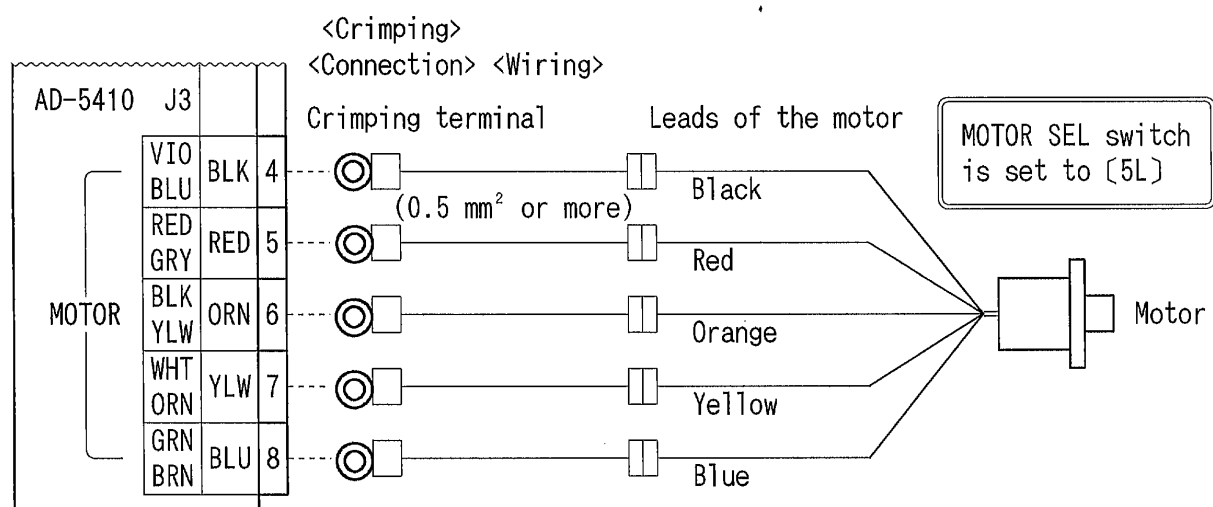
- (1) Turn power of the equipment [OFF].
- (2) Crimp the crimping terminals to the cable used for wiring.
- (3) Remove the cover of the terminal block, then connect.
- (4) Fix the terminal block cover after completing connection.



[Protection earth terminal: AC input terminal]



[Motor output terminal]



● Be sure to ground the protection earth terminal (PE) to the protection earth terminal (PE) of the equipment, using wire rod with a section area of 0.75 mm<sup>2</sup> or more.

● Color indications for the motor crimping terminals (4 - 8) represent colors of the leads of the motor.





## 6 – 4 . Inputting Power

### WARNING

Potential electrical shock is apprehended.  
Do not contact with a wet hand.

### WARNING

Potential electrical shock is apprehended.  
The marks,  and , on the front panel indicate terminals on which power voltage is applied.

Do not touch such terminals while  
inputting power and while POWER LED is on.

### 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 commercial power (100VAC or 115VAC) into the cable connected to terminals No. 2 and 3 of J3.



## 7 . Confirmation of Settings and Connection

### 7 – 1 . Check Points

- (1) 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.
- (2) Check if the protection earth terminal  $\oplus$  of J3 is securely wired.
- (3) Check if the terminal block cover is fixed on J3.

Check Points		Check	Remarks
Setting of MOTOR SELECT switch	MH / ML		
	10L / 5L		
Setting of POWER SELECT switch	L / H		
	LP / HP		
Setting of HOLD I. ADJ trimmer	Trimmer Scale		
Setting of DRIVE I. SELECT switch	Switch No.		
Setting of STEP SELECT switch	Switch No.		
Connection of J1			
Connection of J2			
Connection of J3	Protection earth terminal $\oplus$		
	AC input terminal (L, N)		
	Motor output terminal		
	Terminal block cover		



## 8 . Maintenance and Check-up

### 8 – 1 . Maintenance and Check-up



#### WARNING

Potential electrical shock is apprehended.  
Only specialized engineers are allowed to perform maintenance and checking.

#### WARNING

Potential electrical shock is apprehended.  
Do not contact with a wet hand.

#### WARNING

Potential electrical shock is apprehended.  
The marks,  and , on the front panel indicate terminals on which power voltage is applied.  
Do not touch such terminals while inputting power and while POWER LED is on.

#### WARNING

Potential electrical shock, injury or fire is apprehended.  
Do not replace fuse.  
Do not disassemble, repair or modify.

(1) We recommend that the following check-ups should be performed periodically:

- Checking for any loosened screw on the terminal block and connector.
- Checking for any flaw and crack on the cabling.

(2) 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"> <li>·Connection of power supply.</li> <li>·Value of power voltage.</li> </ul>	<ul style="list-style-type: none"> <li>·Wiring error with power supply.</li> <li>·Power voltage failure.</li> <li>·Driver failure.</li> </ul>
2. The motor is not excited. (It can be easily rotated by hand.)	<ul style="list-style-type: none"> <li>·Connection of the motor to the driver.</li> <li>·ON/OFF status of the M.F signal.</li> <li>·Value of the HOLD CURRENT ADJUSTMENT trimmer.</li> </ul>	<ul style="list-style-type: none"> <li>·Wiring error with the motor and the driver.</li> <li>·The M.F signal is input.</li> <li>·Hold current is set to zero.</li> <li>·Driver failure.</li> </ul>
3. The motor does not rotate. The motor behaves abnormally. The motor steps out.	<ul style="list-style-type: none"> <li>·The same check items as those under item 2 above.</li> <li>·Setting of the MOTOR SELECT switch.</li> <li>·Connection of the pulse signal.</li> <li>·Voltage and wave form of the pulse signal.</li> <li>·Value of the DRIVE CURRENT SELECT switch.</li> <li>·Value of the STEP ANGLE SELECT switch.</li> <li>·ON/OFF status of the C.S signal.</li> </ul>	<ul style="list-style-type: none"> <li>·Wrong setting for the motor selection.</li> <li>·Wiring error with the pulse signal line.</li> <li>·Pulse signal of wrong specifications.</li> <li>·DRIVE current is too low.</li> <li>·Wrong setting for the STEP angle.</li> <li>·The C.S signal is input.</li> <li>·Driver failure.</li> <li>·Motor failure.</li> </ul>
4. The motor steps out during acceleration.	<ul style="list-style-type: none"> <li>·Start-up pulse speed.</li> <li>·Acceleration time.</li> <li>·Setting of the POWER SELECT switch.</li> </ul>	<ul style="list-style-type: none"> <li>·Start-up pulse signal speed is too high.</li> <li>·Acceleration time is too short.</li> <li>·The setting for the POWER SELECT is too low.</li> </ul>
5. The motor generates excessive heat.	<ul style="list-style-type: none"> <li>·Value of the DRIVE CURRENT SELECT switch.</li> <li>·Value of the HOLD CURRENT ADJUSTMENT trimmer.</li> </ul>	<ul style="list-style-type: none"> <li>·DRIVE current is higher than the setting for the applicable motor.</li> <li>·The setting for HOLD current is too high.</li> </ul>
6. O.H.A signal is output.	<ul style="list-style-type: none"> <li>·Ambient temperature around the driver.</li> </ul>	<ul style="list-style-type: none"> <li>·Ambient temperature is too high (40°C or higher).</li> </ul>

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

Short-circuiting between:

- The motor output terminal and the earth terminal (PE).
- The motor output terminal and the power line.
- The motor output terminal and the motor output terminal.

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 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.



# 1 0. Specifications

®4

## 1 0 – 1. General Specifications

Supply Power	Single-phase 100VAC (50/60 Hz) or single-phase 115VAC (60 Hz) *2 ●Rated power at DRIVE: 210VA [POWER SEL ⇒ HP · H set up] ●Rated power at HOLD : 30VA [HOLD I. ADJ ⇒ 40% set up]	
Motor output current	MOTOR SEL switch is set to [5L]	●DRIVE current: 0.17A/phase~0.68A/phase ●HOLD current : 0~100% of the value of the DRIVE current setting
	MOTOR SEL switch is set to [10L]	●DRIVE current: 0.34A/phase~1.35A/phase ●HOLD current : 0~100% of the value of the DRIVE current setting
Input Signal	●Drive pulse input (CW, CCW) : Photo-coupler input ●Motor excitation stop input (M.F) : Photo-coupler input ●STEP angle switch input (C.S) : Photo-coupler input	
Output Signal	●Phase signal output (P.O) : O/C output ●Overheat alarm output signal (O.H.A) : Contact output	
Functions of Operating Sections	●Motor selection (MOTOR SEL) ●High-speed POWER output selection (POWER SEL) ●HOLD current adjustment (HOLD I. ADJ) ●DRIVE current selection (DRIVE I. SEL) ●STEP angle selection (STEP SEL)	
Operating Ambient Temperature	0°C ~ +40°C (No freezing allowed.)	
Operating Ambient Humidity	80% RH or less *1 (No condensation allowed.)	
Storing Temperature	-10°C ~ +55°C (No freezing allowed.)	
Storing Humidity	80% RH or less (No condensation allowed.)	
Atmosphere	Indoor (Exposure to direct sun is not allowed.), without any corrosive or inflammable gas, oil mist, or dust.	
Altitude	At 1000 m above sea level or lower	
Withstanding Vibration	No abnormality should be found after a vibration test at 10 ~ 55 Hz, 0.15 mm P-P.	
·Insulated Withstanding Voltage	(At ordinary temperature and humidity)	
	AC terminal - signal terminal	1500VAC: for one minute 500VDC: 100 MΩ or more
·Insulation Resistance	AC terminal - ⊕ terminal	1500VAC: for one minute 500VDC: 100 MΩ or more
Exterior Dimensions	*125 × *184 × *55	
Weight	0.7 kg	

\*1 In the case of UL: maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C

\*2 Input voltage range is single-phase 100-115V±10%.



## 10-2. Conforming to Low-voltage Directives, UL and CSA

®6

### (1) Scope

This product is not meant to work by itself but it is a component designed to work in combination with other machines and equipment.

Consequently, the machines and equipment incorporating this product will be subject to the safety standards.

### (2) Qualifying safety standards

●UL 61010A-1: Electrical equipment for laboratory use.

●CAN/CSA-C22.2 No. 1010.1:

Safety requirements for electrical equipment for measurement, control, and laboratory use.

●EN50178: Electronic equipment for use in power installations.

### (3) Qualifying EMC standards

●EN 55011: Emission control standard for ISM Group 1, class A.

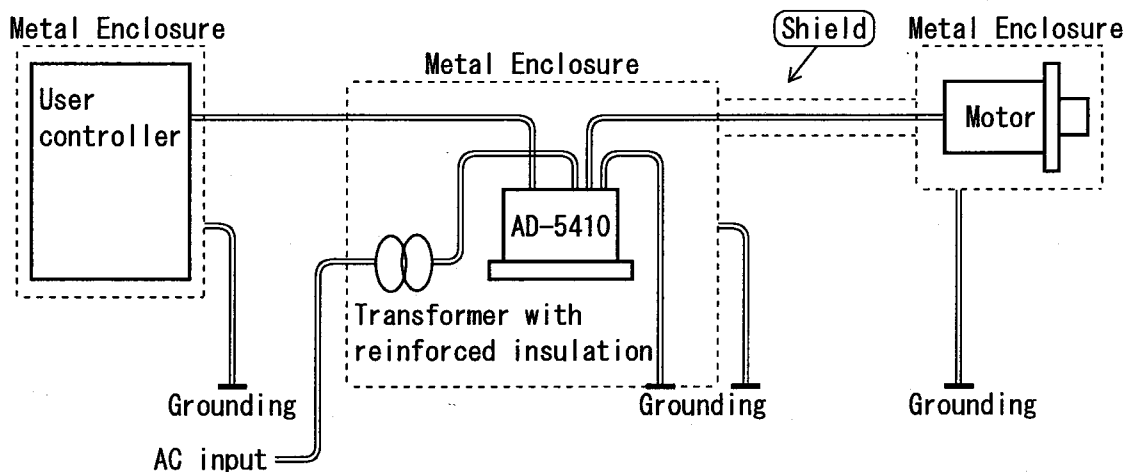
●EN 50082-2: Common immunity standard for industrial environments.

Also, regarding the EMC directives, we have designed a system configuration conforming to the EMC requirements to qualify for the EMC standards.

We are preparing an engineering document titled "System Configuration to conform to the EMC standards". Contact us if you are interested.

#### Configuration

The metallic enclosure and shielded wires work to shield noise.





#### (4) Installation conditions

- Electrical shock protection class

Class I equipment: Equipment for which protection is provided by connection of the protection earth terminal.

- Protection class

IP20: Protection is provided against intrusion of matters with a diameter of 12 mm or more but without waterproofing.

- Overvoltage installation category

Category II: Power supply depends upon the secondary side of the transformer which does not generate excessive overvoltage.

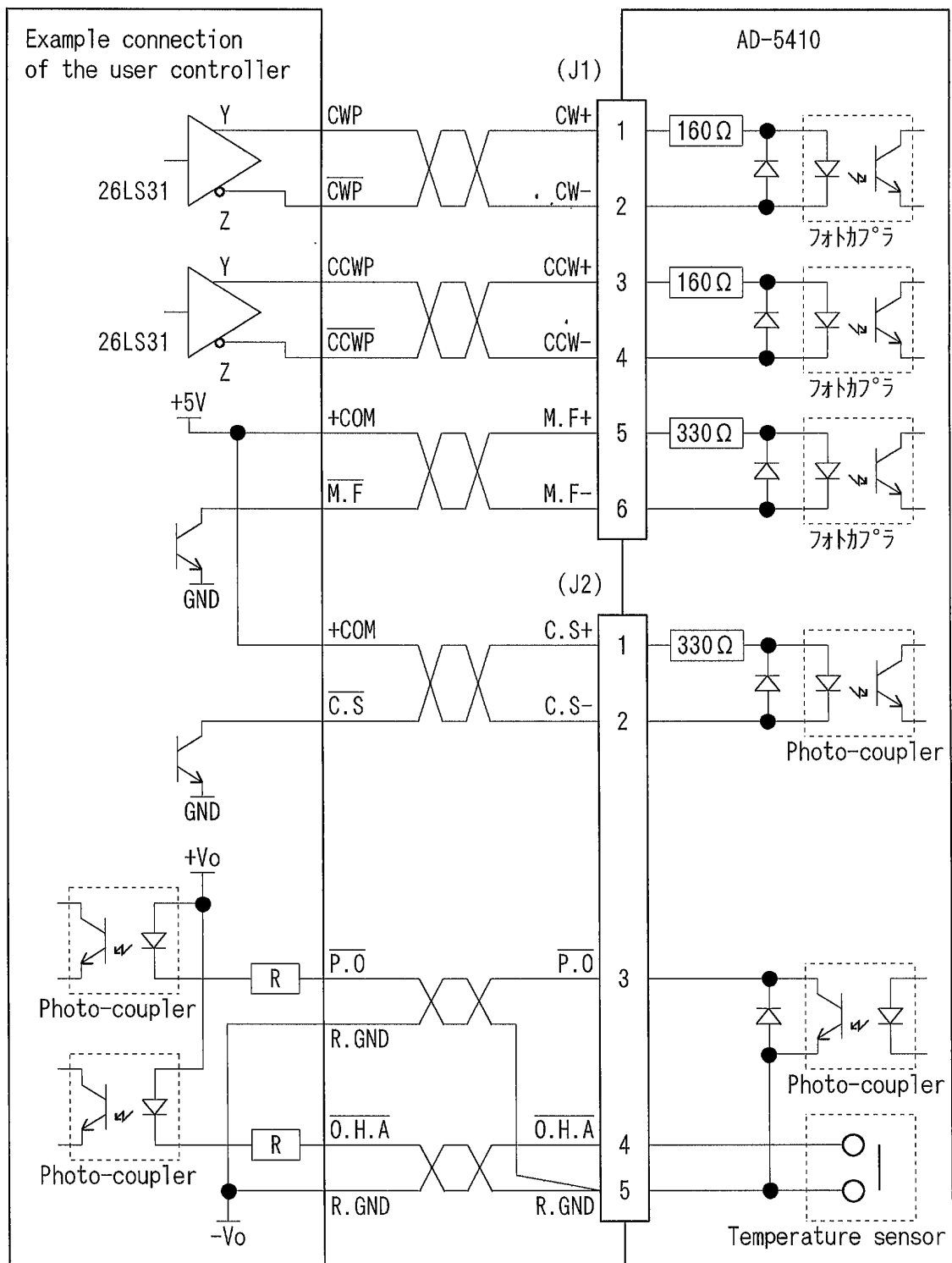
- Pollution degree

Class 2: Environment that does not allow contamination other than non-conductive contamination except for cases where conductivity is expected due to temporary condensation.



## 1 0 - 3 . I/O Signal

### (1) Example Circuit Connection



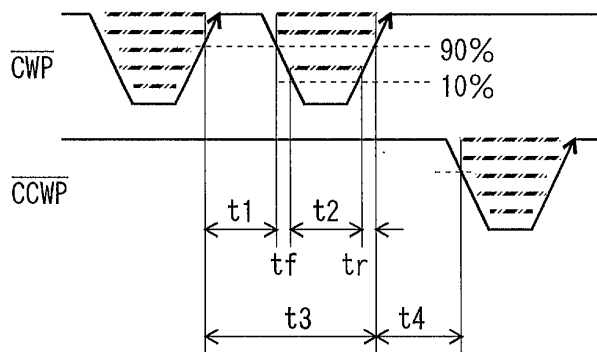


## (2) Drive pulse input (CW, CCW)

### ① Capacity: 9 mA~27 mA

The photo-coupler turns on with inter-terminal voltage of 3.1 V~5.5 V.  
(Photo-coupler diode  $V_F \doteq 1.6$  V)

### ② Timing chart

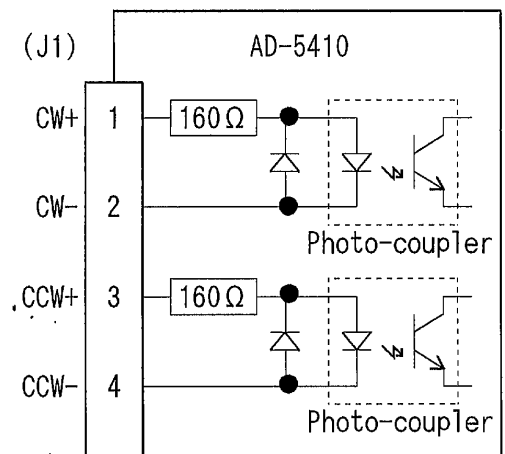


$$t1 \geq 1\mu\text{s}, \quad t2 \geq 1\mu\text{s}, \quad t_f, t_r \leq 2\mu\text{s}$$

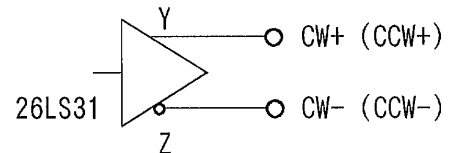
$$t3 > 2\mu\text{s}, \quad t4 > 2\mu\text{s}$$

Maximum response frequency: 500 kpps

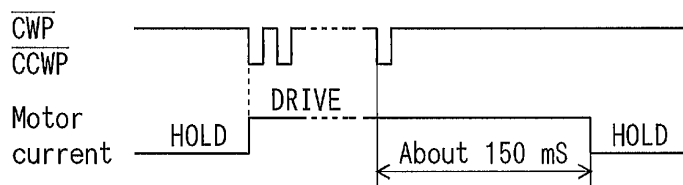
- The shaded area (---) indicates light emission from the photo-coupler, and the motor is driven at the rising edge (↗).
- "t4" greatly varies according to the inertial moment including that of the motor.



[To the line driver 26LS31]

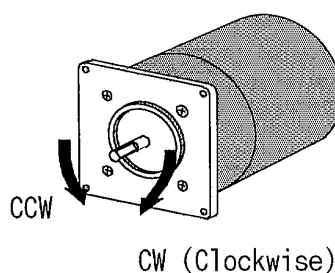


### ③ Automatic switching for DRIVE/HOLD



- Inputting drive pulse causes current output to the motor to change from HOLD current to DRIVE current, which returns to HOLD current in about 150 ms.
- DRIVE current continues if pulse is input in DRIVE current.

### ④ Direction of rotation





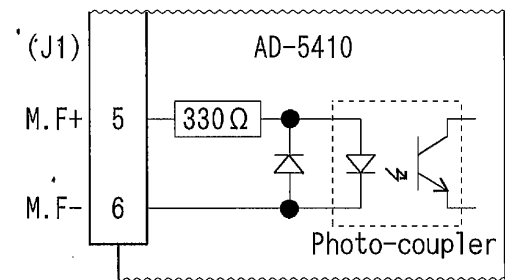
### (3) Motor excitation stop input (M.F)

#### ⚠ CAUTION

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

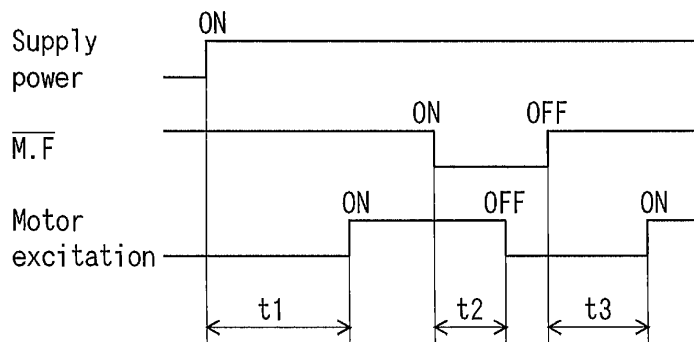
#### ① Capacity: 7 mA~20 mA

The photo-coupler turns on with inter-terminal voltage of 3.4 V~7.7 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



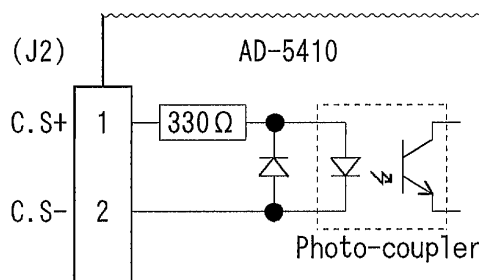
- $t1 \leq 1.5$  S (t1: Time required for the motor to be enabled.)  
 $t2 \leq 5$  mS (t2: Time required for the motor output current to be shut off.)  
 $t3 \leq 100$  mS (t3: Time required for the motor to be enabled.)



#### (4) STEP angle switch input (C.S)

##### ① Capacity: 7 mA~20 mA

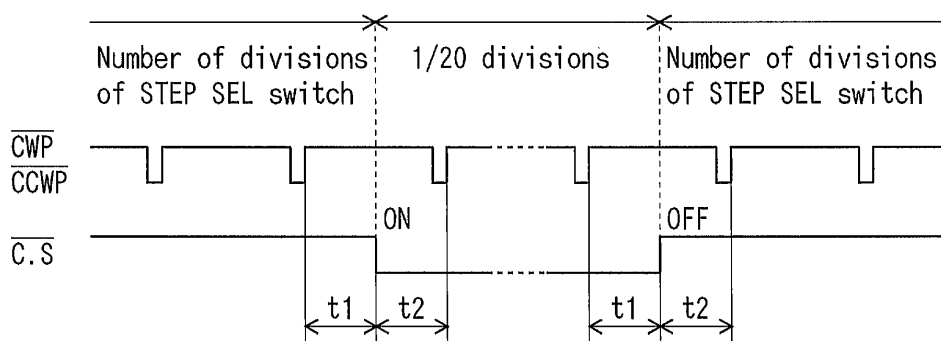
The photo-coupler turns on with inter-terminal voltage of 3.4 V~7.7 V.  
(Photo-coupler diode  $V_F \div 1.1$  V)



●STEP angle division is switched to 1/20 divisions with the photo-coupler ON.  
The setting for the STEP ANGLE SELECT switch is ignored.

●No displacement occurs even if the STEP angle is switched by the C.S signal.

##### ② Timing chart



$t1 \geq 30$  ms

$t2 \geq 0.2$  ms

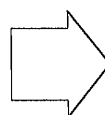
●Switching the STEP angle by the C.S signal requires time  $t1$  and  $t2$  before and after inputting drive pulse.

##### ③ STEP ANGLE SELECT switch and C.S signal

[STEP ANGLE SELECT switch]

Switch No.	Number of Divisions	STEP angle(°)	
		0.72° motor	0.36° motor
0	1/1	0.72	0.36
1	1/2	0.36	0.18
2	1/4	0.18	0.09
3	1/8	0.09	0.045
4	1/10	0.072	0.036
5	1/16	0.045	0.0225
6	1/20	0.036	0.018
7	1/40	0.018	0.009
8	1/80	0.009	0.0045
9	1/160	0.0045	0.00225

[When the C.S signal is input]



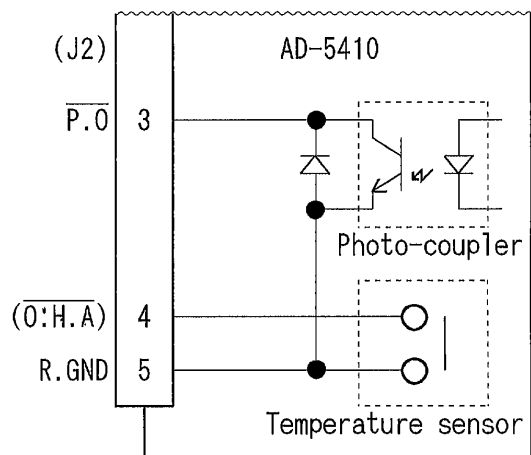
1/20 divisions  
(0.036° or 0.018°)



## (5) Phase signal output (P.0)

### ① Capacity:

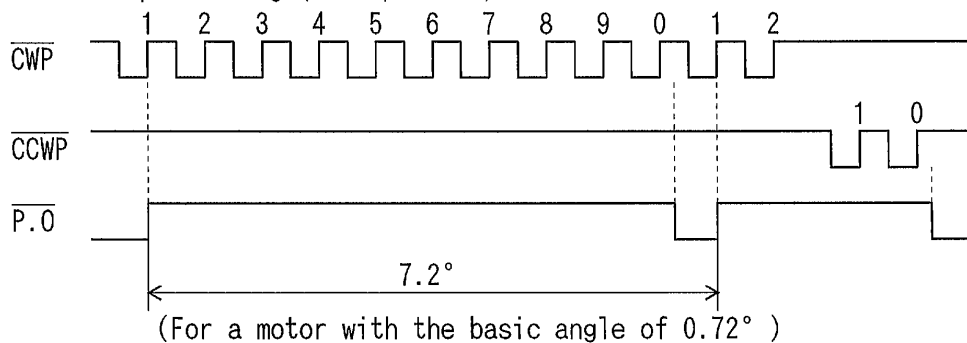
- a.  $I_c \leq 10 \text{ mA}$ ,  $V_{CE(sat)} < 5 \text{ V}$
  - b.  $I_c \leq 3 \text{ mA}$ ,  $V_{CE(sat)} \leq 0.6 \text{ V}$
- $V_{CE0} \leq 30 \text{ V}$



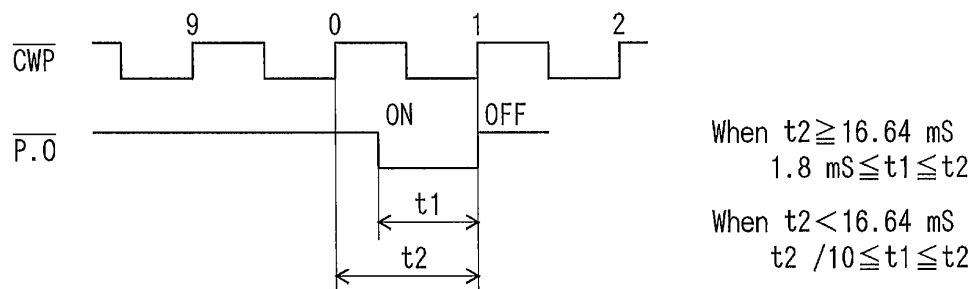
- In case of the excitation sequence at POWER ON, a signal is output (photo-coupler ON).
- In case of simultaneously using P.0 signal and C.S signal, input C.S signal while P.0 signal is being output to switch the step angle. Otherwise, P.0 signal may not be output.

### ② Timing chart

#### ● P.0 output timing (for 1/1 STEP)



#### ● P.0 output time



#### ● P.0 output frequency

1/1 STEP: once in 10 pulses	1/16 STEP: once in 160 pulses
1/2 STEP: once in 20 pulses	1/20 STEP: once in 200 pulses
1/4 STEP: once in 40 pulses	1/40 STEP: once in 400 pulses
1/8 STEP: once in 80 pulses	1/80 STEP: once in 800 pulses
1/10 STEP: once in 100 pulses	1/160 STEP: once in 1600 pulses



(6) Overheat alarm signal output (O.H.A)

**⚠ WARNING**

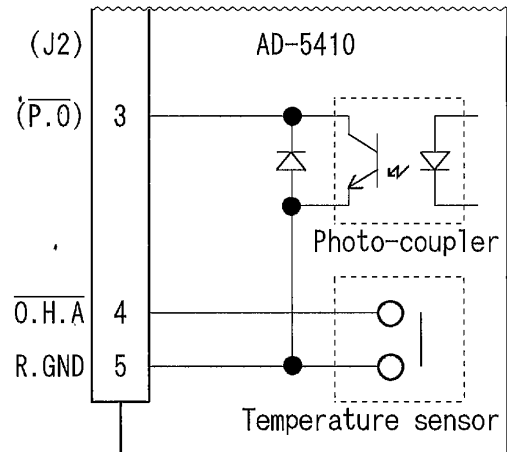
Overheating may cause fire.  
Stop operation upon output of this signal.

① Contact capacity:

Make/break voltage  $\leq 30$  V

Make/break current  $\leq 100$  mA

$1 \text{ mW} \leq \text{Make/break power} \leq 3 \text{ W}$

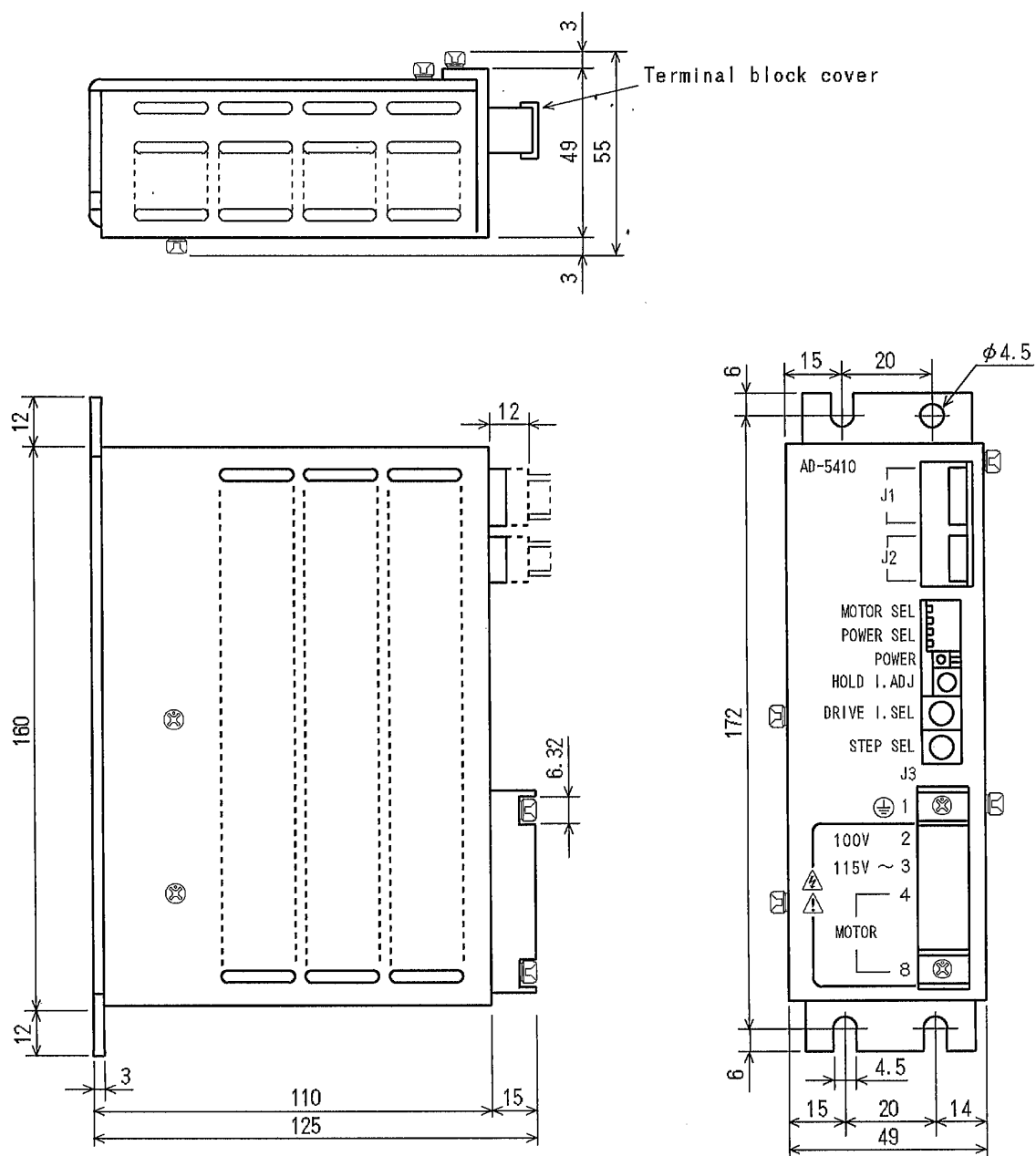


- In case of internal temperature reaches about 65°C or higher, a signal is output (the temperature sensor contact).
- When this signal is output, stop operation and check if there is any abnormality occurring with the motor and the driver.
- Provide mechanical cooling, for example, if this signal is output while no abnormality is detected.
- Continuous operation is possible unless this signal is output.



# 1 0 - 4 . Dimensions

(Unit : mm)





# 1 0 — 5 . Applicable Motors

5-phase stepping motors Applicable Motors	Basic Angle (° )	Current (A/phase)	Setting MOTOR SEL Switch	Setting DRIVE I. SEL Switch No.	Torque Data Fig. No.
Sanyo Denki Co., Ltd.	0.36	0.75	MH · 5L	F	Fig.1 2
5M33HA(B) 5M34HA(B)					
5M64A(B) 5M66HA(B) 5M69A(B) 5M96A(B) 5M99A(B) 5M913A(B)	0.72	0.75	MH · 5L	F	Fig.3 4 5 6 7 8
103H7521-7051(7021) 103H7522-7051(7021) 103H7523-7051(7021) 103H8581-7041(7011) 103H8582-7041(7011)	0.72	0.75	MH · 5L	F	Fig.9 10 11 12 13
Oriental Motor Co., Ltd.	0.36	0.75	MH · 10L	6	Fig.14 15 16
PX533MH-A(B) PX534MH-A(B) PX535MH-A(B)					
PH544-A(B) PH554-A <sub>2</sub> (B <sub>2</sub> ) PH564-A(B) PH566-A(B)	0.72	0.75	MH · 10L	6	Fig.17 18 19 20
PH566H-A(B)	0.72	1.3	MH · 10L	E	Fig.21 22 23 24
PH569-A(B)	0.72	1.4	MH · 10L	F	
PH596-A(B)	0.72	1.25	MH · 10L	D	
PH599-A(B)	0.72	1.15	MH · 10L	C	
PK543-A(B) PK544-A(B) PK545-A(B) PK564-A(B) PK566-A(B)	0.72	0.75	MH · 10L	6	Fig.25 26 27 28 29
PK564H-A(B) PK566H-A(B) PK569-A(B) PK596-A(B) PK599-A(B)	0.72	1.4	MH · 10L	F	Fig.30 31 32 33 34
Setting upon shipping			MH · 5L	F	—

( ) : Both axes



## 10 – 6 . Torque Characteristics

- (1) Representations in the torque characteristics table are made in terms of the motor rotation (rps) vs. torque (kg · cm).  
Motor rotation (rps) and drive pulse frequency (pps) are converted as follows:

$$\text{Motor rotation (rps)} \times \frac{360^\circ}{\text{STEP angle}} = \text{drive pulse input frequency (pps)}$$

- (2) The self-start-up frequency 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.  
If the surface temperature exceeds 100°C, provide cooling measures to control it to operate at 100°C at the highest.



Fig.1

5M33HA(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

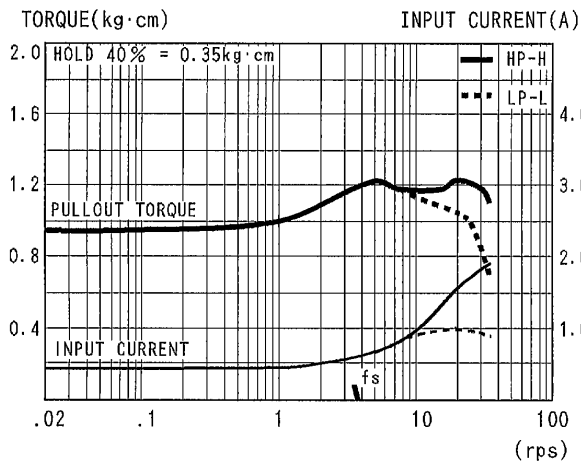


Fig.2

5M34HA(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

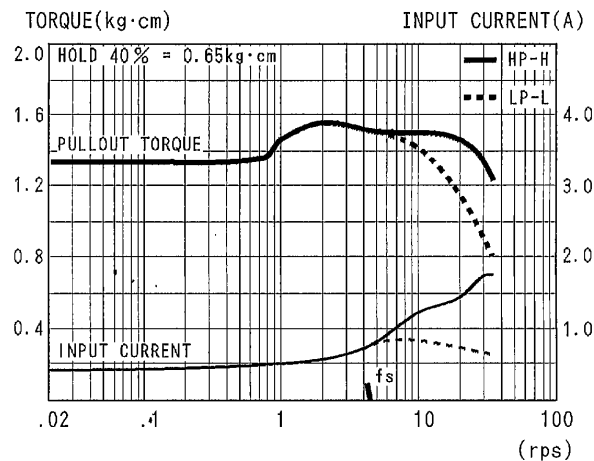


Fig.3

5M64A(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

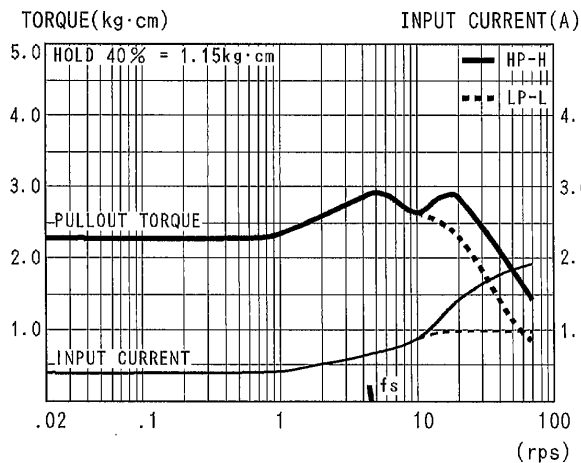


Fig.4

5M66HA(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

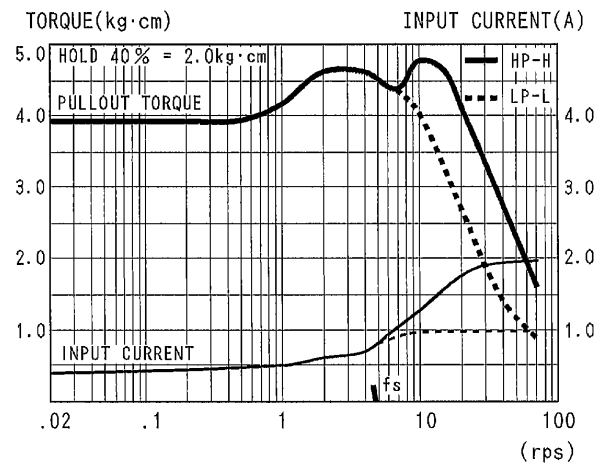


Fig.5

5M69A(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

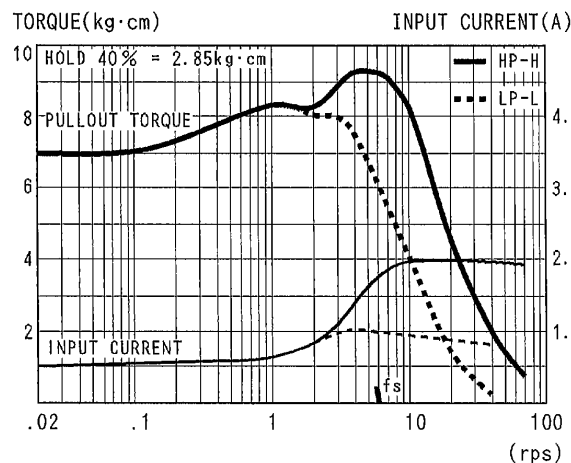


Fig.6

5M96A(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

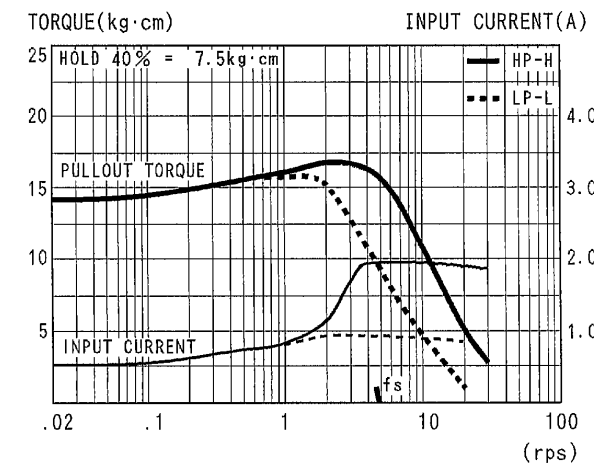




Fig.7

5M99A(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

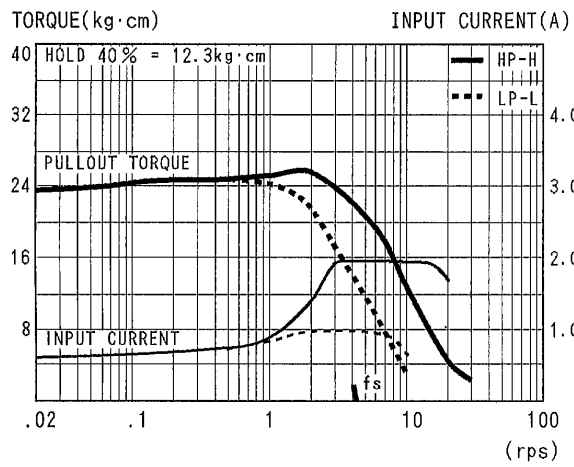


Fig.8

5M913A(B)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

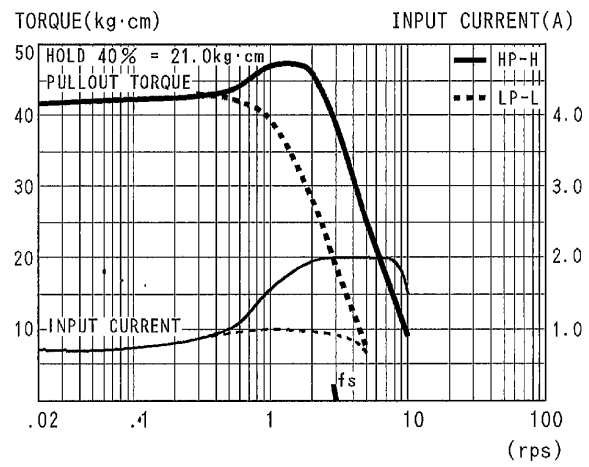




Fig.9

103H7521-7051(7021)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

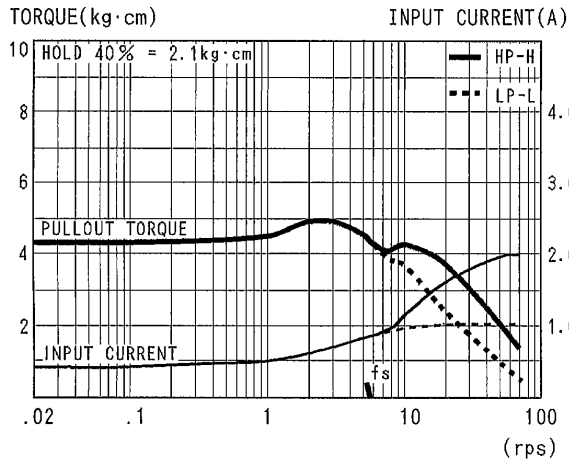


Fig.10

103H7522-7051(7021)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

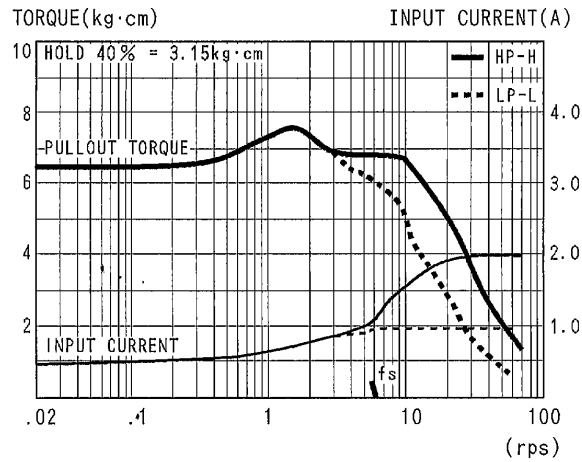


Fig.11

103H7523-7051(7021)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

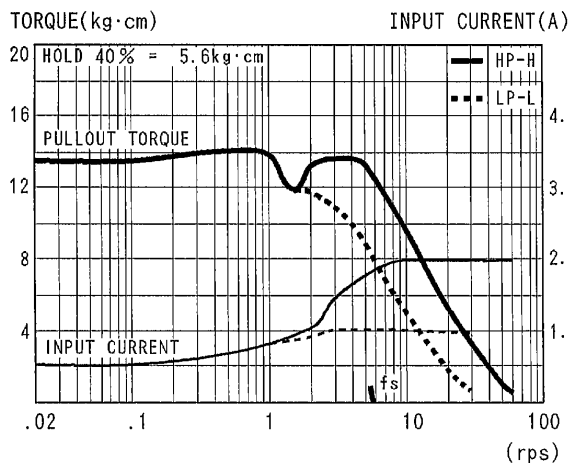


Fig.12

103H8581-7041(7011)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

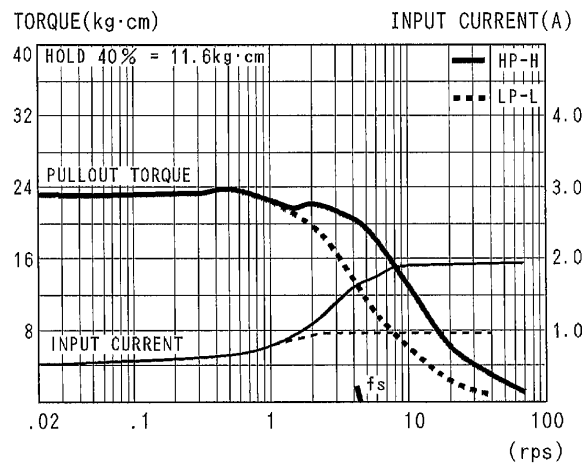


Fig.13

103H8582-7041(7011)  
0.75A/PHASE

MOTOR SEL = MH,5L  
DRIVE I.SEL = No.F  
AC100V

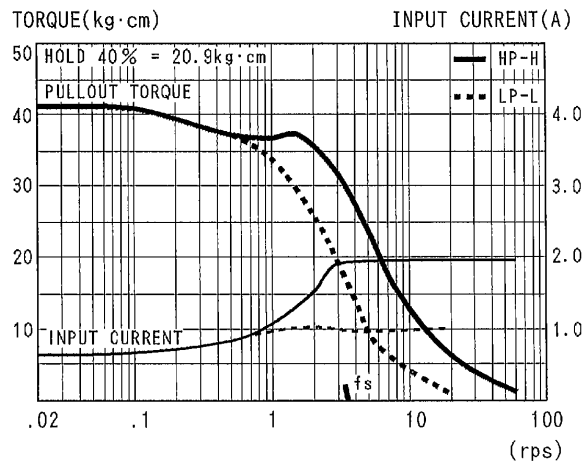




Fig.14

PX533MH-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

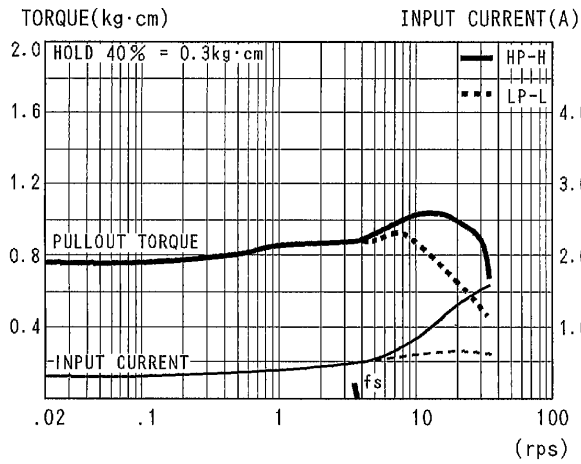


Fig.15

PX534MH-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

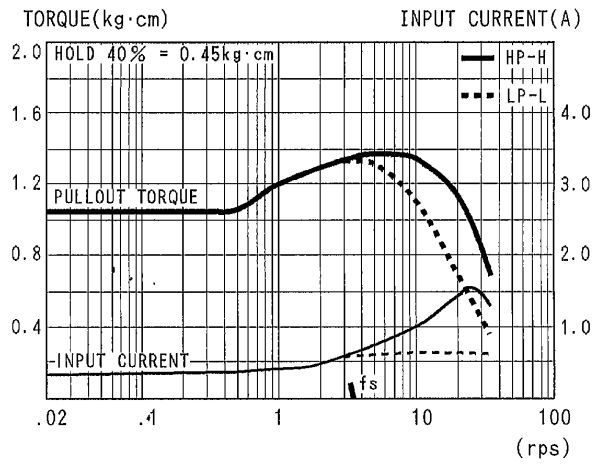


Fig.16

PX535MH-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

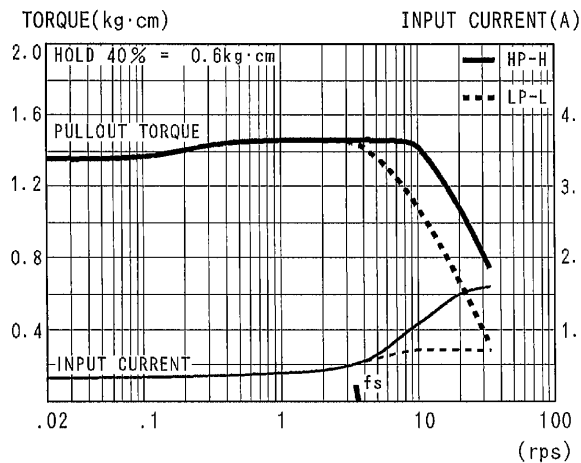


Fig.17

PH544-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

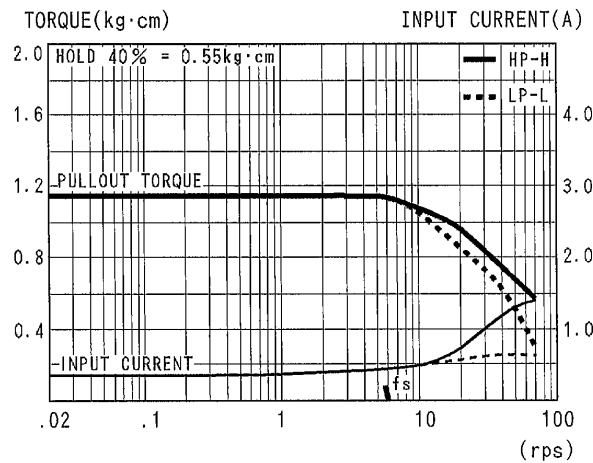


Fig.18

PH554-A<sub>2</sub>(B)<sub>2</sub>  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

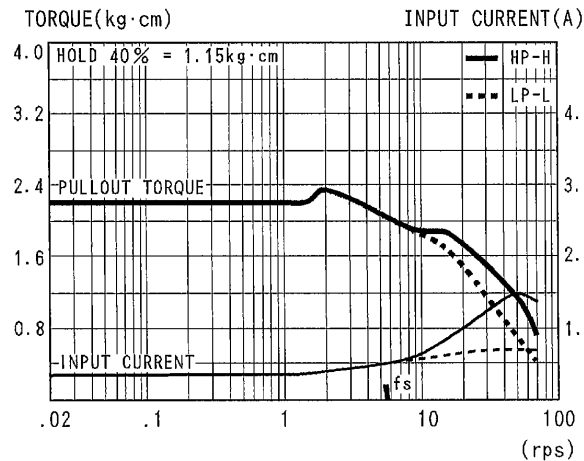


Fig.19

PH564-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

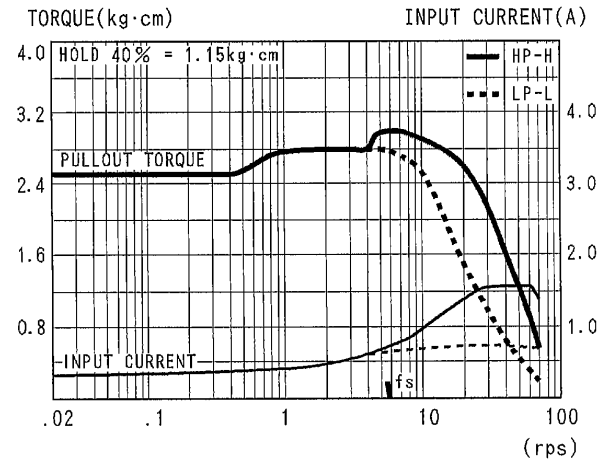




Fig.20

PH566-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

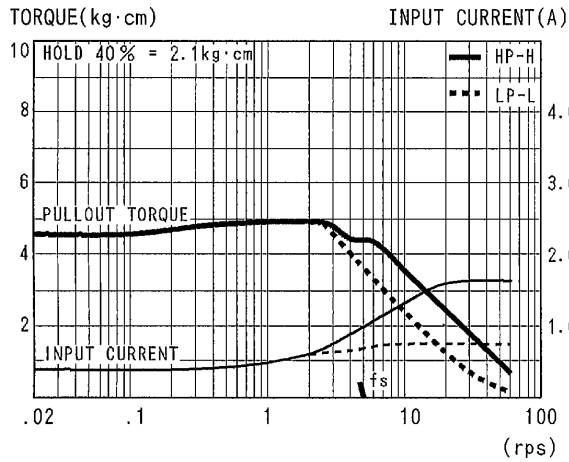


Fig.21

PH566H-A(B)  
1.3A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.E  
AC100V

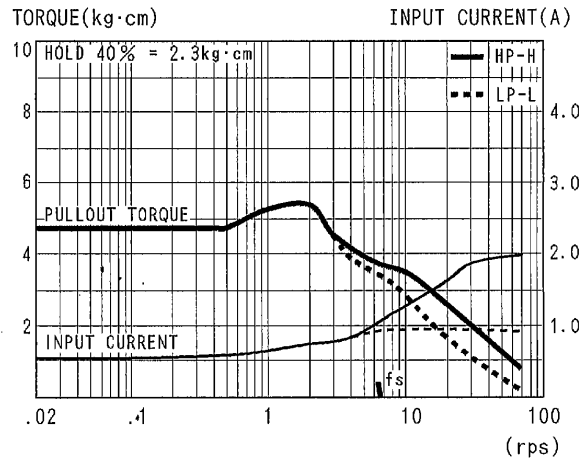


Fig.22

PH569-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V

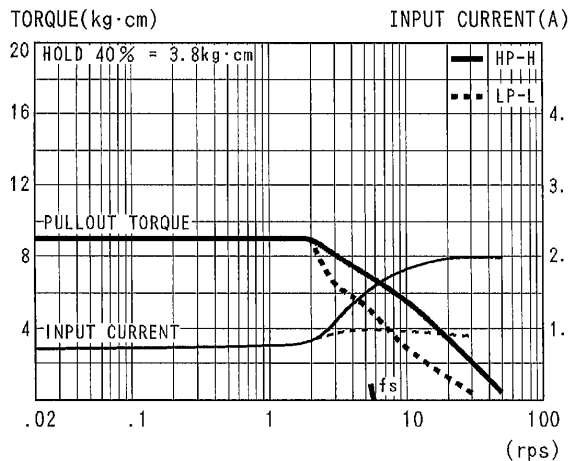


Fig.23

PH596-A(B)  
1.25A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.D  
AC100V

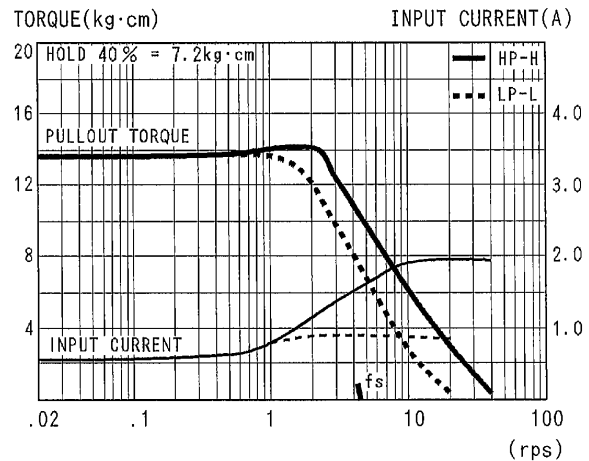


Fig.24

PH599-A(B)  
1.15A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.C  
AC100V

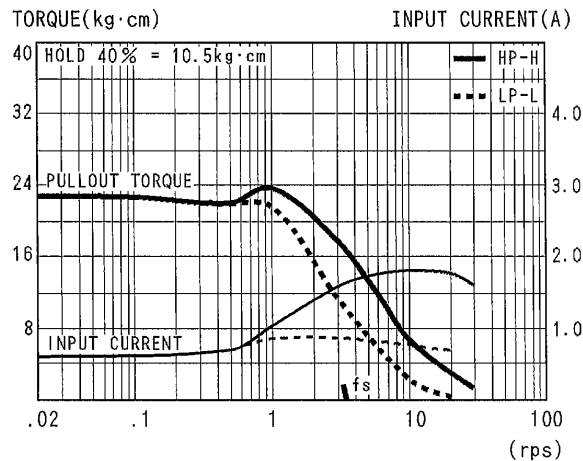




Fig.25

PK543-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

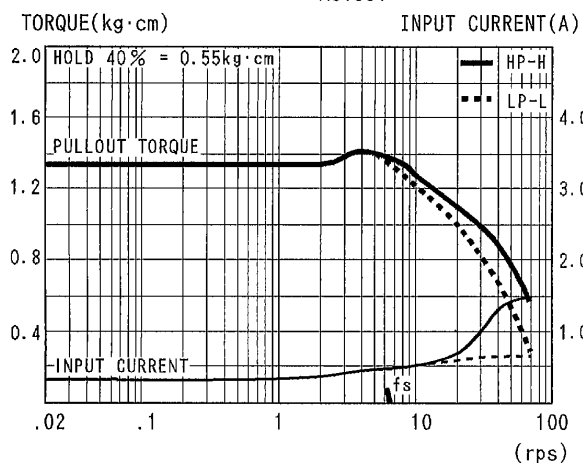


Fig.26

PK544-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

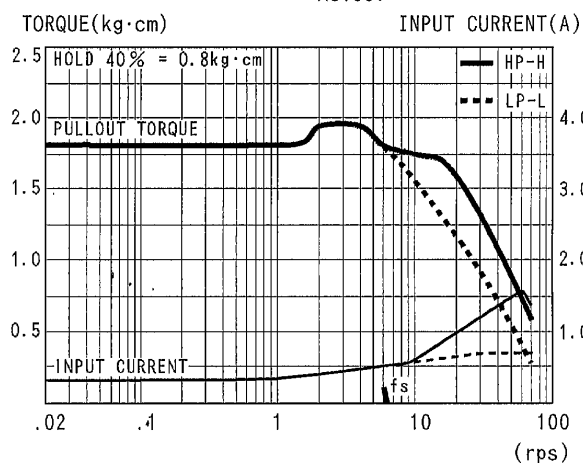


Fig.27

PK545-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

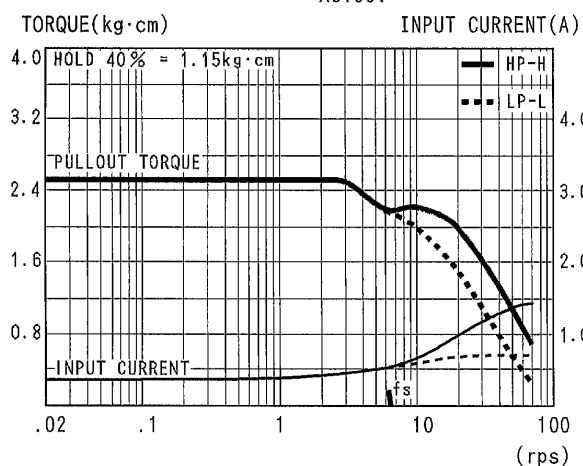


Fig.28

PK564-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

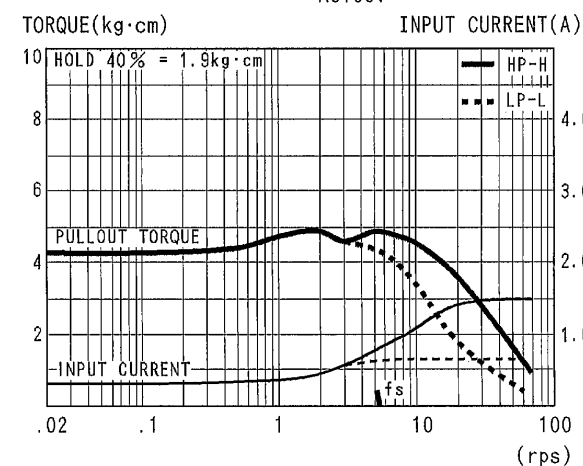


Fig.29

PK566-A(B)  
0.75A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.6  
AC100V

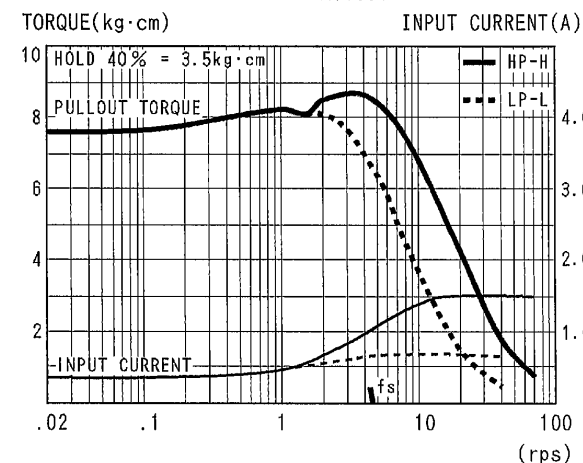


Fig.30

PK564H-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V

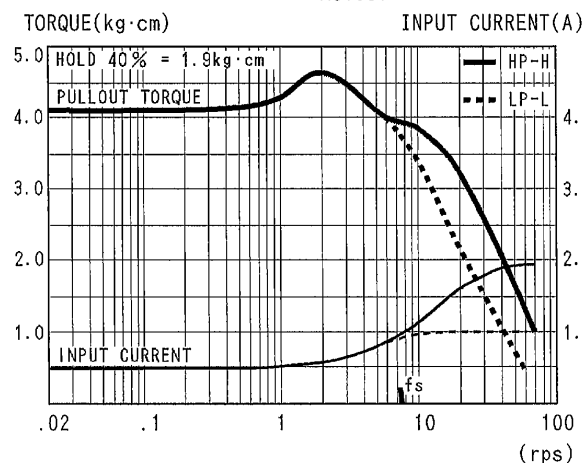




Fig.31

PK566H-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V

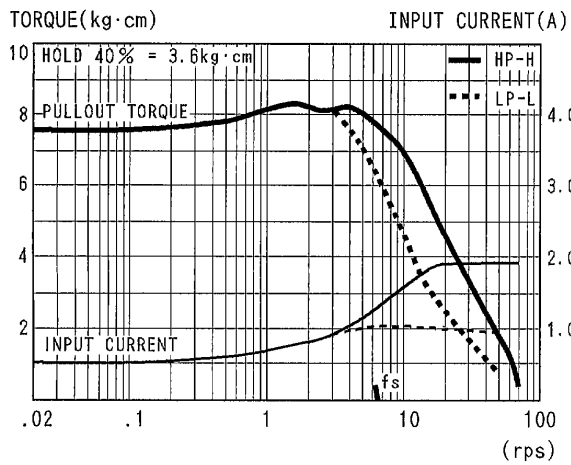


Fig.32

PK569-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V

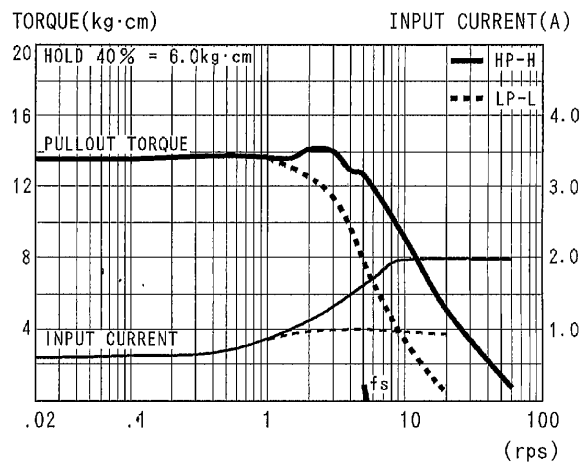


Fig.33

PK596-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V

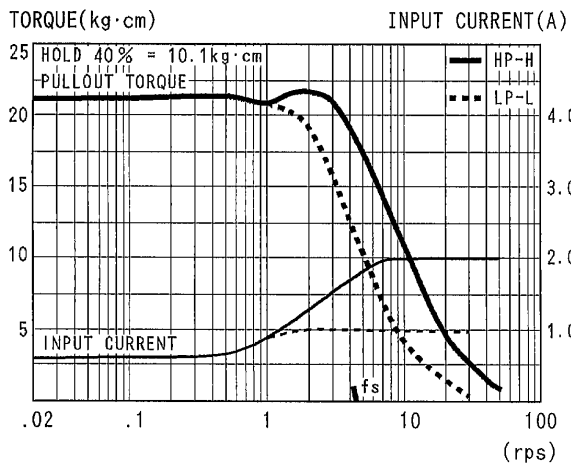
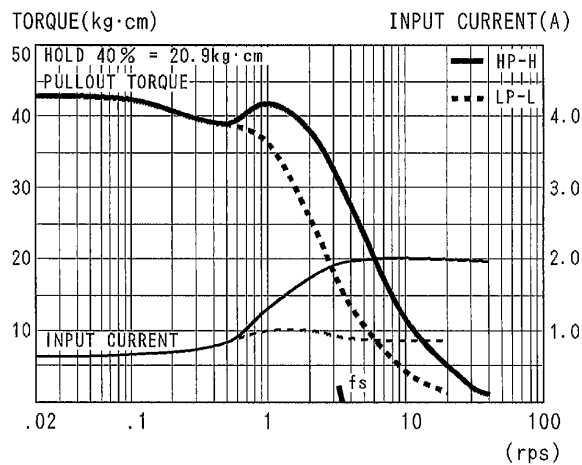


Fig.34

PK599-A(B)  
1.4A/PHASE

MOTOR SEL = MH,10L  
DRIVE I.SEL = No.F  
AC100V





## 10-7. Special Functions

### CAUTION

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

Don't use usually.

Contact us if you use this functions.

#### (1) Function to change pulse signal input modes

You can choose between the double pulse signal input mode and the single pulse signal input mode.

#### (2) Function to change step motion

You can choose between AD Step Motion and MD Step Motion.

#### (3) Function to change motor vibration

You can choose character of the motor vibration on accelerating/decelerating drive.

- We are preparing a technical data titled "Details of Special Function Switch (AD-5410, AD-5610)".

Contact us if you are interested.



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## Technical Service

TEL. (042) 664-5382 FAX. (042) 666-5664  
E-mail [s-support@melec-inc.com](mailto:s-support@melec-inc.com)

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## Sales and Service

TEL. (042) 664-5384 FAX. (042) 666-2031  
URL: <http://www.melec-inc.com>

Melec Inc. Control equipment marketing department  
516-10, Higashiasakawa-cho, Hachioji-shi, Tokyo 193-0834, Japan

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