Oriental motor

On-board type driver for 5-Phase stepping motor

RoHS

12-24VDC Input

DS series

Full step / Microstep

Technical Data

Full step driver

Microstep driver

■ Features

●The compact driver helps the whole system to be smaller

This on-board type driver makes the design of the system to be more flexible.
Power input of 12-24VDC makes it possible to be used on portable devices.

●Only one aluminum electrolytic condenser is needed for outside part

This driver has all the function needed to drive the motor.
The installation of one aluminum electrolytic condenser complete the set up of the system.
Since only one external part is required, parts control becomes easier and driver installation time becomes shorter.

●ECO drive operation helps lower the energy cost

As to the motor's operating current, in addition to the settings of RUN current, ECO current can be set and used depending on the condition of the operation. By lowering the operating current, the energy cost of the system can be lowered.Lowering the operating current also reduces the rise of motor/driver temperature, the level of vibration, and the sound of noise.

■ Compatible motors

Excitation Mode		Compatible Motor (Rated current)
Full / Half step	Microstep	
DS503-2	**DS503F-2**	0.35A/Phase
DS507-2	**DS507F-2**	0.75A/Phase
—	**DS507HF-2**	0.75A /Phase (□28mm High-Speed type)
DS514-2	—	1.4A /Phase (Except for □85mm)

■ Hazardous substances

RoHS (Directive 2002/95EC 27Jan.2003) compliant

■ Product overview

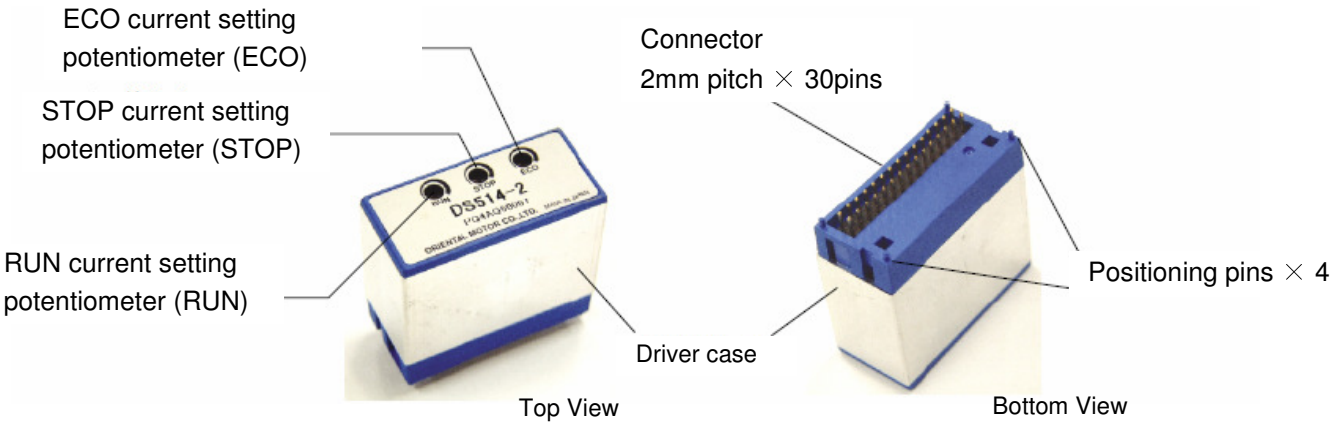
DS series is a compact driver for 5-phase stepping motor. It contains driver circuit, fuse, and the current setting potentiometers.

NOTE: To use this product, mounting board has to be prepared. Also, the test of the temperature rise is needed. Please prepare cooling fans if needed.

■ Specifications

Model	DS503-2	DS507-2	DS514-2	DS503F-2	DS507F-2	DS507HF-2
Drive Method	Bipolar constant current drive					
Excitation Mode	Full Step 0.72°/step Half Step 0.36°/step			Microstep		
Power Source	DC12-24V±10%					
Main power	0.7A	1.4A	2.3A	0.7A	1.4A	
Logic circuit	DC5V±5% 0.02A			DC5V±5% 0.1A		
Rated Current	0.35A/Phase	0.75A/Phase	1.4A/Phase	0.35A/Phase	0.75A/Phase	
Input Signal	C-MOS input H:3.75～5V L:0～1.25V					
	2-pulse input mode, Negative logic pulse input					
	Pulse width 3μs minimum Pulse rise / fall 2μs maximum Maximum input frequency 100kHz (Pulse DUTY50%)			Pulse width 0.625μs minimum Pulse rise / fall 2μs maximum Maximum input frequency 800kHz (Pulse DUTY50%)		
	Step Angle L:Full Step H:Half Step			Step Angle Set by M0～M3 Resolution L:R1 H:R2		
	A.W.OFF L:Current Off H:Normal			A.W.OFF L:Current Off H:Normal		
	ECO drive L:ECO H:Normal			ECO drive L:ECO H:Normal		
	RST L:Reset H:Normal			RST L:Reset H:Normal		
Output Signal	C-MOS output H:4～5V L:0～1V ±1mA maximum					
	Excitation Timing: H level at step 0.			Excitation Timing: H level at step 0.		
				Over Heat Open drain output (Pull-up resistor) L level output at 90℃ or higher Automatically reset at 80℃ (Interlock with A.W.OFF)		
Other Functions	Automatic Current Cutback			Automatic Current Cutback, Smooth Drive		
Permissible Temp. (At driver surface)	80℃ Maximum		72℃ Maximum	67℃ Maximum		
Operating Temp.	0～+40 ℃					
Operating Humidity	85% or less, noncondensing					
Mass	40 g			20g		
Cooling Method	Natural Ventilation (Forced cooling is required when the temperature exceeds permissible temperature.)					

■ Names and functions of parts



Functions

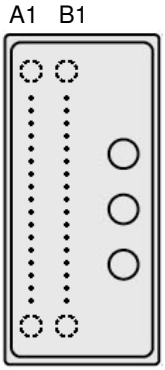
Type	Function	Signal	Description
Input	ECO drive signal	ECO	Change the operating current L: Reflects ECO potentiometer, H: Reflects RUN potentiometer Effective on reducing the motor current, temperature rise, vibration, noise at constant speed operation.
Input	All windings off signal	A.W.OFF	Cut off the motor current, and the motor's shaft can be rotated manually. L: Current off (No excitation), H: Normal operation
Input	Step angle select signal (Only for full step)	F/H	Switch the step angle to full step or to half step L: Full step, H: Half step
Input	Resolution table select signal (Only for microstep)	R1/R2	Select the resolution table to be used. R1: 5-phase stepping motor resolution table, R2: 2-phase stepping motor resolution table
Input	Resolution select signals (Only for microstep)	M0～M3	Choose the resolution Note: Please see the resolution table.
Input	Reset signal	RST	Set the excitation sequence to be at the initial stage. For microstep driver, the motor current is cut off with RST input.
Output	Excitation timing signal	TIM.	TIM is output simultaneously with a pulse input each time the excitation sequence returns to its initial stage. It can be used to increase the accuracy of home position detection.
Output	Over heat signal (Only for microstep)	O.H.	The motor operating current is cut off when the internal temperature of the driver exceeds 176F (80℃). The motor operating current becomes on when the internal temperature of the driver becomes 176F (80℃) or below.
–	Automatic current cutback	–	This is the function which automatically reduces the motor operating current when the motor is at a standstill. The operating current reduces to standstill current 100msec after the motor stops. The standstill current can be set by STOP potentiometer.

Resolution ~Microstep~

M3	M2	M1	M0	Step angle select signal R1			Step angle select signal R2		
Input	Input	Input	Input	Division 1	Resolution 1	Step Angle 1	Division 2	Resolution 2	Step Angle 2
L	L	L	L	1/1	500	0.72	1/0.4	200	1.8
L	L	L	H	1/2	1,000	0.36	1/0.8	400	0.9 (1.8/2)
L	L	H	L	1/2.5	1,250	0.288	1/1.6	800	0.45 (1.8/4)
L	L	H	H	1/4	2,000	0.18	1/2	1,000	0.36 (1.8/5)
L	H	L	L	1/5	2,500	0.144	1/3.2	1,600	0.225 (1.8/8)
L	H	L	H	1/8	4,000	0.09	1/4	2,000	0.18 (1.8/10)
L	H	H	L	1/10	5,000	0.072	1/6.4	3,200	0.1125 (1.8/16)
L	H	H	H	1/20	10,000	0.036	1/10	5,000	0.072 (1.8/25)
H	L	L	L	1/25	12,500	0.0288	1/12.8	6,400	0.05625 (1.8/32)
H	L	L	H	1/40	20,000	0.018	1/20	10,000	0.036 (1.8/50)
H	L	H	L	1/50	25,000	0.0144	1/25.6	12,800	0.028125 (1.8/64)
H	L	H	H	1/80	40,000	0.009	1/40	20,000	0.018 (1.8/100)
H	H	L	L	1/100	50,000	0.0072	1/50	25,000	0.0144 (1.8/125)
H	H	L	H	1/125	62,500	0.00576	1/51.2	25,600	0.0140625 (1.8/128)
H	H	H	L	1/200	100,000	0.0036	1/100	50,000	0.0072 (1.8/250)
H	H	H	H	1/250	125,000	0.00288	1/102.4	51,200	0.00703125 (1.8/256)

■ Pin assignments

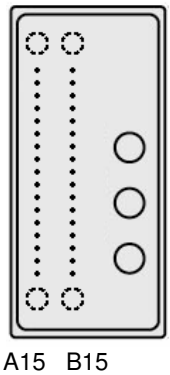
＜Full step＞



Top View

Pin Number		Signal	Name of Signal	Input/Output
A1	B1	BLUE	Blue (Motor Lead)	Output
A2	B2	RED	Red (Motor Lead)	Output
A3	B3	ORANGE	Orange (Motor Lead)	Output
A4	B4	GREEN	Green (Motor Lead)	Output
A5	B5	BLACK	Black (Motor Lead)	Output
A6	B6	POWER	12-24VDC	Input
A7				
	B7	GND	GND	Input
A8	B8			
	B9			
A9		DC5V	5VDC	Input
A10		CW	CW pulse	Input
	B10	CCW	CCW pulse	Input
A11		F/H	Step angle select input	Input
	B11	RST	Reset input	Input
A12		ECO	ECO drive input	Input
	B12	A.W.OFF	All windings off input	Input
A13		TIM.	Excitation timing output	Output
	B13	NC	not used	–
A14	B14			
A15	B15			

＜Microstep＞

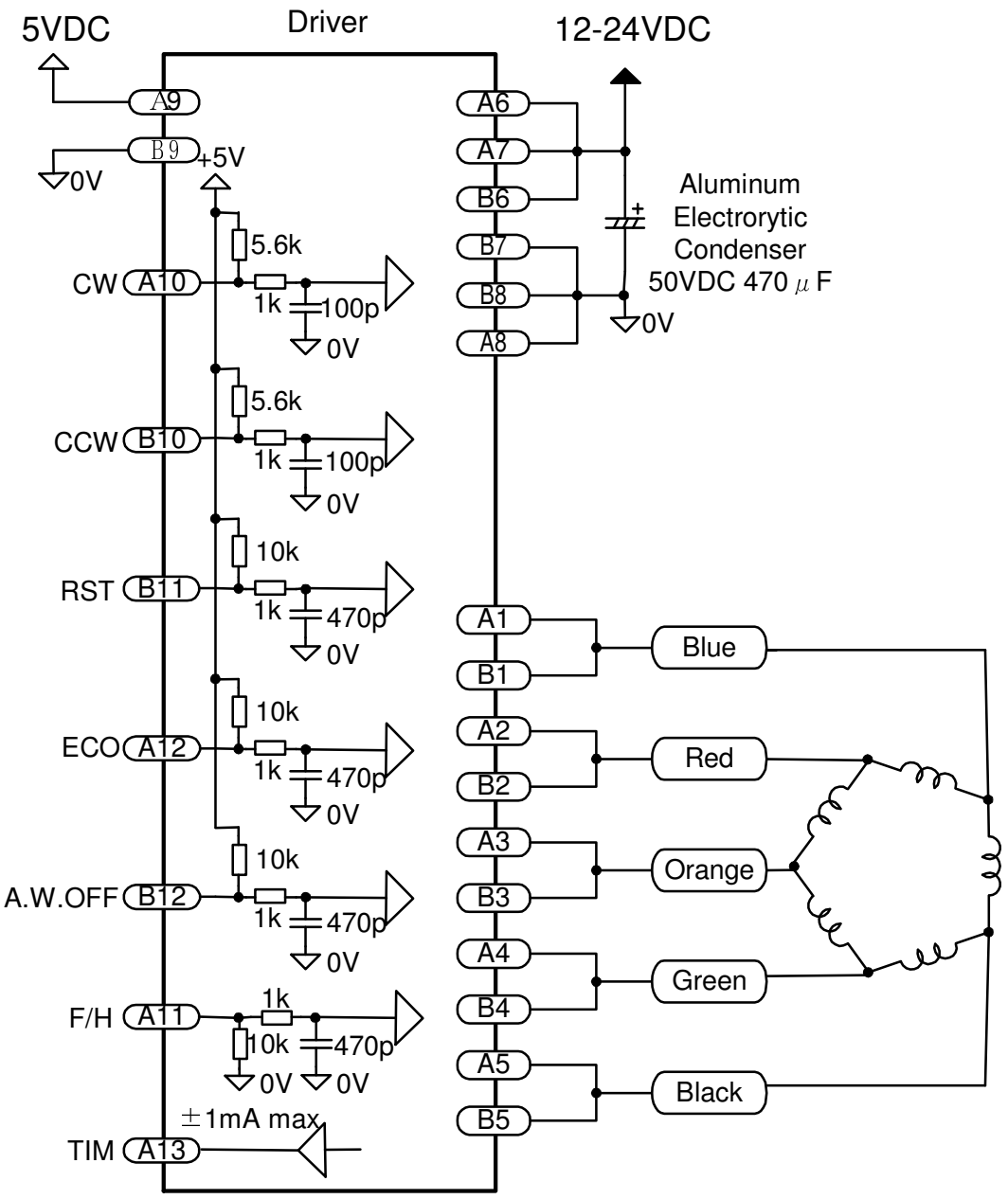


Top View

Pin Number		Signal	Name of Signal	Input/Output
A1	B1	BLUE	Blue (Motor Lead)	Output
A2	B2	RED	Red (Motor Lead)	Output
A3	B3	ORANGE	Orange (Motor Lead)	Output
A4	B4	GREEN	Green (Motor Lead)	Output
A5	B5	BLACK	Black (Motor Lead)	Output
A6	B6	POWER	12-24VDC	Input
A7				
	B7	GND	GND	Input
A8	B8			
	B9			
A9		DC5V	5VDC	Input
A10		CW	CW pulse	Input
	B10	CCW	CCW pulse	Input
A11		R1/R2	Resolution table select input	Input
	B11	RST	Reset input	Input
A12		ECO	ECO drive input	Input
	B12	A.W.OFF	All windings off input	Input
A13		TIM.	Excitation timing output	Output
	B13	M0	Resolution select inputs	Input
A14		M1		Input
	B14	M2		Input
A15		M3		Input
	B15	O.H.	Over heat protection	Output

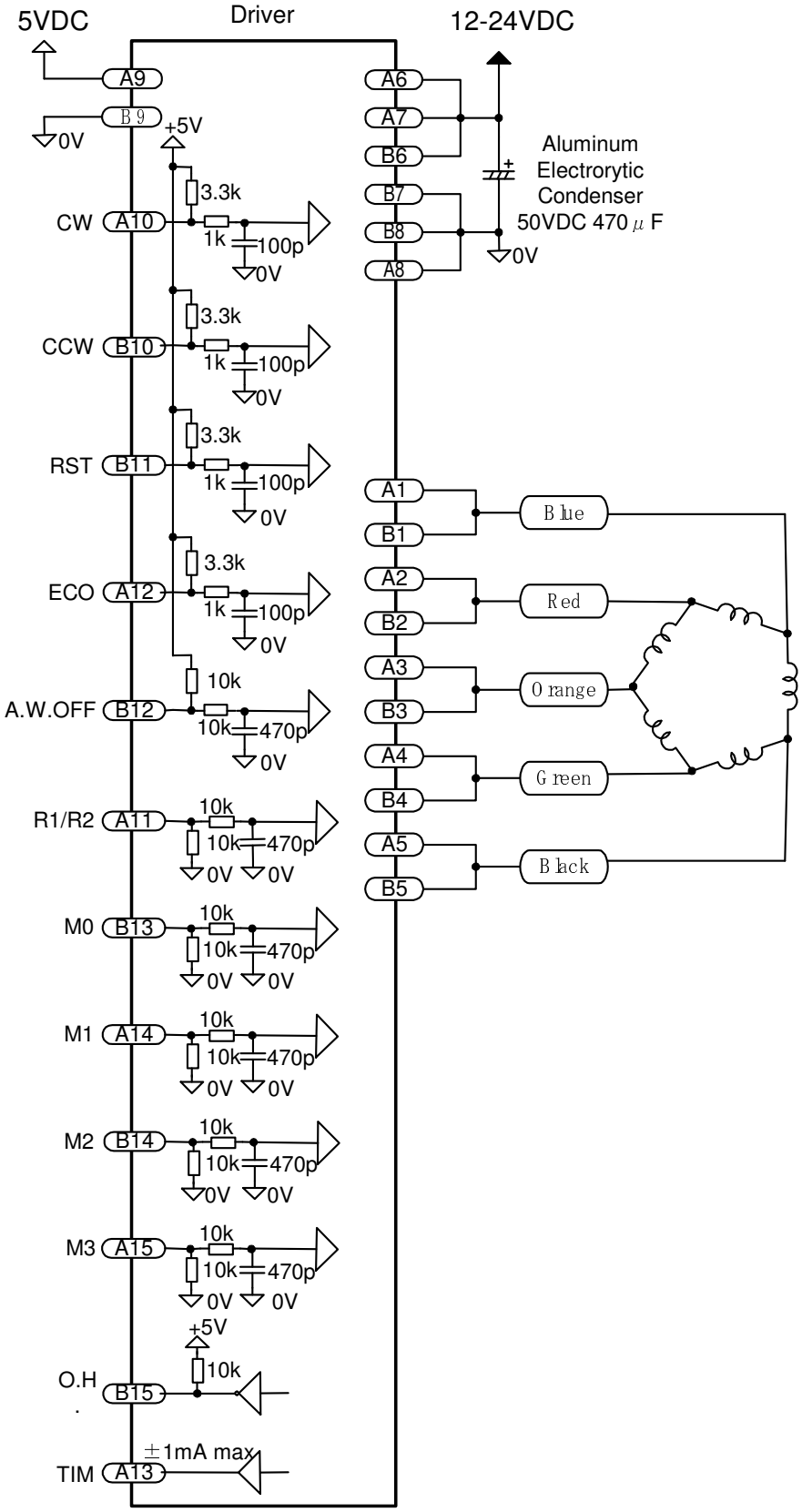
■ Input/Output circuit

＜Full Step＞

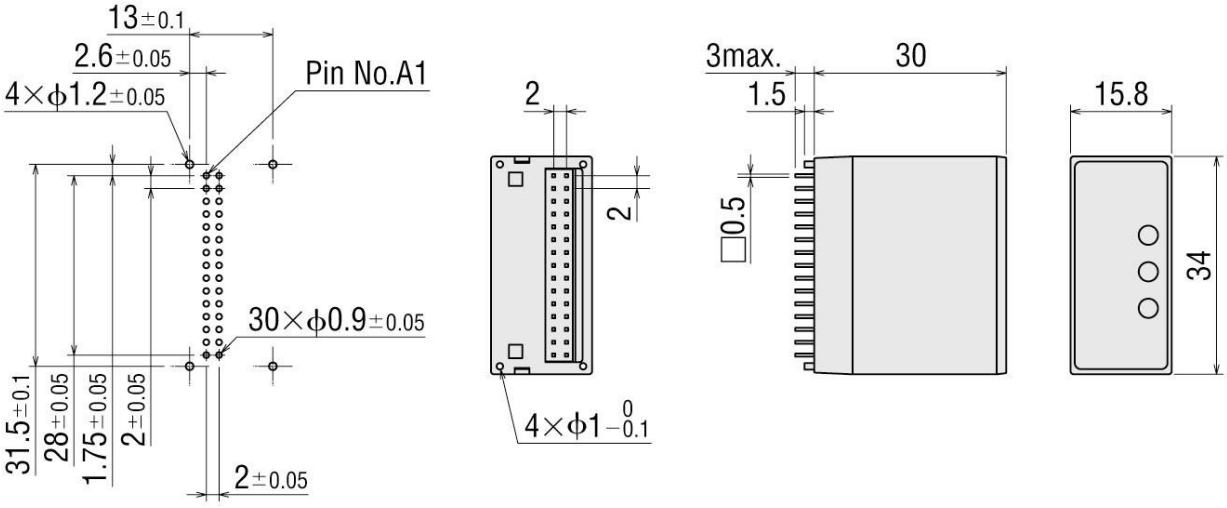


■ Input/Output circuit

＜Microstep＞

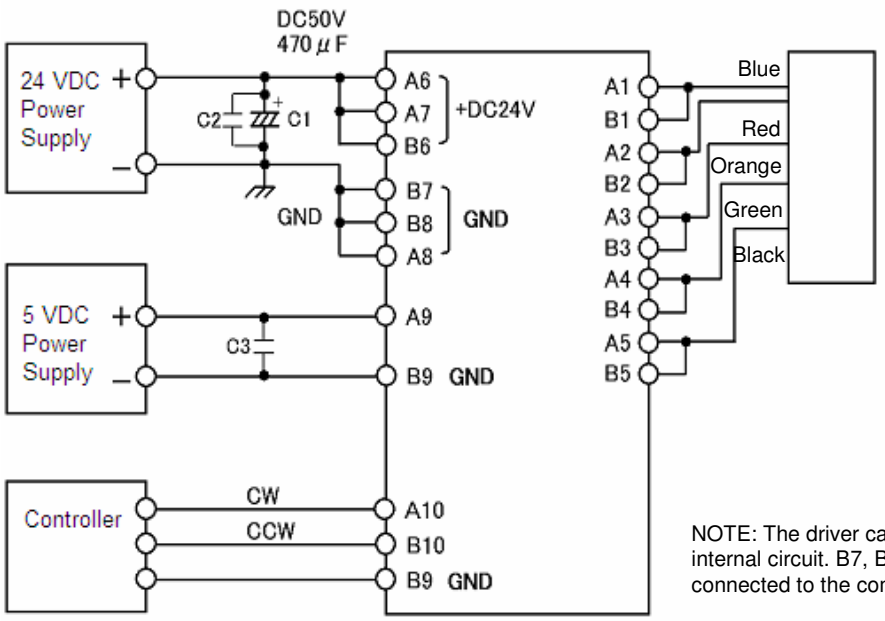


■ Dimensions



Recommended dimensions of the mounting holes
(view from the top surface of the board)
Recommended board thickness t = 1.6

■ Example of applied circuit



NOTE: The driver case is insulated from the internal circuit. B7, B8, B9, and A8 are connected to the common GND.

Component values (For reference)

- C1 : Smoothing electrolytic condenser for the input 50VDC、470 μ F
- C2, C3 : Laminated ceramic condenser for noise protection 1000pF ～ 0.1 μ F
- When a cable is used for power source or pulse input, please prepare shielded cable or ferrite core.

■ Example of printed circuit board ＜Basic pattern＞

The pattern shown below is an example of designing the circuit on single sided board

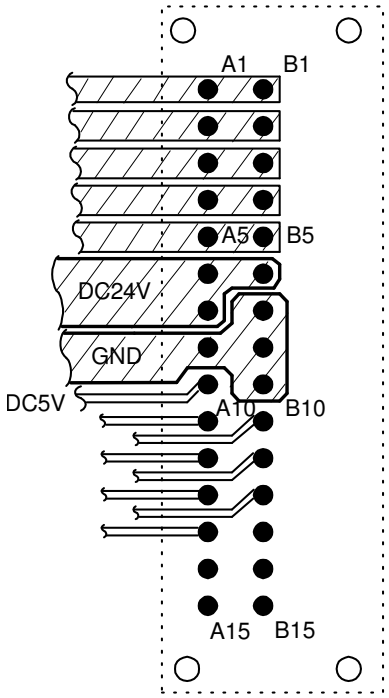
Thickness of copper foil	35um
Recommended conductor width	
Motor current output	1.5mm Minimum
24VDC input	2.0mm Minimum
5VDC input	0.5mm Minimum
Input/Output signals	0.2mm Minimum

NOTE: Conductor width varies depending on the circuit board material, the number of layers, and the thickness of copper foil. Please design the conductor width considering the condition of the circuit where the driver to be placed.

・The circuit with large current such as motor line, power input, and GND line, should be short and thick to reduce the impedance.

・Smoothing electrolytic condenser for the power input and the noise protection parts should be placed near the driver.

・Pulse input circuit should be as short as possible, and far from the power source pattern in order to reduce the influence of noise.



●: Pin holes for driver mounting
○: Holes for positioning the driver

■ Soldering specifications

Soldering time should be as short as possible along with the conditions below.

・Dip soldering should be done no more than twice with the conditions of
Temperature: 260℃ maximum, Time length: 10sec maximum

・Soldering iron should be used no more than twice with the conditions of
Temperature: 350℃ maximum, Time length: 3sec maximum

NOTE: Soldering in reflow furnace may break the driver.

■ About washing

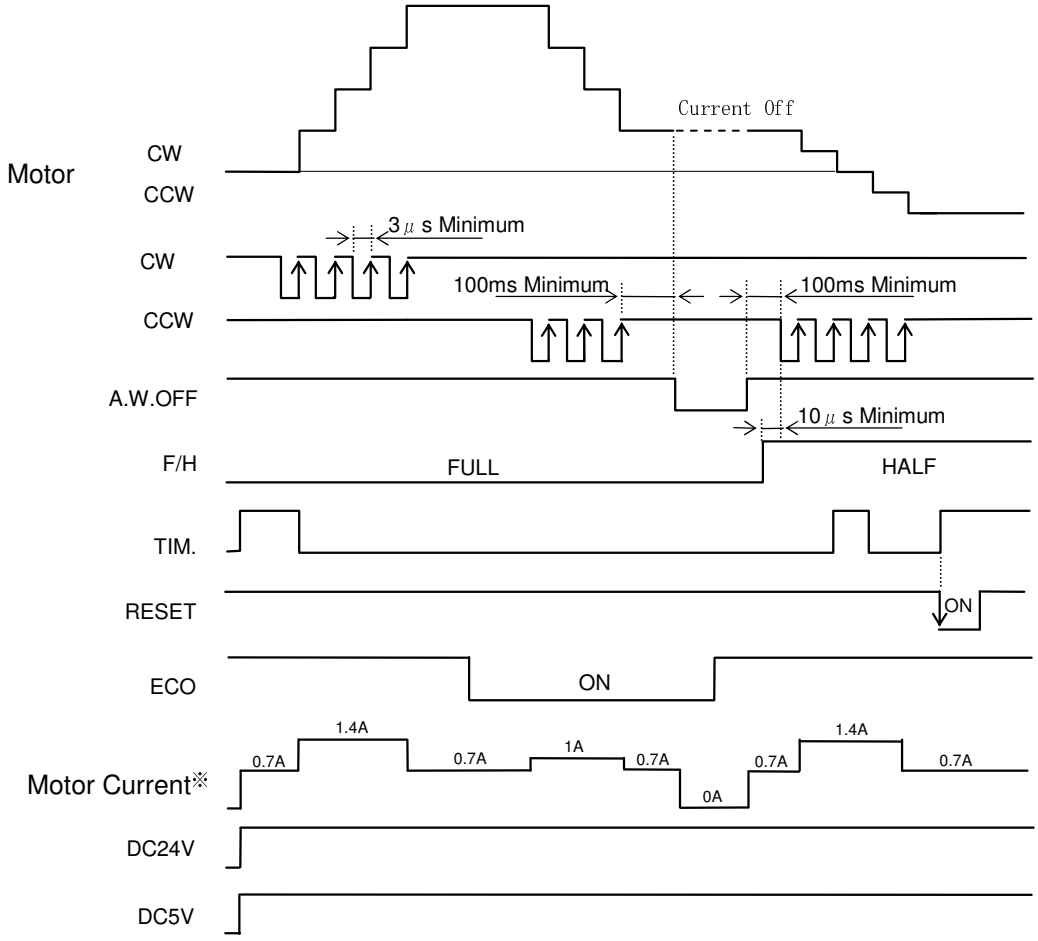
This product is not designed for being washed.

■ Timing Chart

＜Full step＞

Example of DS514-2

Current Settings	RUN current	1.4A/Phase
	ECO current	1.0A/Phase
	STOP current	Current cutback to 50%



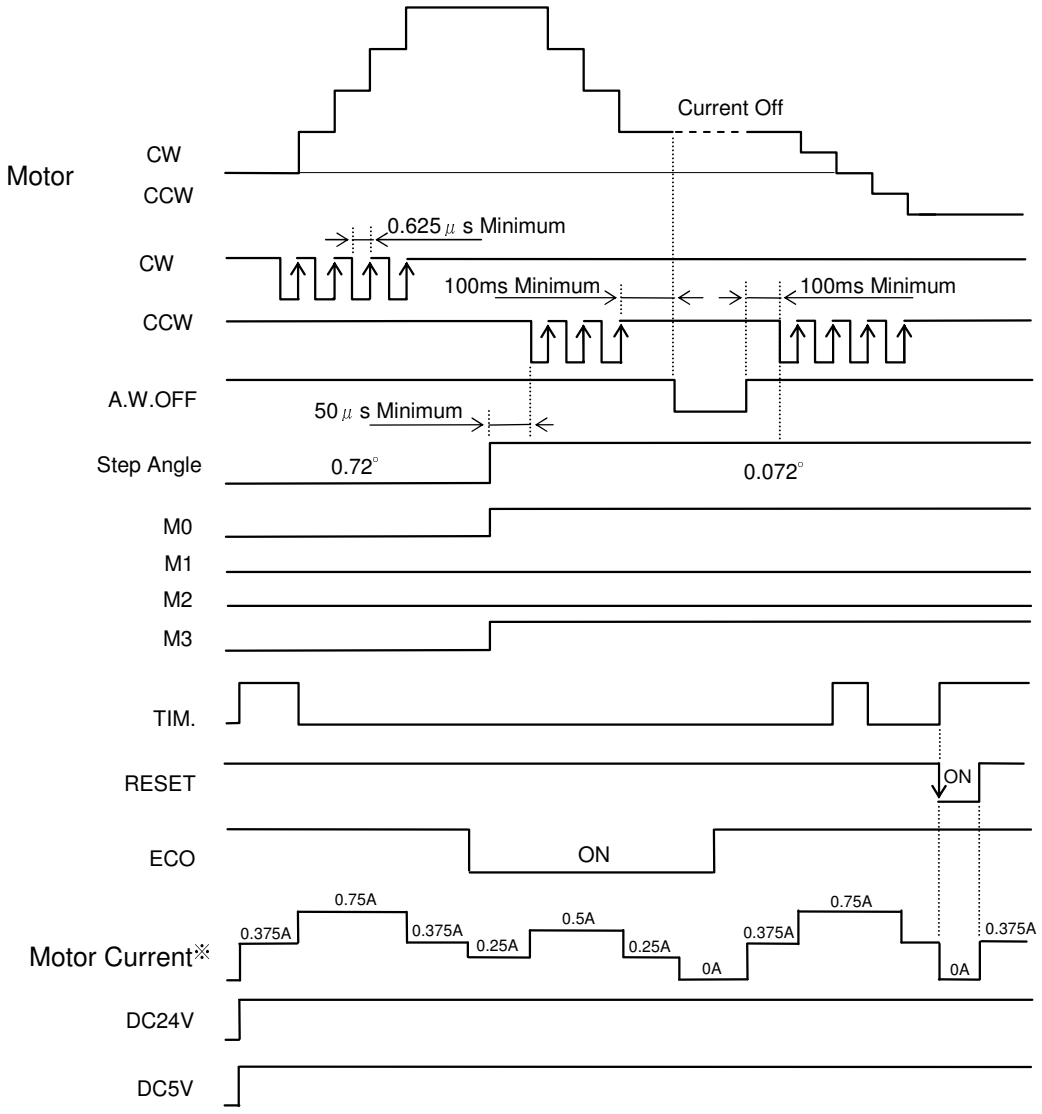
※Please consider the delay of approximately 100msec for the motor current to change.

■ Timing Chart

＜Microstep＞

Example of DS507F-2

Current settings　　RUN current　0.75A/Phase
ECO current　0.5A/Phase
STOP current　Current cutback to 50%



※Please consider the delay of approximately 100msec for the motor current to change.

■ Adjusting the motor current

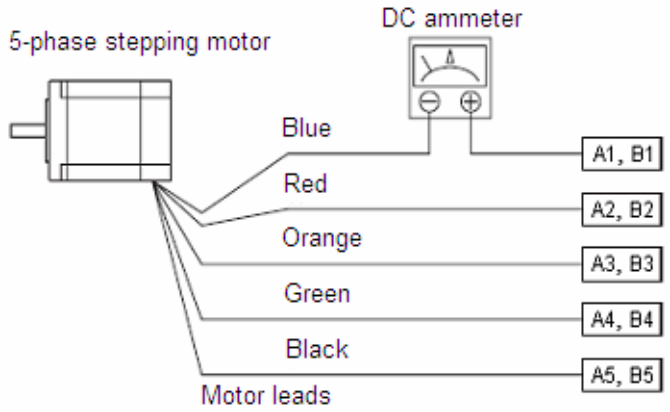
When there is sufficient torque, adjusting the motor current is very effective on suppressing the motor vibration or the temperature rise in the motor/driver.

Suppress the vibration	→	Reduce the operating current and standstill current.
Suppress the temperature rise	→	Reduce the operating current.

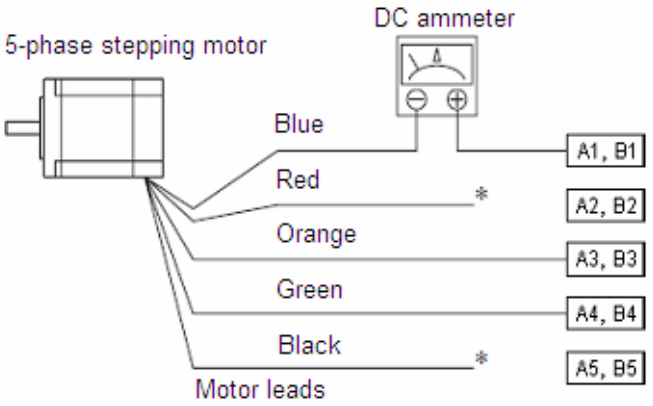
Connection of DC ammeter

DC ammeter is needed to adjust the motor current.

＜Full Step＞



＜Microstep＞



Note If the red or black motor lead (indicated by ∗) contacts the other lead, equipment, etc., damage may result. Provide an insulation measure to protect against electric shock.

Connect the DC ammeter in between the blue motor lead wire and A1, A2 pins of the driver.

NOTE: Current corresponding to a dual-phase value flows to the ammeter. A value of one-half that which is indicated equals the single-phase current value. For example, when the indication value on the ammeter shows 1.5A, it stands for the setting of 0.75A/phase.

■ Procedure of adjusting the motor current

◆Adjusting the RUN current

The RUN current is set to the rated current as a factory default, and it is adjusted by the RUN potentiometer..

＜Setting procedure＞

①After connecting the motor and the DC ammeter, turn on the power sources of 24VDC and 5VDC.

②Set the voltage level of CW pulse input to low. Do not input other signals.

③Adjust the RUN current with RUN potentiometer.

- The RUN current becomes low by twisting the potentiometer in counter clockwise.
- To avoid breaking the driver, please be careful for the RUN current not to exceed the rated value.

◆Adjusting the ECO current

The ECO current is set to the half of the rated RUN current as a factory default, and it is adjusted by the ECO potentiometer.

＜Setting procedure＞

①After connecting the motor and the DC ammeter, turn on the power sources of 24VDC and 5VDC.

②Set the voltage level of CW pulse input and ECO input to low. Do not input other signals.

③Adjust the ECO current with ECO potentiometer.

- The current becomes low by twisting the potentiometer in counter clockwise.
- To avoid breaking the driver, please be careful for the ECO current not to exceed the rated value.

◆Adjusting the STOP current

The STOP current (standstill current) is set to 50% of the motor rated current as a factory default, it is adjusted by the STOP potentiometer.

＜Setting procedure＞

①After connecting the motor and the DC ammeter, turn on the power sources of 24VDC and 5VDC.

②Set the voltage level of CW pulse input to high. Do not input other signals.

③Adjust the STOP current with STOP potentiometer.

NOTE Full step： The STOP potentiometer sets the ratio of standstill current to the RUN current. Even in ECO driver mode, the standstill current becomes the discounted value to the motor run current.

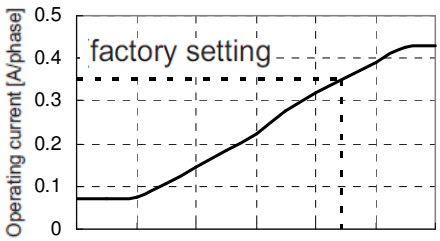
Microstep: The STOP potentiometer sets the ratio of standstill current to the motor operating current. In ECO drive mode, the standstill current becomes the discounted value to the ECO current.

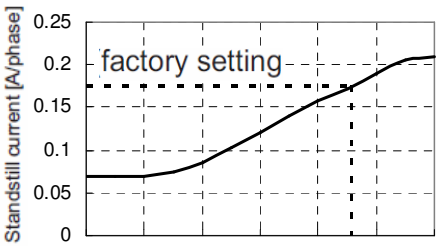
NOTE: Please refer to the timing charts for the details.

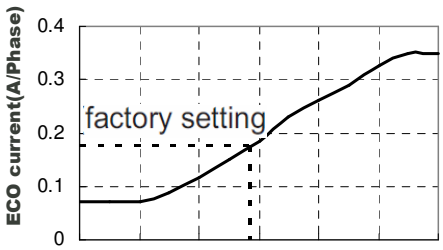
■ Ranges of current setting

＜Full step＞

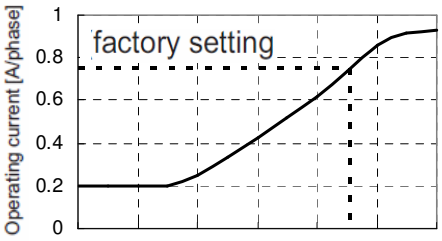
DS503-2

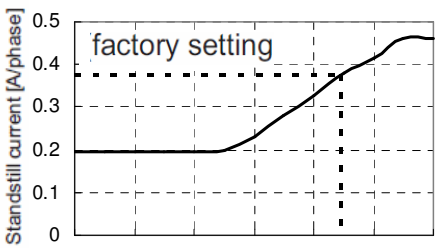


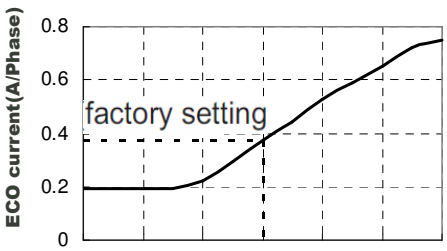




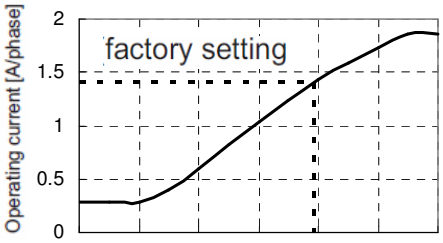
DS507-2

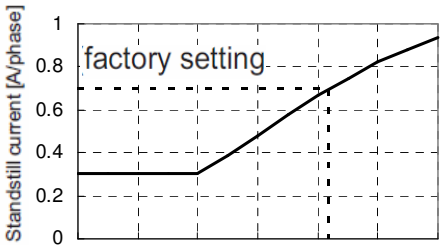


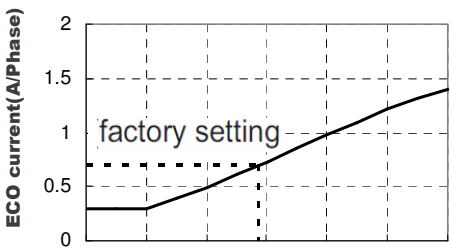




DS514-2



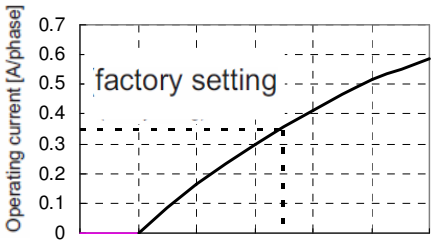


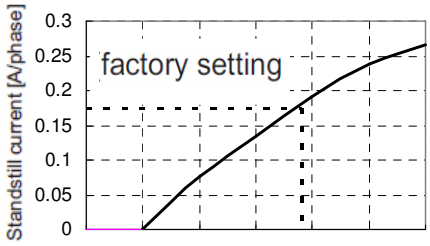


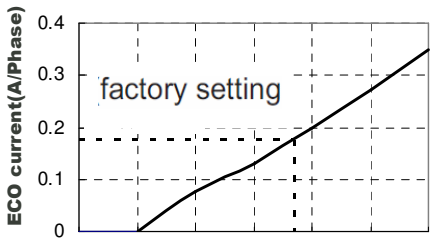
■ Ranges of current setting

＜Microstep＞

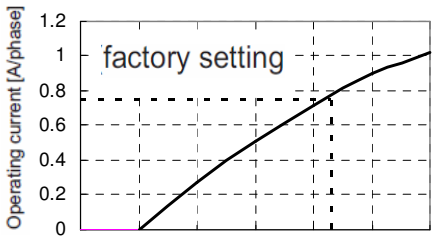
DS503F-2

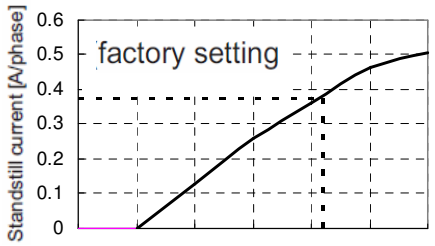


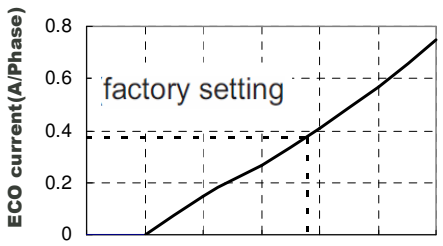




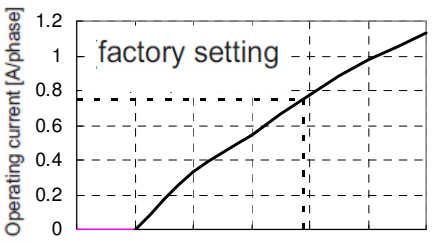
DS507F-2

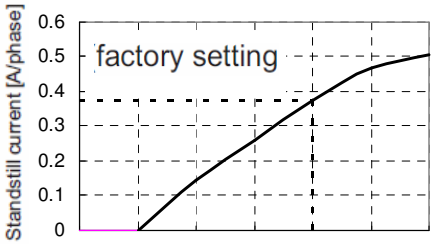


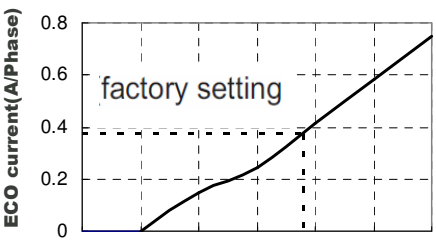




DS507HF-2

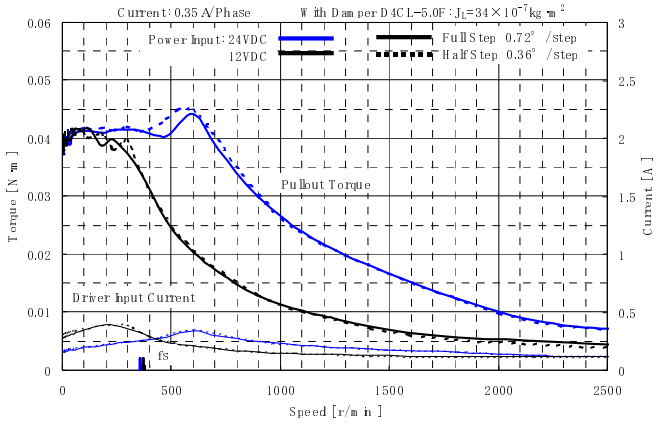






■ Speed-Torque Characteristics ＜Full Step＞

PK523PMB



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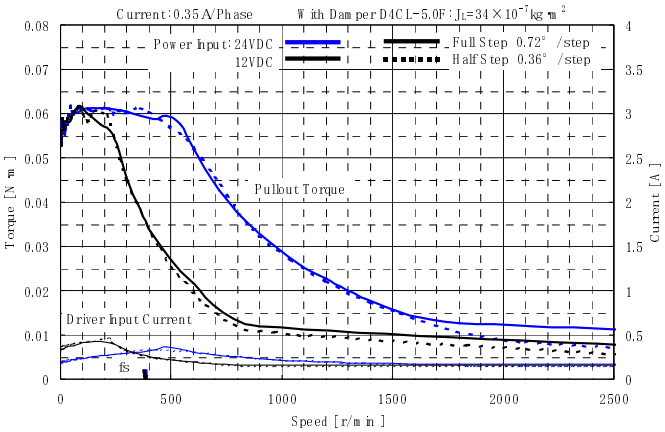

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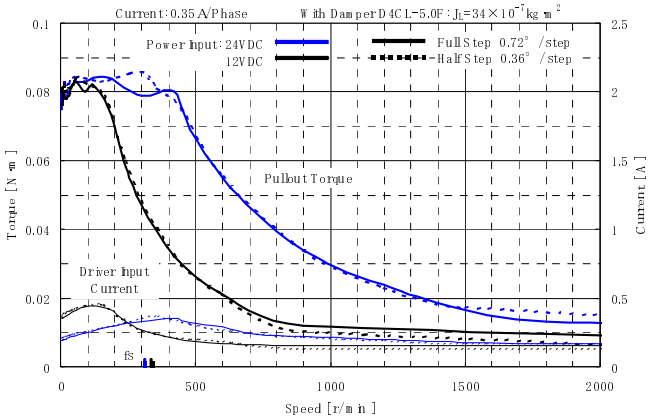

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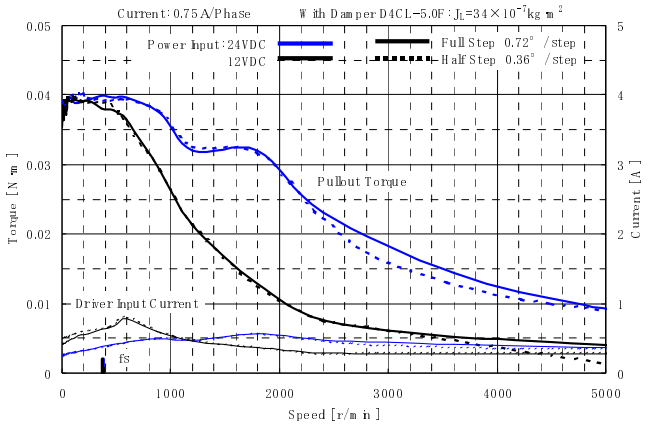

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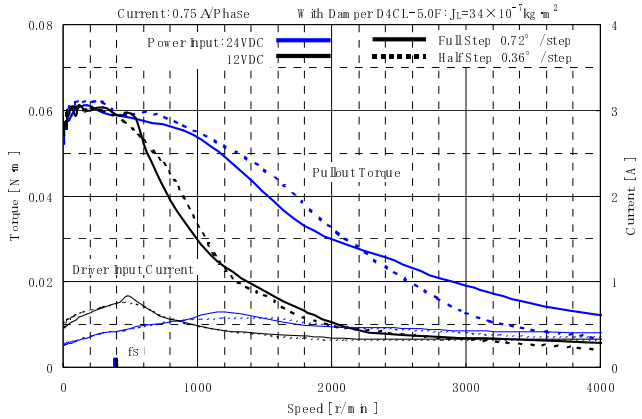

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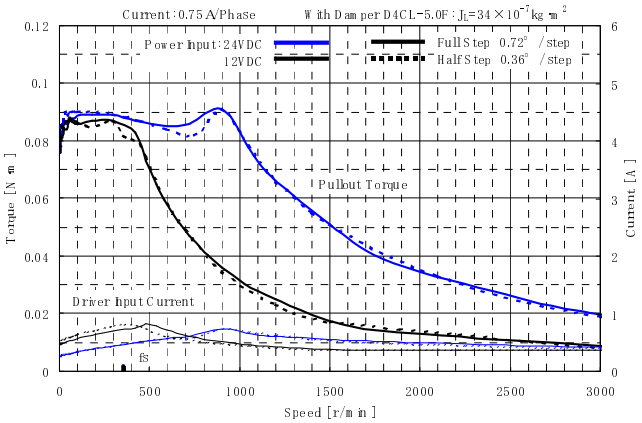

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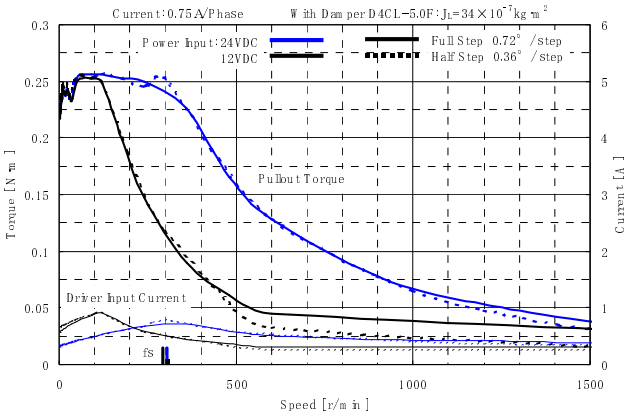

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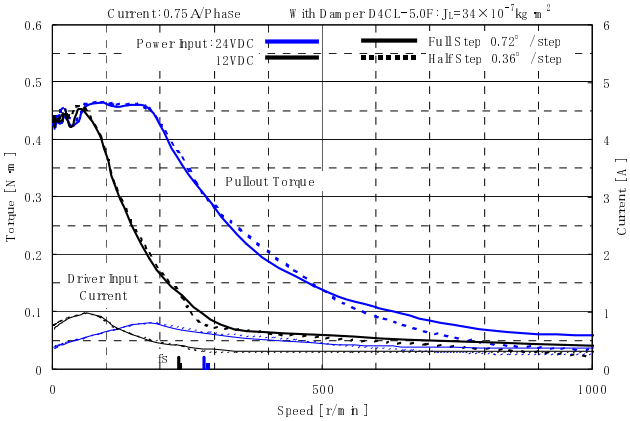

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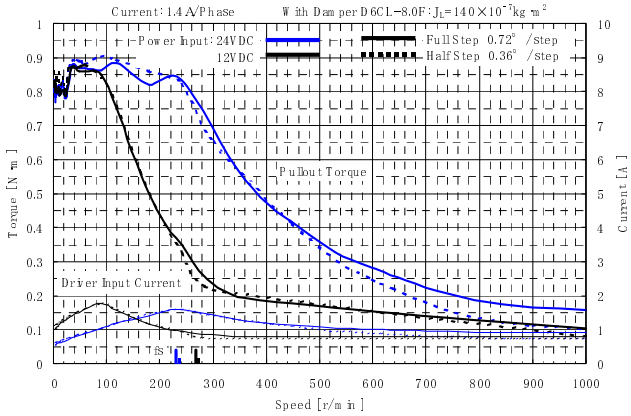

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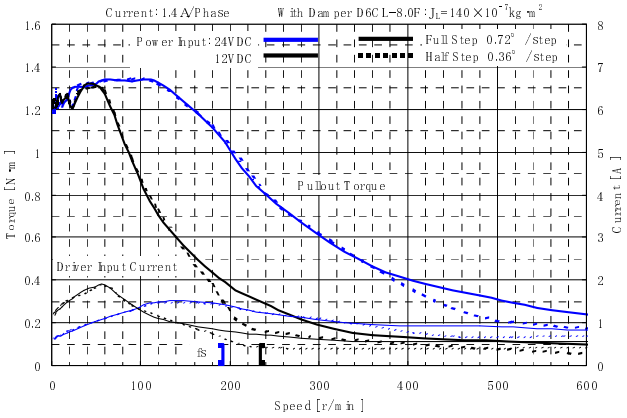

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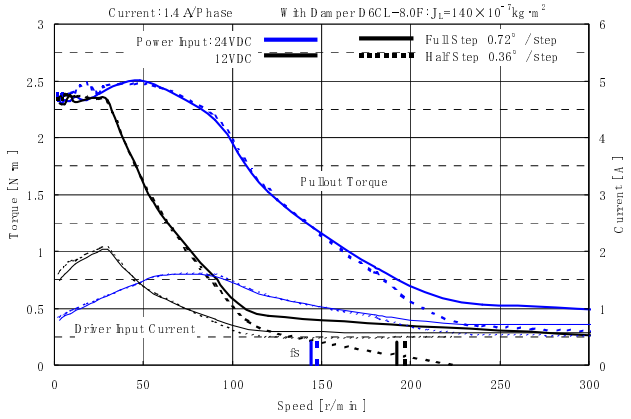

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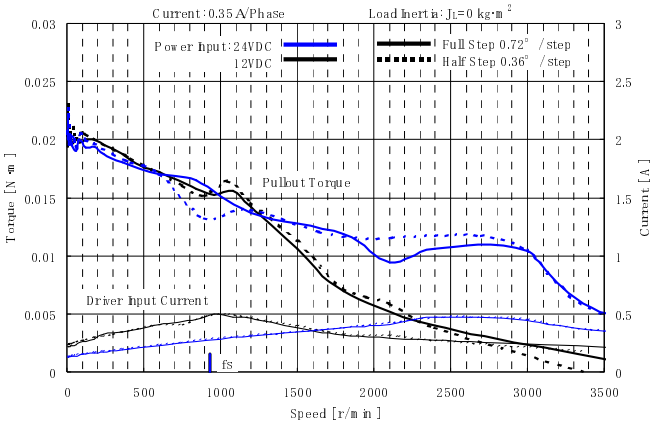

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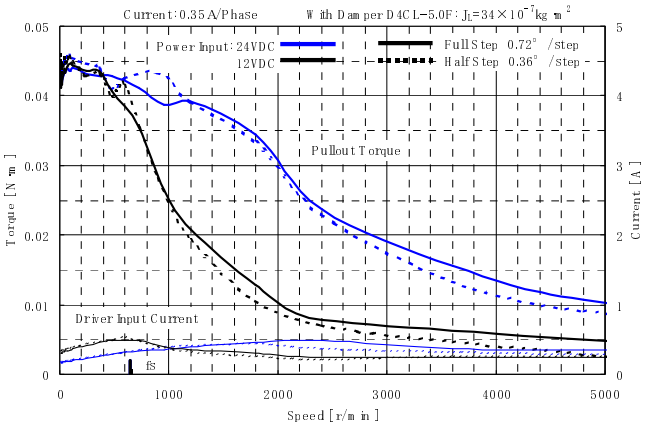

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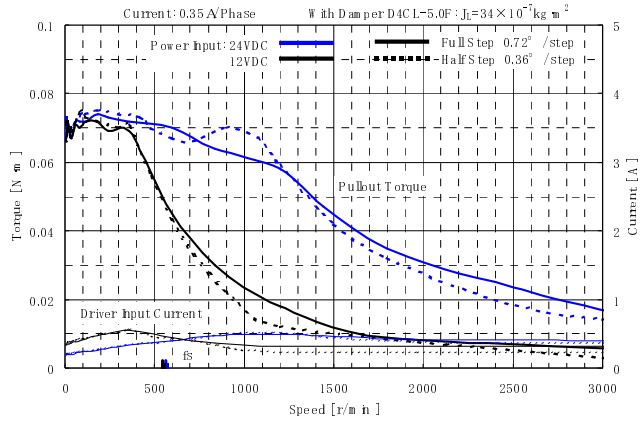

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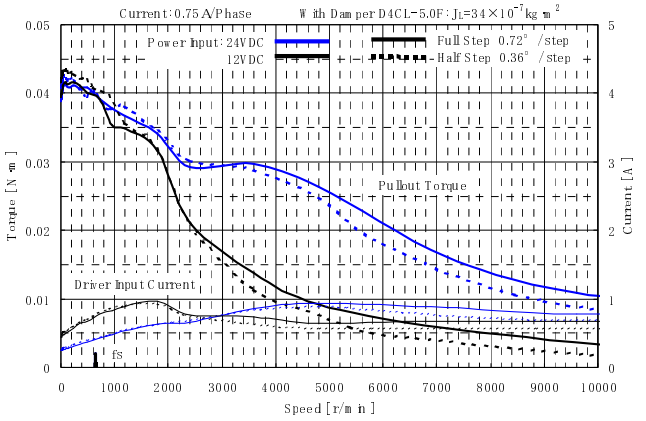

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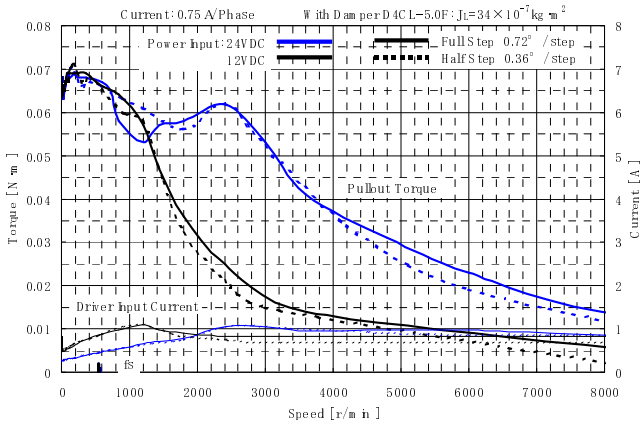

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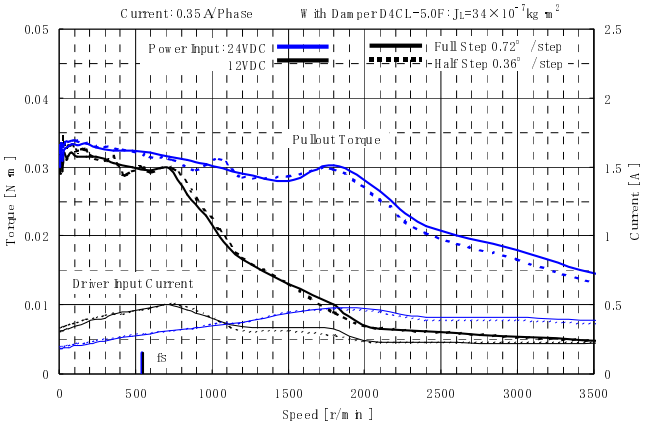

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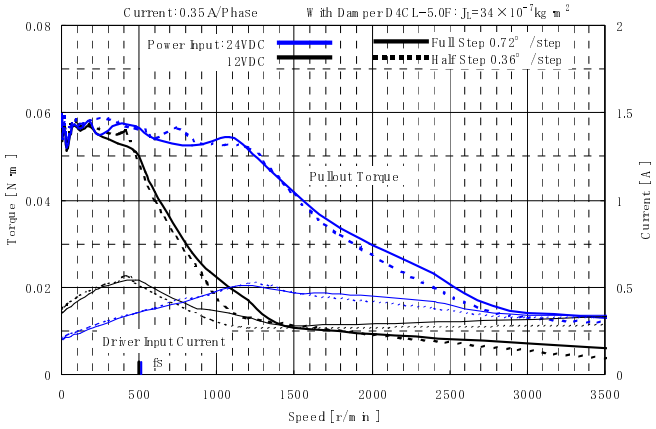

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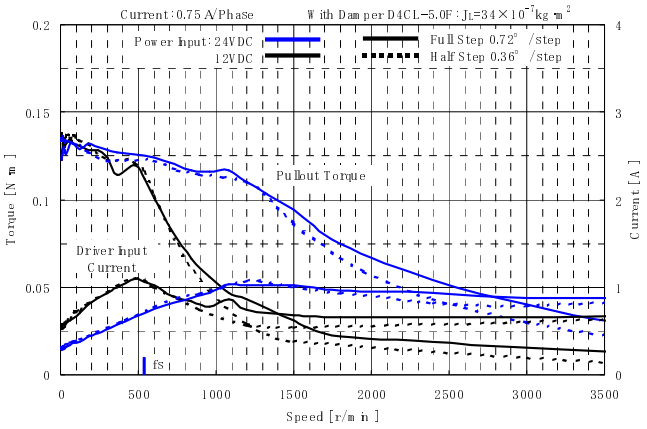

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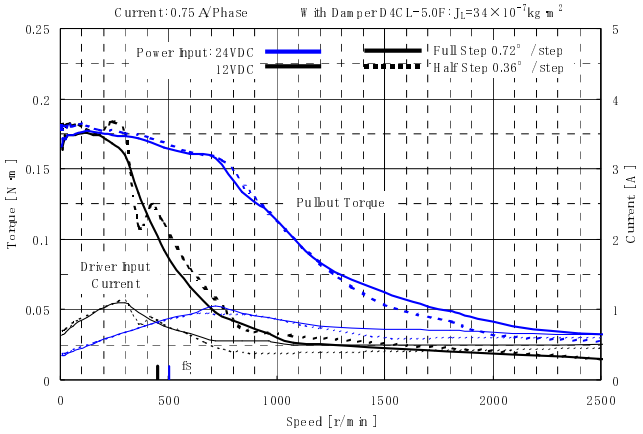

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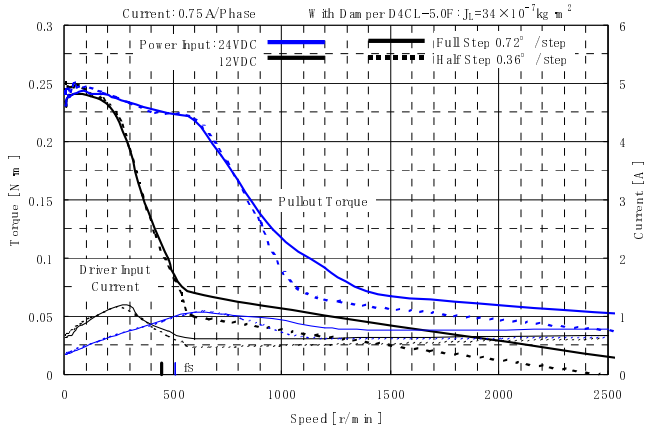

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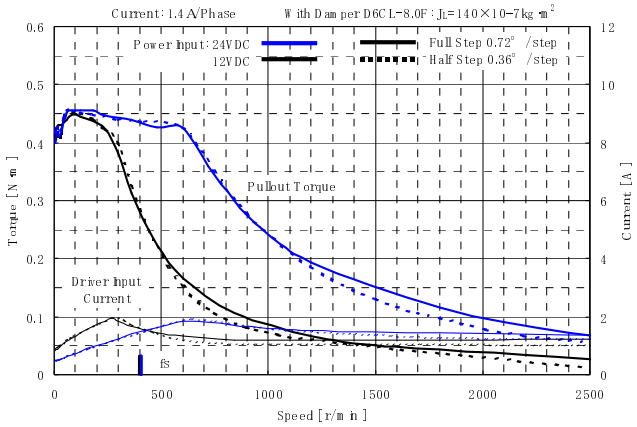

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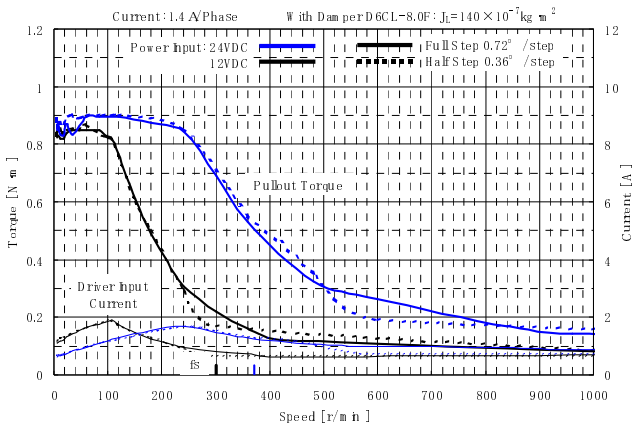

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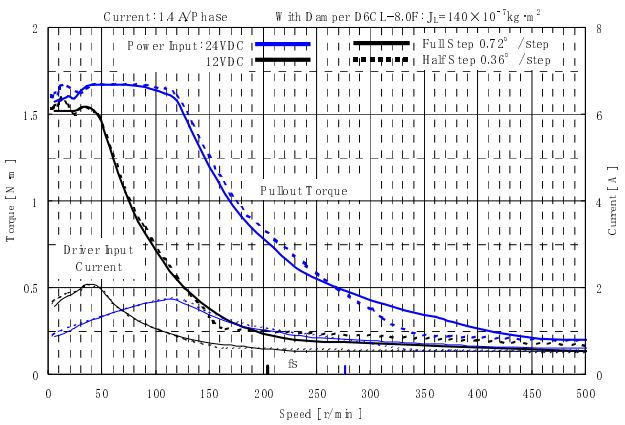

■ Speed-Torque Characteristics ＜Micro Step＞

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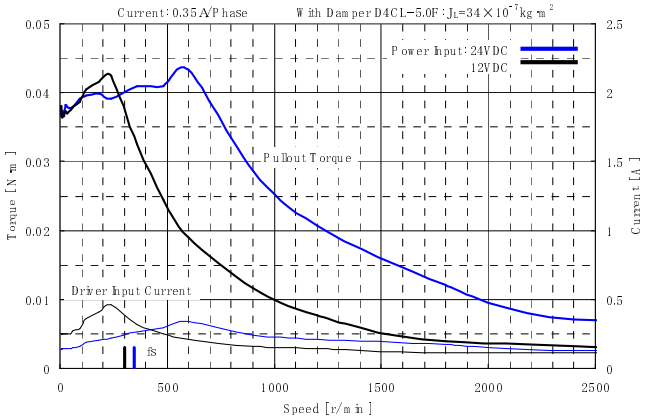

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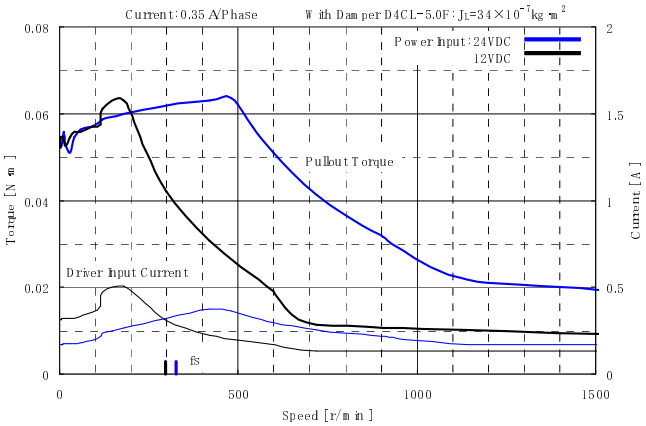

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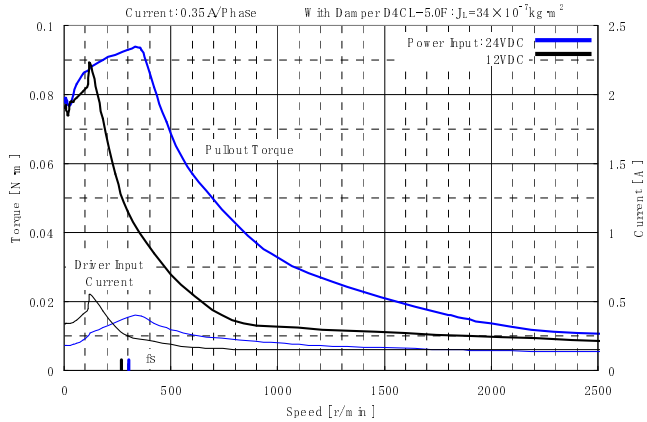

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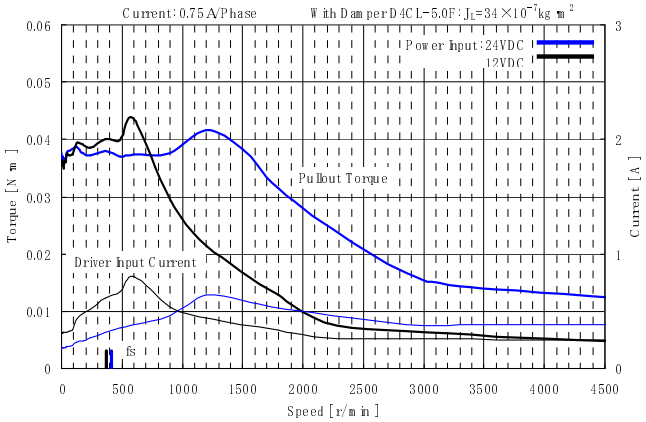

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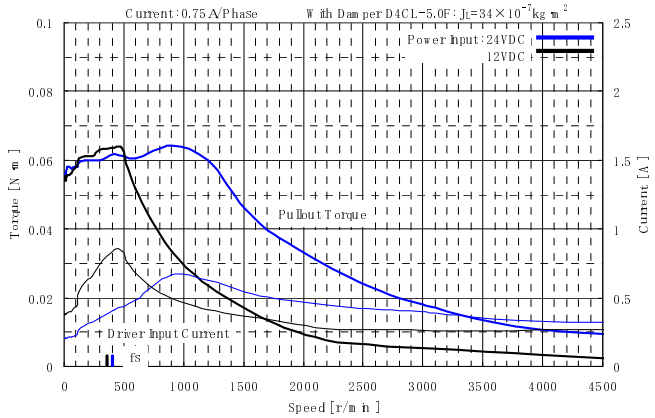

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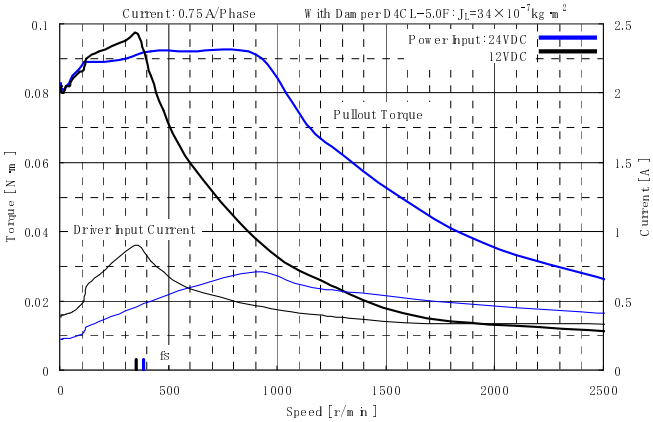

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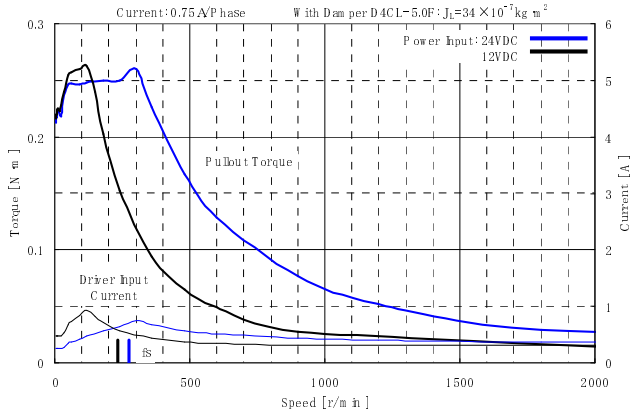

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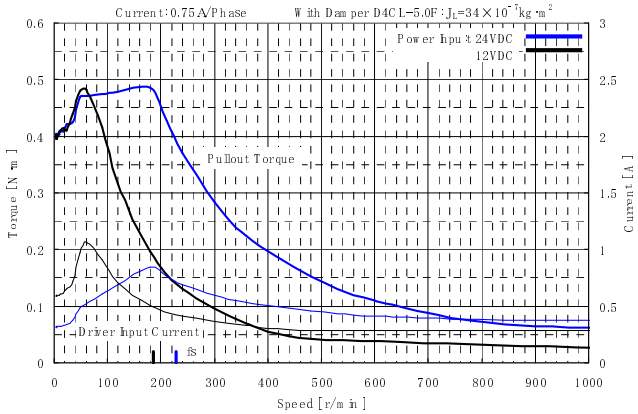

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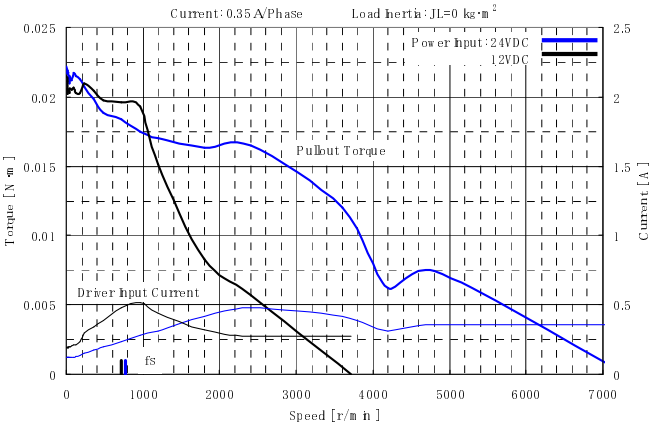

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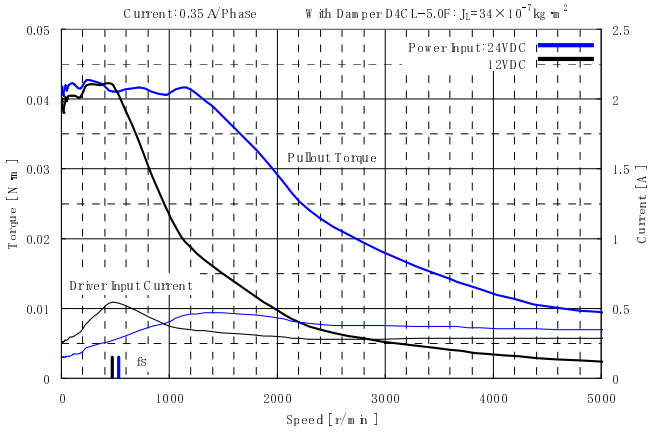

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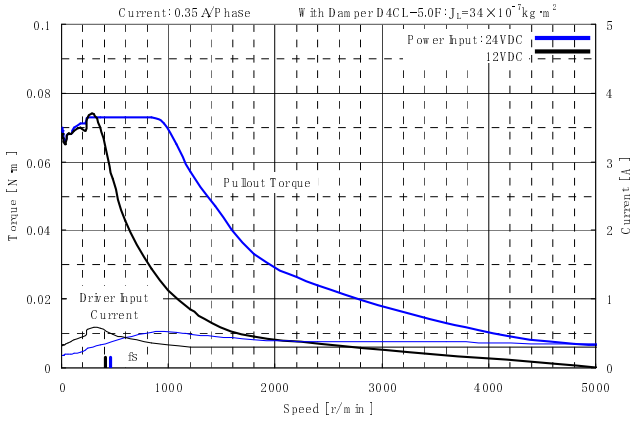

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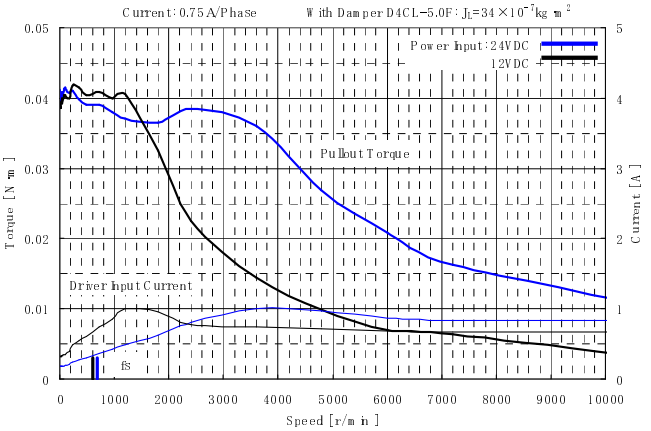

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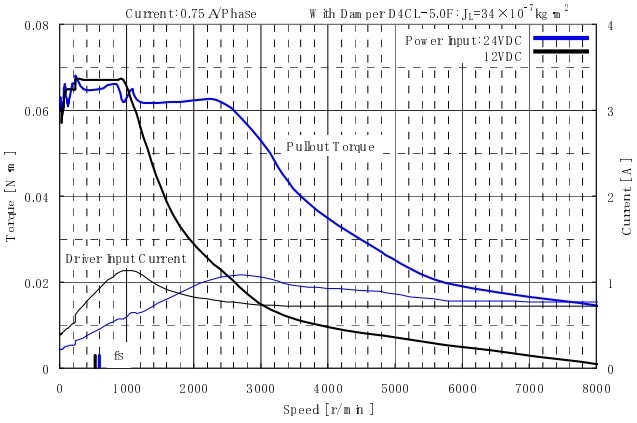

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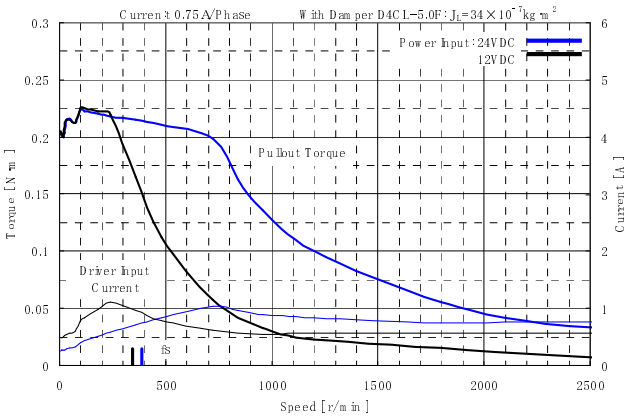

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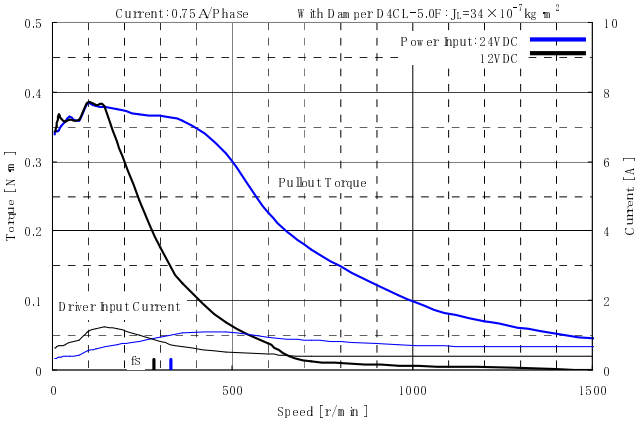

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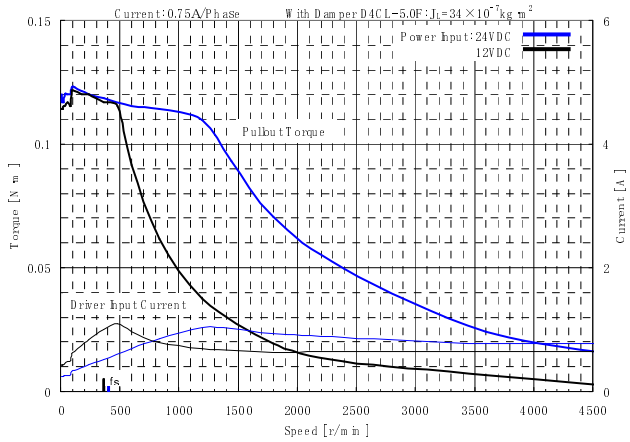

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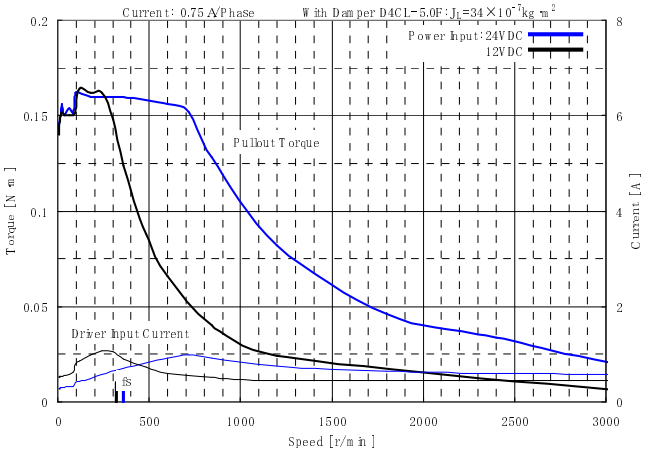

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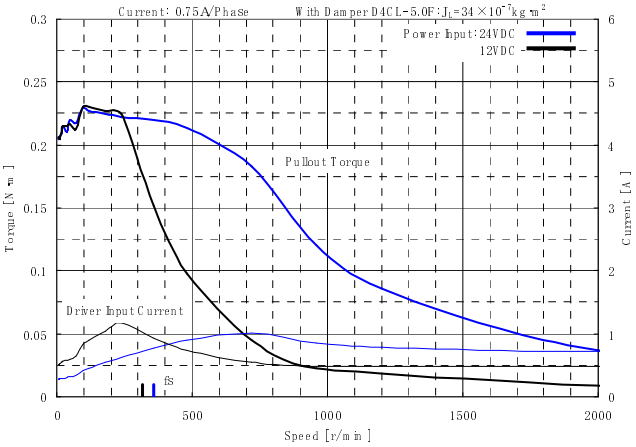


■ Safety precautions

The precautions described below are intended to prevent danger or injury to the user and other personnel through safe, correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

△Warning

Handling the product without observing the instructions that accompany a “Warning” symbol may result in serious injury or death.

General

- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, locations subjected to splashing water, or near combustibles. Doing so may result in fire or injury.
- Assign qualified personnel the task of installing, wiring, operating/controlling, inspecting and troubleshooting the product. Failure to do so may result in fire or injury.
- If this product is used in an elevator application, be sure to provide a measure for the position retention of moving parts. The motor loses its holding torque when the power supply is turned off. Failure to provide such a measure may cause the moving parts to fall, resulting in injury or damage to the equipment.
- Handle the product after turning off the power supply. Residual voltage may cause the electric shock.

Installation

- Install the motor and driver in their enclosures in order to prevent injury.

Connection

- Keep the driver’s power supply input voltage within the specified range to avoid fire.
- Connect the cables securely according to the wiring diagram in order to prevent fire.
- 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 result in electric shock.
- Do not forcibly bend, pull or pinch the power supply cable or motor cable. Doing so may result in fire.

Operation

- Turn off the driver power supply in the event of a power failure, or the motor may suddenly start when the power is restored and may cause injury or damage to equipment.
- Do not turn the A.W.OFF input to ON while the motor is operating. The motor will stop and lose its holding ability, which may result in injury or damage to the equipment.

Repair, disassembly and modification

- Do not disassemble or modify the motor or driver. This may cause injury. Refer all such internal inspections and repairs to the branch or sales office from which you purchased the product.

△Caution

Handling the product without observing the instructions that accompany a “Caution” symbol may result in injury or property damage.

General

- Do not use the motor and driver beyond their specifications, or injury or damage to equipment may result.
- Keep your fingers and objects out of the openings in the motor and driver, or fire or injury.
- Do not touch the motor or driver during operation or immediately after stopping. The surfaces are hot and may cause a skin burn(s).
- Eliminate static electricity before touching the product. Static electricity may damage the driver and equipment.
- If the power supply cable or motor cable connected the driver are forcibly bent or pulled, the driver will receive stress and may suffer damage.

Transportation

- Do not hold the motor output shaft or motor cable. This may cause injury.

Installation

- Keep the area around the motor and driver free of combustible materials in order to prevent fire or a skin burn(s).
- To prevent the risk of damage to equipment, leave nothing around the motor and driver that would obstruct ventilation.
- Provide a cover over the rotating parts (output shaft) of the motor to prevent injury.

Operation

- Use a motor and driver only in the specified combination. An incorrect combination may cause a fire.
- Provide an emergency stop device or emergency stop circuit external to the equipment so that the entire equipment will operate safely in the event of a system failure or malfunction. Failure to do so may result in injury.
- Before supplying power to the driver, turn all input signals to the driver to OFF. Otherwise, the motor may start suddenly and cause injury or damage to equipment.
- Do not touch the rotating parts (output shaft) of the motor to prevent the injury.
- Before moving the motor directly with the hands (as in the case of manual positioning), confirm that the driver A.W.OFF input is ON to prevent injury.
- Immediately when trouble has occurred, stop running and turn off the driver power supply. Failure to do so may result in fire or injury.

Disposal

- To dispose of the motor and driver, disassemble it into parts and components as much as possible and dispose of individual parts/components as industrial waste.

＜Driver components＞

- Aluminum case
- Resin cover Material：PBT
- Various electronic parts

■ Precautions for use

●Conduct the insulation resistance measurement or withstand voltage test separately on the motor and the driver.

Conducting the insulation resistance measurement or withstand voltage test with the motor and driver connected may result in injury or damage to equipment.

●Do not apply an overhung load and thrust load in excess of the specified permissible limit.

Be sure to operate the motor within the specified permissible limit of overhung load and thrust load. Operating it under an excessive overhung load and thrust load may damage the motor bearings (ball bearings).

Motor model		Permissible overhung load [N (lb.)] Distance from the tip motor's output shaft [mm (in.)]					Permissible thrust load [N (lb.)]
Single shaft	Double shaft	0 (0)	5 (0.20)	10 (0.39)	15 (0.59)	20 (0.79)	
PK513PA	PK513PB	12 (2.7)	15 (3.3)	–	–	–	0.05 (0.11)*
PK523PA	PK523PB	25 (5.6)	34 (7.6)	52 (11.7)	–	–	0.11 (0.24)*
PK525PA	PK525PB						0.2 (0.44)*
PK523HPA	PK523HPB						0.11 (0.24)*
PK525HPA	PK525HPB						0.2 (0.44)*
PK523PMA	PK523PMB						0.11 (0.24)*
PK524PMA	PK524PMB						0.15 (0.33)*
PK525PMA	PK525PMB						0.2 (0.44)*
PK523HPMA	PK523HPMB						0.11 (0.24)*
PK524HPMA	PK524HPMB						0.15 (0.33)*
PK525HPMA	PK525HPMB						0.2 (0.44)*
PK544PA	PK544PB	20 (4.5)	25 (5.6)	34 (7.6)	52 (11.7)	–	0.3 (0.66)*
PK546PA	PK546PB						0.5 (1.1)*
PK544PMA	PK544PMB						0.3 (0.66)*
PK546PMA	PK546PMB						0.5 (1.1)*
PK543NAW	PK543NBW						0.21 (0.46)*
PK544NAW	PK544NBW						0.27 (0.59)*
PK545NAW	PK545NBW						0.35 (0.77)*
PK564PMA	PK564PMB	90 (20)	100 (22)	130 (29)	180 (40)	270 (60)	0.65 (1.43)*
PK566PMA	PK566PMB						0.87 (1.91)*
PK569PMA	PK569PMB						1.5 (3.3)*
PK564NAW	PK564NBW	63 (14.1)	75 (16.8)	95 (21)	130 (29)	190 (42)	0.6 (1.32)*
PK566NAW	PK566NBW						0.8 (1.76)*
PK569NAW	PK569NBW						1.3 (2.9)*

- The figures indicated by * are the motor's mass [kg (lb.)]. The thrust load should not exceed the motor's mass.

●Operate the motor with a surface temperature not exceeding 100 ℃ (212° F)

The motor casing's surface temperature may exceed 100 ℃ (212° F) under certain conditions (ambient temperature, operating speed, duty cycle, etc.). Keeping the surface temperature of the motor casing below 100 ℃ (212° F) will also maximize the life of the motor bearings (ball bearings).

When a harmonic geared type is used, make sure the gear case temperature is kept at 70 ℃ (158° F) or below to prevent degradation of grease applied to the gear.

●Maximum static torque at excitation

Maximum static torque at excitation represents a value obtained when the motor is excited using the rated current. When the motor is combined with a dedicated driver, the maximum static torque at excitation drops to approximately 50% due to the current cutback function that suppresses the rise in motor temperature in a standstill state. Acceleration and operation at the maximum static torque at excitation is possible in start-up, but it only has approximately 50% holding power after it has stopped. When selecting a motor for your application, consider the fact that the holding power will be reduced to approximately 50% after the motor has topped.

●Geared type motors

・Backlash

The TH gear output shaft is subject to backlash of 10 to 60 minutes. As for the PL gear output shaft is subject to backlash of 15 to 35 minutes. As for the PN gear output shaft is subject to backlash of 2 to 3 minutes. Backlash refers to the looseness at the gear output shaft, as generated when the input side of the gear is fixed. To reduce the effect of backlash, positioning should be from one direction only either from the CW direction or the CCW direction.

・Maximum torque

Always operate geared types with loads not exceeding their maximum torque. If a geared type is operated with a load exceeding the maximum torque, the gear will be damaged.

・Rotating direction of the gear output shaft

The relationship between the rotating direction of the motor shaft and that of the gear output shaft changes as follows, depending on the gear type and gear ratio.

<table>
<tr><th rowspan="3">Gear type</th><th rowspan="3">Gear ratio</th><th colspan="4">Rotating direction
(Relative to the motor rotation direction)</th></tr>
<tr><th colspan="4">Motor size [mm (in.)]</th></tr>
<tr><th>20 (0.79)</th><th>28 (1.10)
30 (1.18)</th><th>42 (1.65)</th><th>60 (2.36)</th></tr>
<tr><td rowspan="2">TH gear</td><td>3.6:1
7.2:1
10:1</td><td>–</td><td>Opposite direction</td><td colspan="2">Same direction</td></tr>
<tr><td>20:1
30:1</td><td>–</td><td>Same direction</td><td colspan="2">Opposite direction</td></tr>
<tr><td>PL gear
PN gear</td><td>5:1
7.2:1
10:1
25:1
36:1
50:1</td><td>–</td><td colspan="3">Same direction</td></tr>
<tr><td>Harmonic gear</td><td>50:1
100:1</td><td colspan="4">Opposite direction</td></tr>
</table>

・Grease of geared motor

On rare occasions, a small amount of grease may ooze out from the geared motor. If there is concern over possible environmental damage resulting from the leakage of grease, check for grease stains during regular inspections. Alternatively, install an oil pan or other device to prevent leakage from causing further damage. Oil leakage may lead to problems in the customer's equipment or products.

●Regeneration

When a large inertial load is operated at high speed, regenerative energy will generate and increase the power supply voltage, which can damage the driver. Review the operating condition and make sure regenerative voltage will not generate.

●Precaution as to static electricity

Eliminate static electricity before touching the product. Static electricity may damage the driver and equipment

Please be careful handling the product after the power is turned on. Static electricity may cause malfunction or damage the driver.

To prevent electric shock, use only an insulated screwdriver to adjust the driver's switches.

●Prevention of electrical noise

This section shows the methods for preventing electrical noise. Please refer to the examples of printed circuit board and applied circuit.

Power supply

The DS series products are specifically designed for DC power supply input. Use a DC power supply (such as a switching power supply) compliant with the EMC Directive.

Mains filter

Connect a mains filter on the input side of the DC power supply so as to prevent the noise generated in the driver from being transmitted externally via the power supply line. When a power supply transformer is used, be sure to connect a mains filter on the AC input side of the power supply transformer.

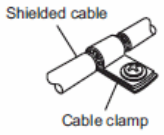
- Install the mains filter as close to the AC input terminal of DC power supply as possible. Also, secure the I/O cables (AWG18: 0.75 mm^2 or more) using cable clamps or the like so that the cables won't lift from the surface of the enclosure panel.
- The cable used to ground the mains filter must be as thick and short to the grounding point as possible.
- Do not wire the AC input cable and the output cable of the mains filter in parallel. If these two cables are wired in parallel, noise inside the enclosure will be connected to the power supply cable via stray capacitance, reducing the effect of the mains filter.

Grounding method

When grounding the driver and mains filter, use a cable of the largest possible size and connect to the ground point over the shortest distance so that no potential difference will be generated at the grounded position. The ground point must be a large, thick and uniform conductive surface. Install the motor onto a grounded metal surface.

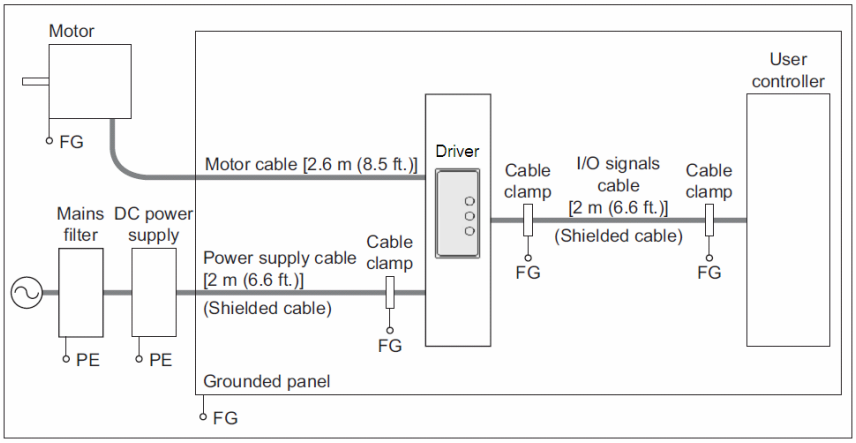
Wiring the power supply cable and I/O signals cable

- Use a shielded cable of AWG22 (0.3 mm^2) or more in diameter for the driver power supply cable, and keep it as short as possible.
- Use a shielded cable of AWG24 (0.2 mm^2) or more in diameter for the driver I/O signals cable, and keep it as short as possible.
- Use a metal cable clamp that contacts the shielded cable along its entire circumference to secure/ground the power supply cable or I/O signals cable. Attach a cable clamp as close to the end of the cable as possible, and connect it as shown in the figure.



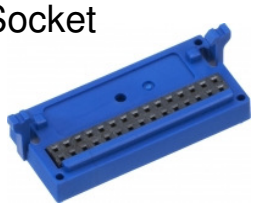
Notes about installation and wiring

- Connect the motor, driver and any surrounding control system equipment directly to the grounding point so as to prevent a potential difference from generating between grounds.
- When relays or electromagnetic switches are used together with the system, use mains filters and CR circuits to suppress surges generated by them.
- Keep the cable lengths as short as possible. Do not wind or bundle extra lengths.
- Separate the power supply cables such as motor cable and power supply cable from the signal cables, and wire them apart by around 100 to 200 mm (3.94 to 7.87 in.). If a power supply cable must cross over a signal cable, wire them at right angles. Keep an appropriate distance between the AC input cable and output cable of the mains filter.



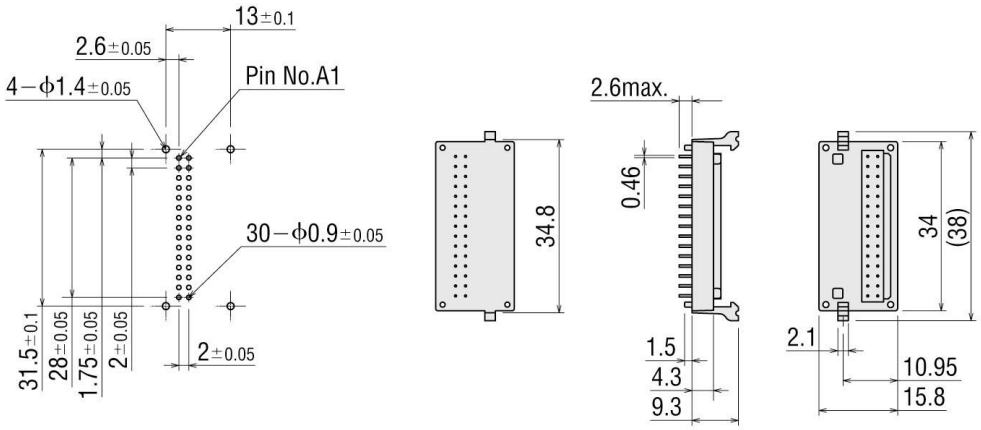
■ Options

Socket



DMS01 **(@ 10 pieces)**

Model	DMS01
Connector	Molex 79107-1400
Resin parts	Nylon66, UL94V-0
Pitch	2.0mm
Pole number	30
Weight	3g

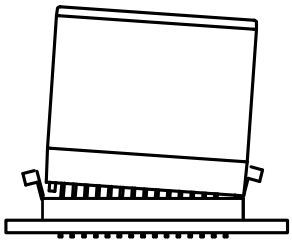


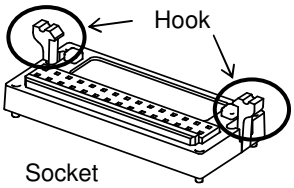
Recommended dimensions of mounting holes
(view from the top surface of the board)
Recommended board thickness t = 1.6

● Precautions for use

When detaching the driver, make sure to slowly unclasp the hooks one by one with precision screw driver. Hooks should be unclasped for 1-2mm. Hooks may break if they are unclasped for more than 3mm.

Detach the driver





◆Soldering specifications

Soldering time should be as short as possible along with the conditions below.

・Dip soldering should be done no more than twice with the conditions of
Temperature: 260℃ maximum, Time length: 10sec maximum

・Soldering iron should be used no more than twice with the conditions of
Temperature: 350℃ maximum, Time length: 3sec maximum

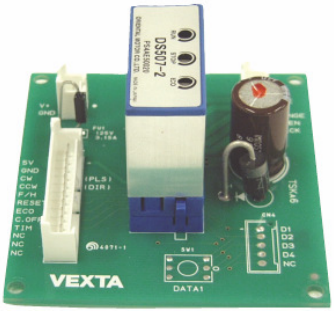
NOTE: Soldering in reflow furnace may break the driver.

※The socket is attached by soldering. The pins may fall out from the plastic case, if external force acts on these pins before soldering. Make sure that there are all the pins connected before attaching onto the board.

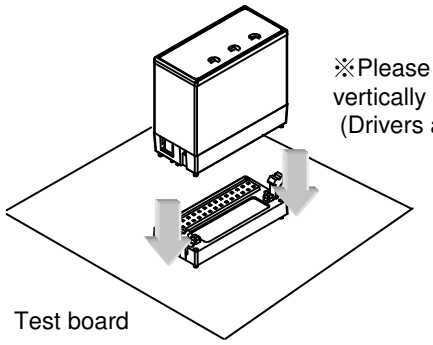
■ Options

Test board

This is the test board which makes it easy to conduct the operation testing. The motor can be used by attaching the driver, which sold separately, and wiring the attached cables.



DMB01S



Test board

※Please attach the driver vertically as shown on the figure. (Drivers are sold separately)

◆Precautions for use

CN4, the connector for resolution settings) is not mounted on this product.

This spot has to be modified when external signals for resolution setting are used on microstep driver.

Characteristics, specifications and dimensions are subject to change without notice.

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Oriental Motor U.S.A. Corp.

Western Sales and Customer Service Center
Tel: (310) 715-3301

Fax: (310) 225-2594

Eastern Sales and Customer Service Center
Tel: (781) 848-2426

Fax: (781) 848-2617

Midwest Sales and Customer Service Center

Tel: (847) 285-5100

Fax: (847) 843-4121

Technical Support

Tel: (800) 468-3982

8:30 A.M. to 5:00 P.M. P.S.T. (M-F)
7:30 A.M. to 5:00 P.M. C.S.T. (M-F)

E-mail: techsupport@orientalmotor.com