# BLDC motor driver

**BLD250-D, Analog & Digital input, 250watt**


BLDC DRIVER

- Surface-mount technology
- Small size, low cost, easy
- Hall sensor commutation
- Set value speed : Volume(2.5Vdc), PWM(open-collector), 4~20mA(current loop)
- Slow start, slow stop
- Brake, Direction and Enable input
- Current limit adjustable (communication mode)
- Motor lock detection : Blockage protection
- Aluminium housing
- Alarm output funtion at time of error
- FG out

## General Description

The BLD-250 series drivers are designed to drive 3-phase brushless DC motors at a high switching frequency.

Driver has enable, direction, and brake input.

In addition, rotation of the motor can be detected by logic output FG.

All models interface with digital controllers or can be used as stand-alone drives.

Driver require only a single regulated DC power supply and a red/green led indicates operating status.

| Electrical Data | BLD250-D |
|---|---|
| **DC supply voltage $V_m$** | 24 Vdc |
| **Absolute minimum supply voltage Vm min** | 12 Vdc |
| **Absolute maximum supply voltage Vm max** | 28 Vdc |
| **Max. output voltage** | $V_m$ - 0.5 |
| **Peak. Current (1 sec. max., internally limited)** | 30 A |
| **Max. continuous output current** | 15 A |
| **Switching frequency of power stage** | 25 kHz |
| **Power dissipation at cont. current** | 250 W |
| **Input** | |
| Set value speed | PWM : Open collector Input, 250Hz<br>Volume : 0~2.5Vdc<br>Current loop : 4~20mA |
| Enable | Open collector Input |
| Brake | Open collector Input |
| Direction | Open collector Input |
| **Output** | |
| FG | Open collector, Vceo : 80Vdc, Ic max : 50mA |
| ALARM | Open collector, Vceo : 80Vdc, Ic max : 50mA |
| **Voltage outputs** | |
| Hall sensor supply voltage Vcc hall | +5.8Vdc ± 5%, max. output current 20mA |
| **Indicator** | Green : LED blink or on(Blinks during motor rotation)<br>Red : LED on(Fault), LED blink(board on)<br>Yellow : LED on(CCW), LED blink(ACC/DEC conversion) |
| **Trim potentiometers** | Set of motor acceleration time (slow start), decelation time (slow stop). |
| **Protective function** | |
| Current limit (OCP) | 20A Typ, The set current limit is adjusted at communication mode.(<99A) |
| Blockage protection | Detect a motor lock if motor shaft is blocked for longer than 3 sec.<br>Set in communication mode.(2~5sec) |
| **Ambient temperature and humidity** | |
| Operation condition | Dry bulb temp:-10~+50 [℃], Relative humidity : 0 ~ 90 [%] |
| Storage condition | Dry bulb temp:-10~+60 [℃], Relative humidity : 10 ~ 90 [%] |

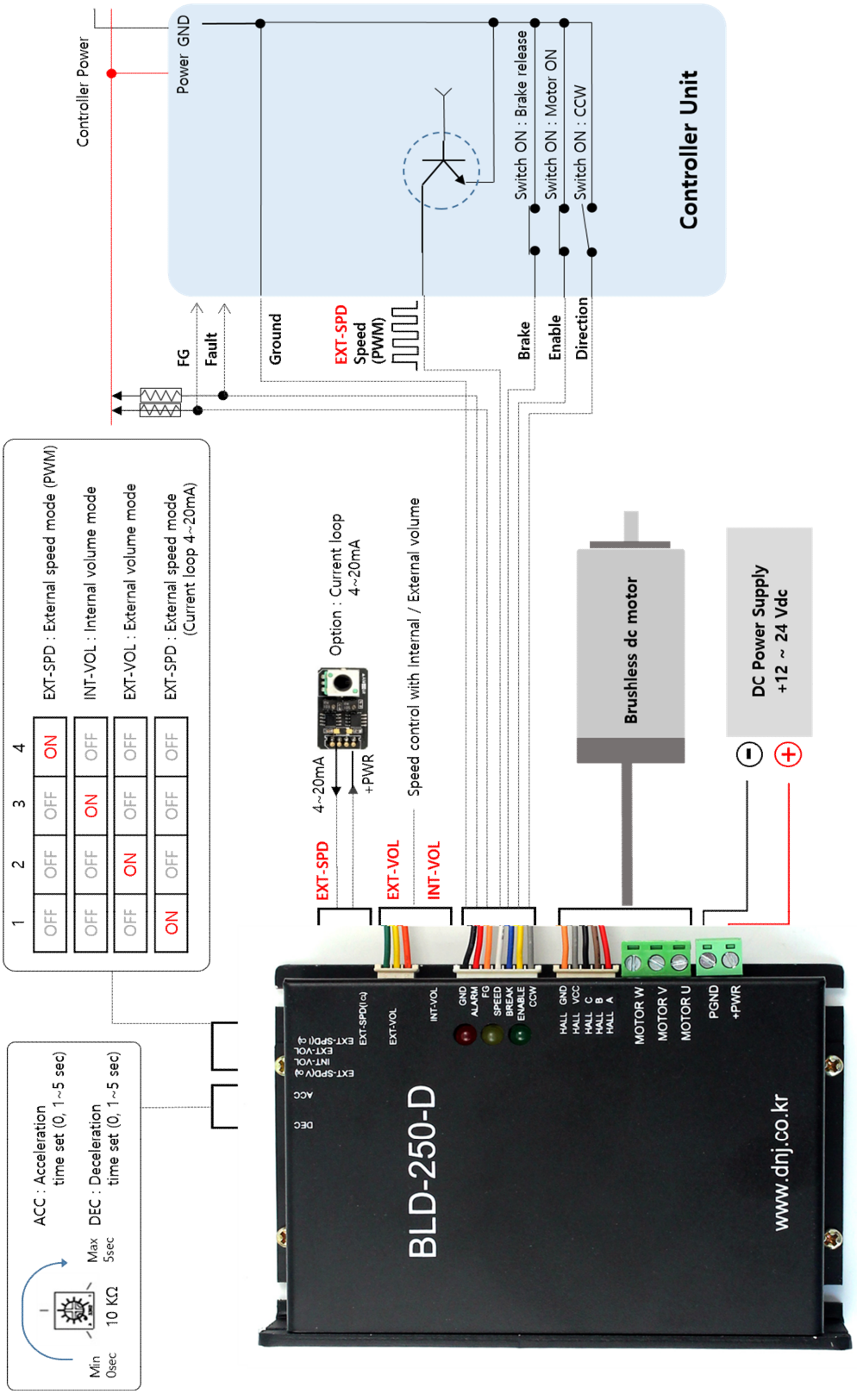
## Mechanical data

| | |
|---|---|
| Weight | 325 g Typ |
| Dimention (L x W x H) | 131 x 90 x 31.5 mm |
| Mounting threads | Flange for M3-screws |

## Terminals

| | |
|---|---|
| **Power, Motor** | Male header (PCB) : SLPH-300R-2P(Power), SLPH-300R-3P(Motor) |
| | Suitable plug : SLPS-300V-2P, SLPS-300V-3P |
| **Signal I/O** | Male header (PCB) : MOLEX 5268 |
| | Suitable plug : MOLEX 5264 |

## Wiring diagram



## Pin configuration

| VOLUME | Function |
|---|---|
| DEC | Deceleration time adjustment |
| ACC | Acceleration time adjustment |

| DIP S/W | Function (Control mode) |
|---|---|
| EXT-SPD(Vol) | PWM input mode |
| INT-VOL | Internal Volume mode |
| EXT-VOL | External Volume mode |
| EXT-SPD(ICL) | Current loop mode |


| LED | Function |
|---|---|
| ● | BLINK : Board ON |
| | RED ON : FAULT |
| ● | BLINK : ACC/DEC conversion |
| | YELLOW ON : Motor direction, CCW |
| ● | GREEN BLINK or ON:<br>Blinks during motor rotation |

| CON 6 | Function (External speed) |
|---|---|
| EXT-SPD(ICL) | Control motor speed in current loop mode.(4~20mA) |

| CON 5 | Function (External speed) |
|---|---|
| EXT-VOL | GND |
| | 0~2.5Vdc input<br>Input speed control with external volume (10kΩ) |
| | +3.3 Vdc |

| VOLUME | Function (Internal speed) |
|---|---|
| INT-VOL | Controls motor speed with internal volume trimmer(10kΩ) |

| CON 4 | Function (Control IO) |
|---|---|
| GND | Grounded |
| ALARM | FAULT output |
| FG | Motor speed pulse output |
| SPEED | Motor speed control input |
| BRAKE | Motor brake control input |
| ENABLE | Motor ON/OFF control input |
| CCW | Motor rotation direction control input |

| CON 3 | Function (Hall sensor) |
|---|---|
| HALL GND | Hall sensor grounded |
| HALL VCC | Hall sensor power(5.8Vdc out) |
| HALL C | Hall sensor C (W) |
| HALL B | Hall sensor B (V) |
| HALL A | Hall sensor A (U) |

| CON 2 | Function (Motor phase) |
|---|---|
| MOTOR W | Motor W phase |
| MOTOR V | Motor V phase |
| MOTOR U | Motor U phase |

| CON 1 | Function (Power) |
|---|---|
| PGND | Power ground |
| +PWR | +12 ~ 24Vdc supply voltage input |

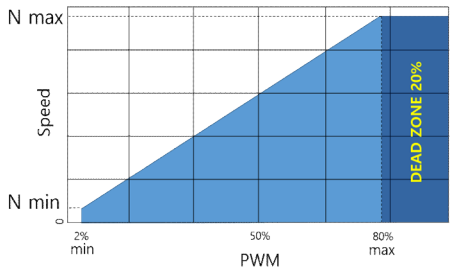
## Inputs and outputs

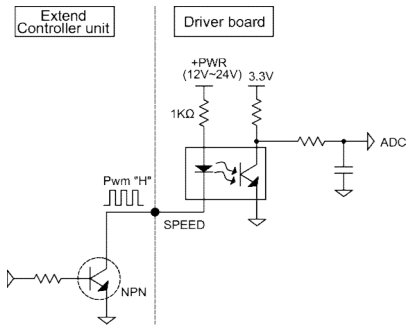
### Control input PWM <SPEED>

Motor speed control input

Pulse Width Modulated input, opto-coupled

Dip-switch no. 4 is turned on.




| | |
|---|---|
| Input | Open-collector Input |
| Frequency | PWM frequency range is 250Hz (between 0.2 ~ 1 [kHz]) |
| Set value input | Speed setting for speed control via PWM duty 0~80% |
| Interface |  |

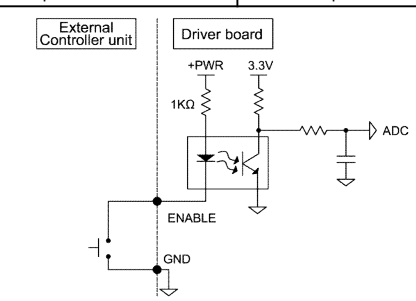


### Control input ON/OFF <ENABLE>

Enables or disables the power stage.

If the <ENABLE> input contacts ground potentia, the driver is activated.

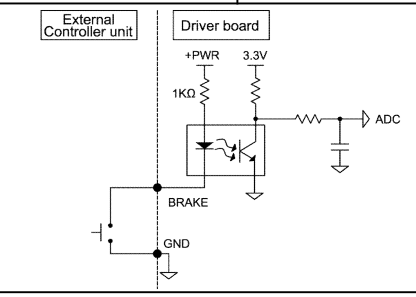
If the <ENABLE> input is open, mosfets on the bridge drive turns off and the motor shaft freewheels slows down

| | | |
|---|---|---|
| Input | High(1) : Input OPEN | Power stage switched off |
| | Low(0) : Input to GND | Motor power on |
| Interface |  | |



### Control input brake <BRAKE>

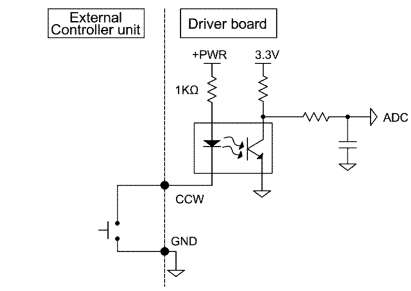
The motor shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings.

| | | |
|---|---|---|
| Input | High(1) : Input OPEN | Brake active |
| | Low(0) : Input to GND | Brake release |
| Interface |  | |



### Control input direction <CCW>

When the level changes, the motor shaft slows down in an uncontrolled fashion to a standstill by short-circuiting the motor windings, and accelerates in the opposite direction, until the nominal speed reaches again.

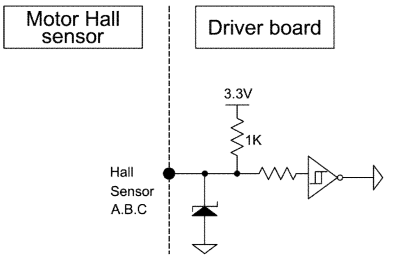
| | | |
|---|---|---|
| Input | High(1) : Input OPEN | Clockwise rotation |
| | Low(0) : Input to GND | Counter-clockwise rotation |
| Interface |  | |



### Hall sensor input <HALL A, B, C>

Hall sensors need for detecting rotor position and actual speed.

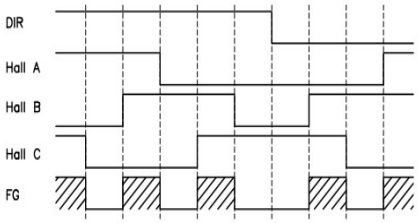
Suitable for Hall effect sensors IC using Schmitt trigger and open collector output.

| | |
|---|---|
| Input | High(1) : 2.4 to 3.3 Vdc |
| | Low(0) : 0 to 0.8 Vdc |
| Input impedance | 1kΩ pull-up resistor +3.3Vdc |
| Interface |  |

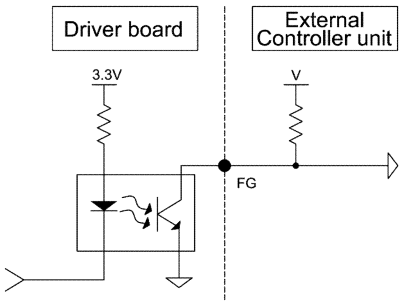
## <FG> out

1FG is put into toggle-operation in which the logic reverses every time when excitation phase is switched by hall input.

*** SPEED = ( Pole - Pairs ) x 3**




Open collector output
$U_{CEO}$ = 80 Vdc
$U_{ECO}$ = 7 Vdc
$I_{cmax}$ = 50 mA




You need to pull up for 1FG terminal, so that the terminal is NPN open-collector output.

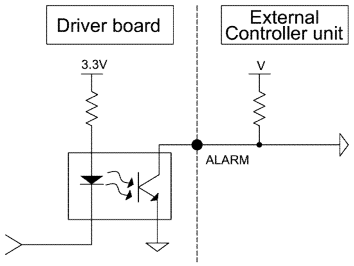
## <ALARM> out

Driver fault output.

This open collector output is active low during one or more of the following conditions : Invalid Sensor input code, Enable input at logic 0, over current, motor rock detection, and Thermal shutdown.

* Reset : Enable, Power off

Open collector output
$U_{CEO}$ = 80 Vdc
$U_{ECO}$ = 7 Vdc
$I_{cmax}$ = 50 mA




You need to pull up for alarm terminal, so that the terminal is NPN open-collector output.

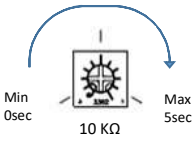
## Hall sensor voltage out

+5.8Vdc @ 20mA

An internal voltage of +5.8 Vdc is provided for powering the hall sensors.
Output voltage 5.8 Vdc ± 5%
Max. output current 20mA (short-circuit protection)

## Adjusting the potentiometers

Motor accelation time, decelation time can be adjusted using 1-turn potentiometers.




Pre-adjustment

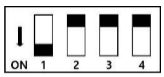
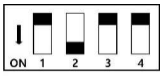
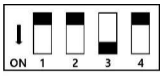
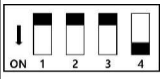
With pre-adjustment, the potentiometers are set in a preferred position.

**Pre-adjustment of potentiometers**

| | |
|---|---|
| ACC | Set the acceleration time of the motor. (0 or 1~5 sec) |
| DEC | Set the deceleration time of the motor. (0 or 1~5 sec) |

## Dip switch

Setting of motor speed control mode

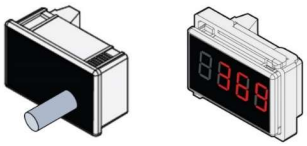
| No | DIP switch | Function | Discription |
|---|---|---|---|
| 1 |  | EXT-SPD(ICL) | External current loop mode<br>- Input to connector 6 |
| 2 |  | EXT-VOL | External Volume control mode<br>- Input to connector 5 |
| 3 |  | INT-VOL | Internal Volume control mode<br>- Controlled by internal volume control |
| 4 |  | EXT-SPD(VOL) | External PWM input mode<br>- Input to Connector 4 <SPEED><br>Note. If the <SPEED> pwm input is open, the motor rotates at full speed. |

## Current loop 4 ~ 20mA <EXT-SPD(ICL)>

Motor speed control input

Dip-switch no. 1 is turned on.

Optional Products



It could be controlled for the speed on motors to use converters of output the electric current sending the signal on 4-20[mA] through electric current loop without POWER.

Product Number : **MTD-0420C**

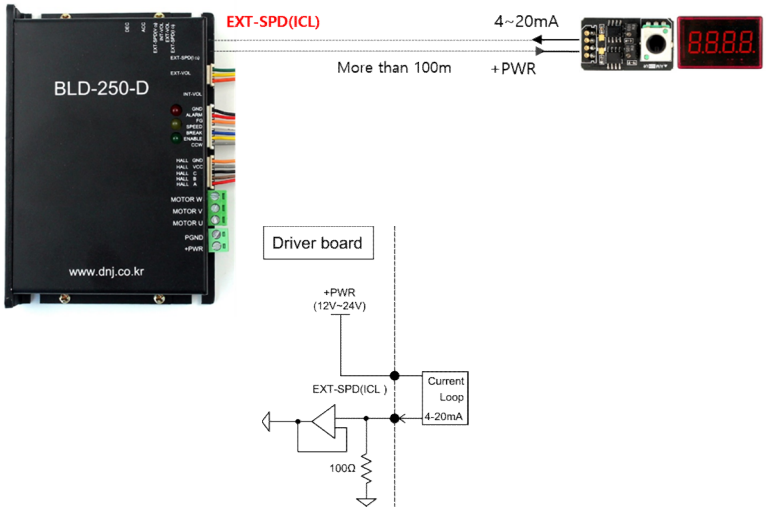
It is possible to display the order for the speed on motors in long distance using the current loop in real time.

Product Number : **DP-0420C**

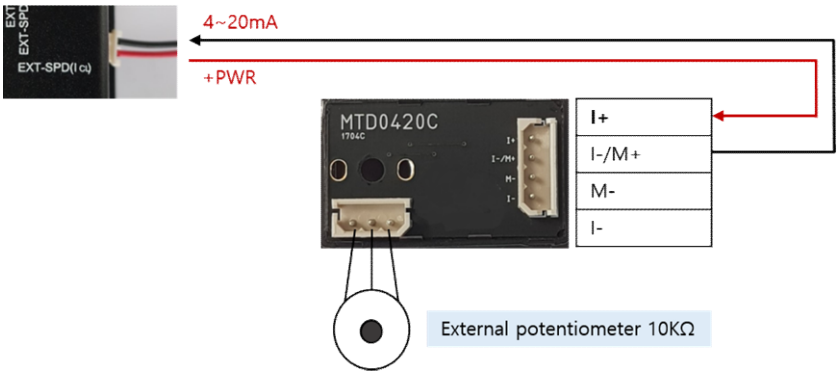
The control of speed on motors uses electric current loop.

It could be controlled by supplying flow of electricity on 4~20[mA] for the speed on motors.

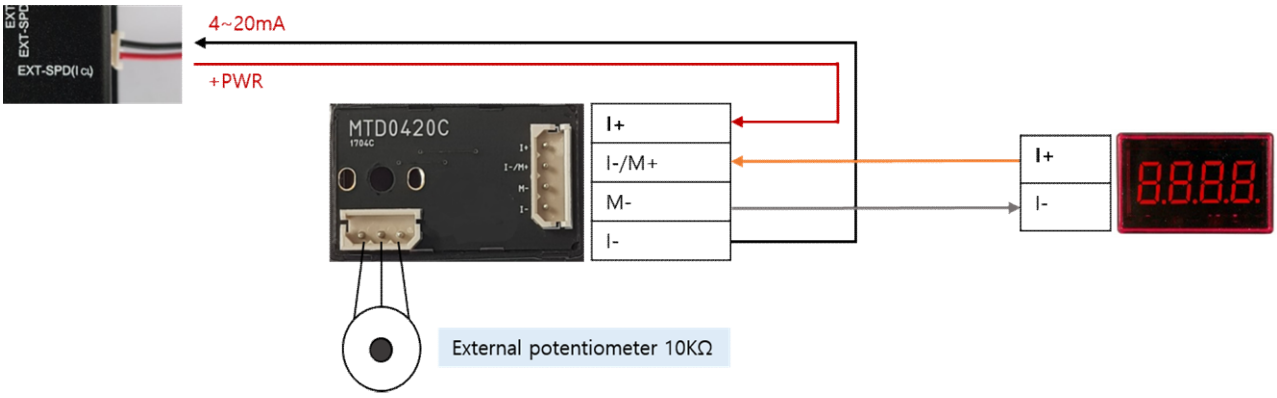
It sets on 0[rpm] under 4[mA] and maximum speed on 20[mA] as it changes by 1[rpm].




**4~20mA volume controller (current loop)**




**4~20mA volume controller + digital panal-meter (external unit)**



## Internal Volume<INT-VOL>

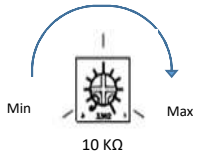
Motor speed control input

Dip-switch no. 3 is turned on.

The motor speed is controlled by a 1-turn potentiometers.(10kΩ)

Left end stop of potentiometers : Motor speed is minimum

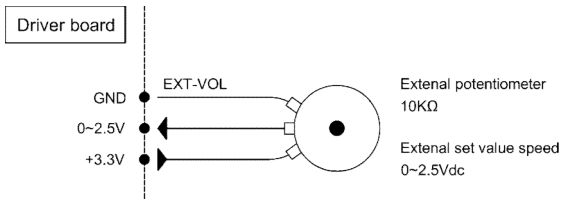
Right end stop of potentiometers : Motor speed is maximum




## External Volume<EXT-VOL>

Motor speed control input

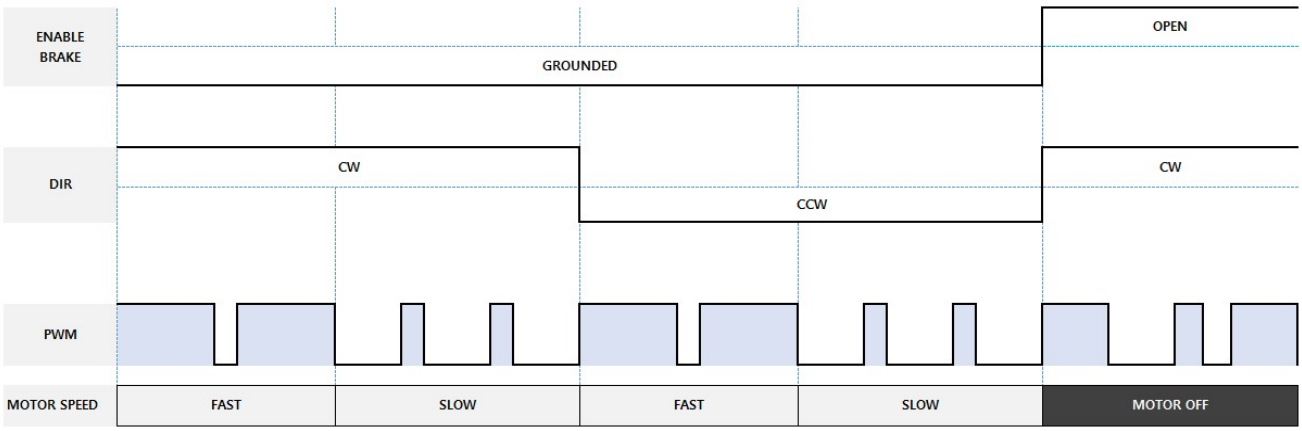
Dip-switch no. 2 is turned on.




## Driver protection

| No | Item | Specification | Note |
|---|---|---|---|
| 1 | Current limit | 20 [A] Typ | The continuous current limit level can be set using RS485 communication.<br><br>It can be released by setting the current limit level to 99A. |
| 2 | Thermal shutdown | 160±10 [℃] | When the driver IC reaches the defined temperature, the motor current automatically cuts off. The highest rating temperature of IC is 160 [℃]<br><br>Component reliability can't be ensured when motor is used in exceeded 160 [℃].<br>There is no guarantee of proper operation when thermal shutdown motor is reused. |
| 3 | Motor lock detection | 3 sec | When the motor locks, the motor current automatically cuts off within the defined time.<br><br>You can set the lock detection time using RS485 communication (2 ~ 60 seconds). |

## Control sequence timing chart



## Dimension Drawing

[mm]