

5-phase stepper motor driver

BCDC5030

User's Manual

NPM

Nippon Pulse Motor Co., Ltd

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BCDC5030 is a single axis 5-phase stepper motor driver for seeking downsizing and high reliability.

1. Features

1. Low-vibration and low-noise driver with new-pentagon wiring.
2. Realized to make driving circuit downsized with newly-developed dedicated ASIC.
3. Strengthened input / output signal line protection against noise by using photocoupler.

2. Specifications

Product name : Stepper motor driver circuit		Model : BCDC5030
Electrical specifications	Input Power Supply	24VDC \pm 10%, 2.5A (MIN)
	Control Mode	Bipolar common chopper drive
	Excitation Mode	Full-step: 0.72°/STEP (4-4 phase), Half-step: 0.36°/STEP(4-5 phase)
	Output Current	Total driver current: 3.0A (MAX), Current can be adjusted by trimmer.
Input Signals	Input Signal Circuit	Photocoupler input (Input impedance=220 ohm, Input current: 20mA MAX) H: 4.0 to 5.0V, L: 0 to 0.5V
	CW/CCW Pulse Input	CW/CCW Step Command pulse Input pulse width: 5 μ sec MIN, Pulse rise/fall time: 2 μ sec MAX. Operation starts at the rising edge of pulse signal (negative logic).
	Excitation Signal Input (Excitation ON/OFF)	Excitation is OFF by photocoupler ON (Shaft free) Excitation is ON by photocoupler OFF (Motor operation starts.)
	Step Angle Switch	Half-step by photocoupler ON (0.36°/STEP) Full-step by photocoupler OFF (0.72°/STEP)
	Auto Current Down	Auto current down is invalid by photocoupler ON Auto current down is valid by photocoupler OFF (Current is cutback approx 0.5 sec after the motor stops.) Current can be adjusted by trimmer.
	Output	Output Signal Circuit
Origin Signal Output		Signal is output every time the inner ring-counter returned to step "0" (photo transistor ON) Full- step mode: Signal is output every 10 pulses. Half--step mode: Signal is output every 20 pulses.
Environmental Conditions	Operating Temperature	0 to 40°C
	Humidity	0 to 80%RH (No condensing)
	Storage Temperature	-10 to 70°C
	Vibration	2G (10 to 150Hz, X-Y-Z directions, 2.5H)
	Shock	15G (X-Y-Z directions, 3 times)
Others	Dimensions	94(W) x 62(D) x 33(H) mm
	Weight	0.2 Kg
	Cooling	Natural Ventilation (mounted to chassis)
	Accessories	Connector housing: 3 pieces (CNA, CNB, CNC) Connector pins: 20 pieces

3. Connection

3-1. Connection to a stepper motor

This driver supplies the coils of a 5-phase stepper motor with current by turning FETs in the output layer on and off according to a previously specified sequence, which rotates the motor.

There are two types of 5-phase motors: one is a motor wired with 5 leads by new pentagon-wiring internally, and the other is a motor that has 10 leads for 5 phases.

A motor with 10 leads can be treated like the new pentagon-wiring motor by externally connecting the leads as shown on the next page.

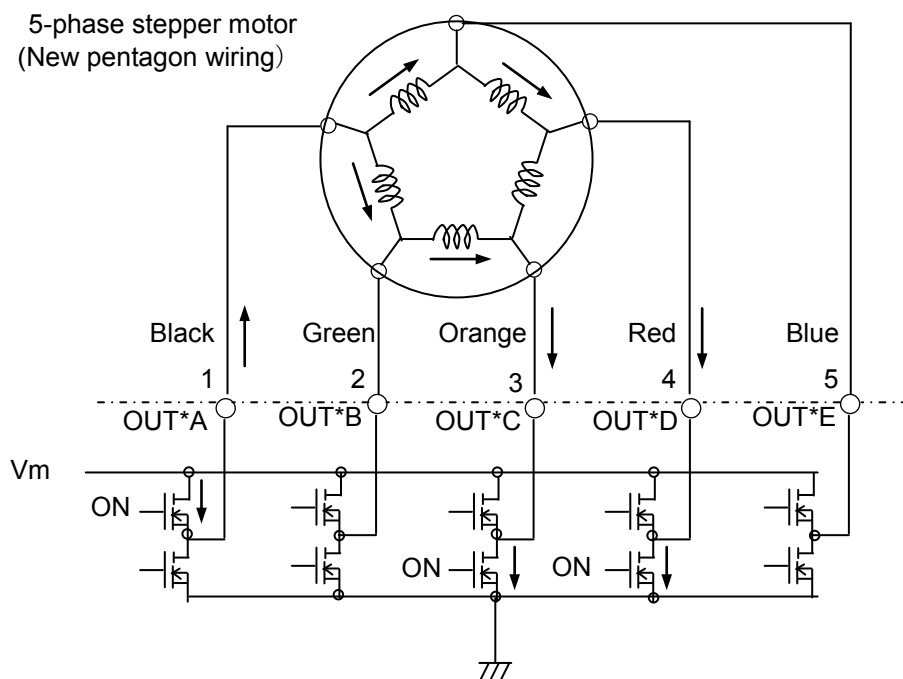
Shown below are typical motor wiring methods.

3-2. Example of 5 leads connection

The motor shown below is an example of a motor wired by new pentagon-wiring previously and internally.

PK569-NA made by Oriental Motor (1.4 A/phase)

PK544-NA made by Oriental Motor (0.75 A/phase)



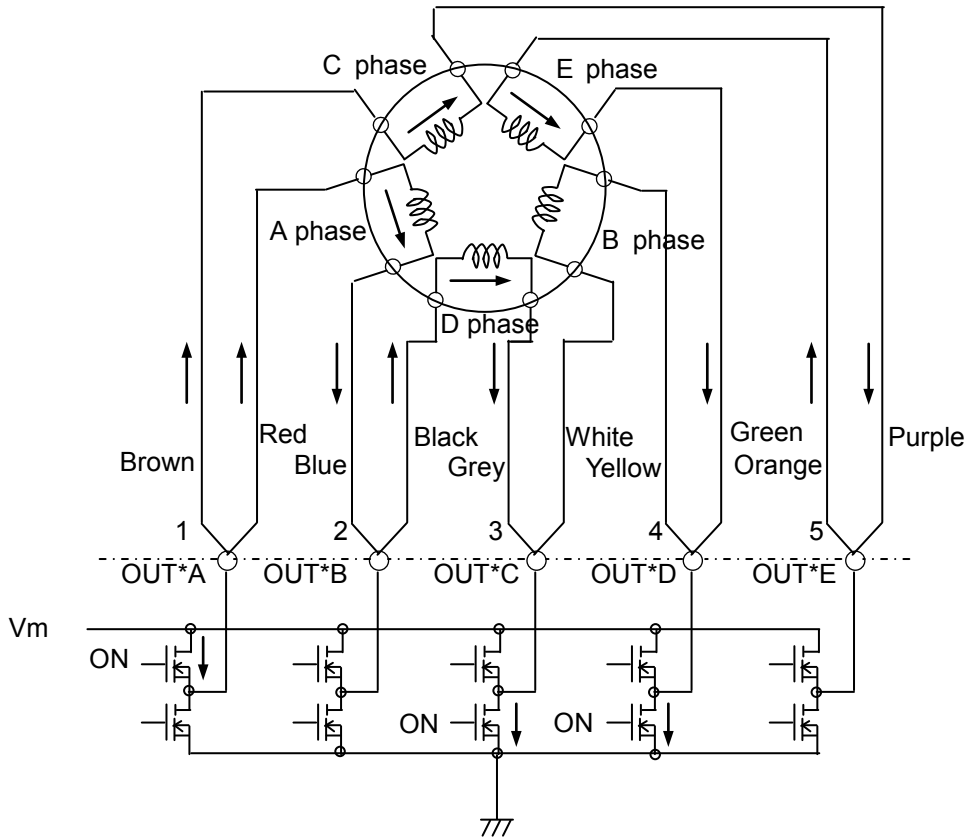
3-3. Example of 10 leads connection

The motor in this connection example has 10 leads (2 leads for each phase). Connect leads to the new pentagon externally as follows.

PK569-A made by Oriental Motor (1.4 A/phase)

PK544-A made by Oriental Motor (0.75 A/phase)

5-phase stepper motor



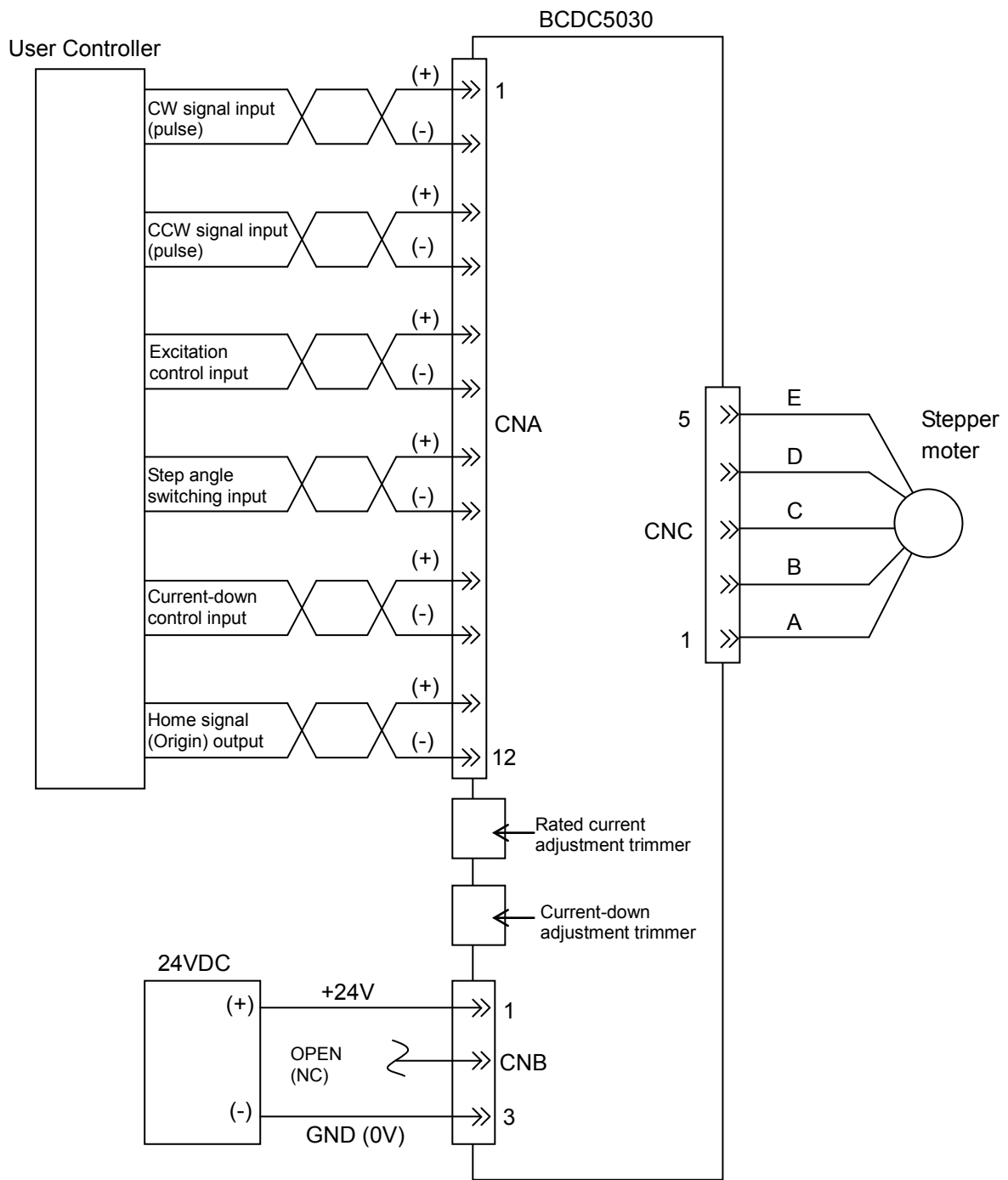


Figure 1

3-4. Connector Signals

Connector No.	Pin No	Signal	Description
CNA	1	CW (+)	CW rotation signal input
	2	CW (-)	Inputs pulse signals in CW rotation.
	3	CCW (+)	CCW rotation signal input
	4	CCW (-)	Inputs pulse signals in CCW rotation.
	5	MOTOR OFF (+)	Excitation signal input
	6	MOTOR OFF (-)	Excitation is OFF by photocoupler ON Excitation is ON by photocoupler OFF
	7	FULL/HALF (+)	Step angle switching input
	8	FULL/HALF (-)	Half-step by photocoupler ON (0.36°) Full-step by photocoupler OFF (0.72°)
	9	AUTO C.D. (+)	Auto-current down control input
	10	AUTO C.D. (-)	Auto current down is invalid by photocoupler ON Auto current down is valid by photocoupler OFF
	11	ORG (+)	Home position (origin) signal input
	12	ORG (-)	Full-step mode: Signal is output every 10 pulses. Half-step mode: Signal is output every 20 pulses.
CNB	1	V IN (+)	DC24V (+) input
	2	N.C	Open
	3	V IN (-)	DC24V (-) input
CNC	1	OUT*A	Motor lead wire
	2	OUT*B	Motor lead wire
	3	OUT*C	Motor lead wire
	4	OUT*D	Motor lead wire
	5	OUT*E	Motor lead wire

3-5. Signal Input / Output Configuration (Figure 2, Figure 3)

CW/CCW Pulse Input,
Excitation Control Input,
Step Angle Switching Input,
Auto-Current down Control Input

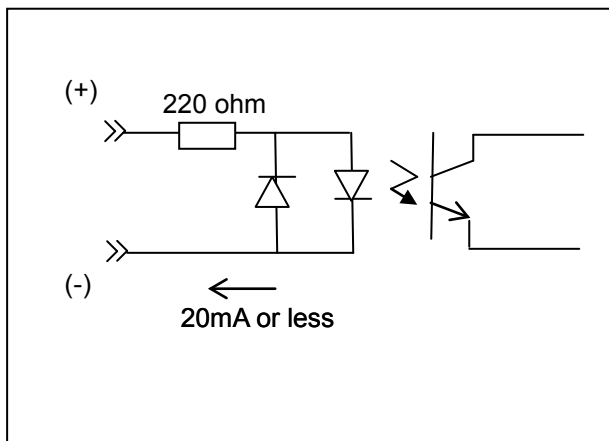


Figure 2

Home Position (Origin) Signal Output

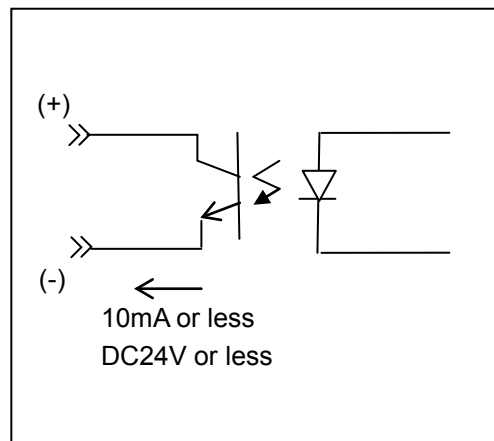


Figure 3

4. Current Adjustment

Initially, we set the current at 1.5A/phase. If you change the current setting due to the motor specification or heating problems, please adjust by the following procedure.

4-1. How to Connect an Ammeter

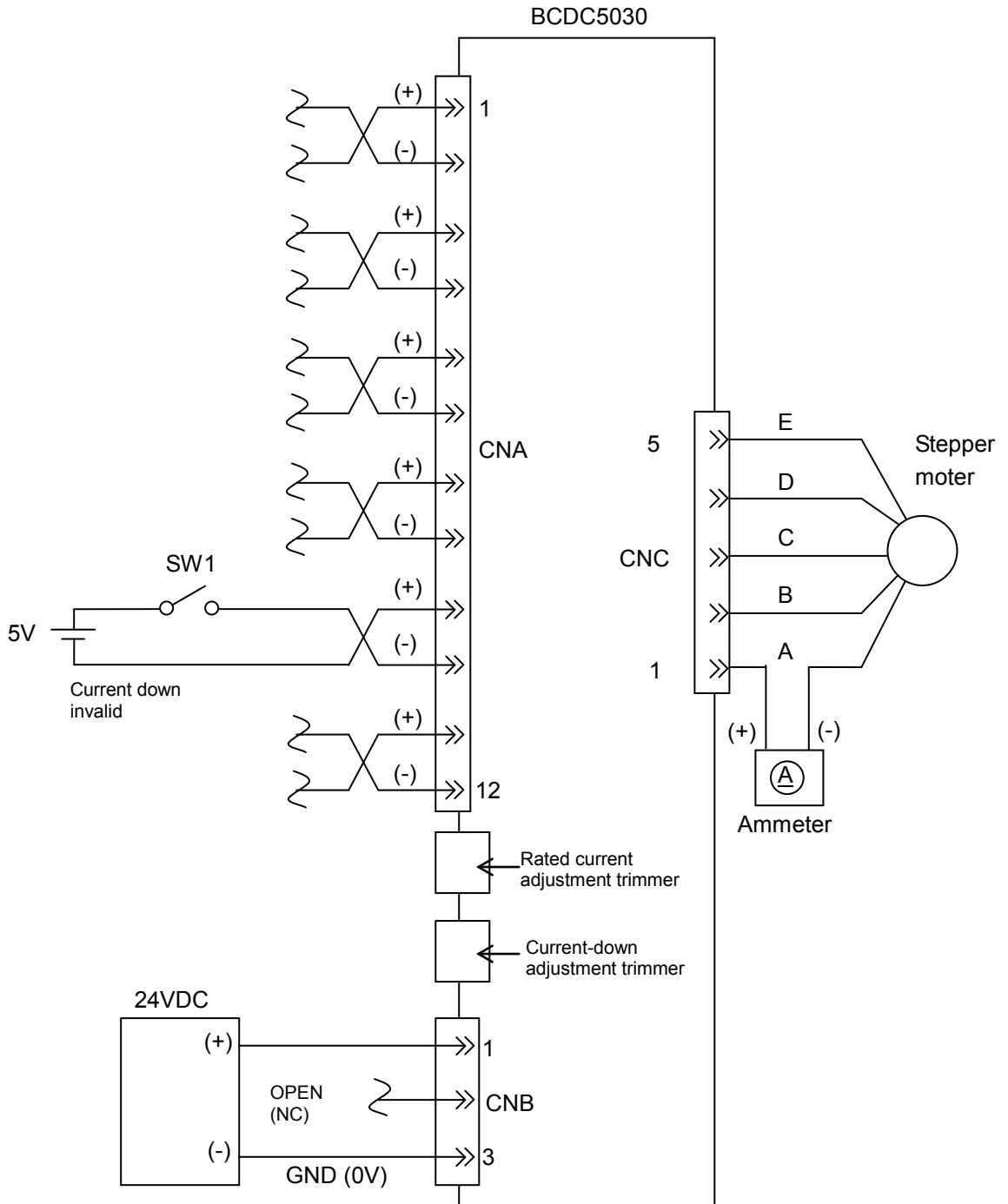


Figure 4

4-2. Adjustment of Motor Rated Current

- (1) Turn ON SW1 and make Auto current down invalid by photocoupler ON. (Refer to Figure 4.)
- (2) Set other input signal pins open. (Signal is not input.)
- (3) Connect an ammeter with caution to polar character. (Use an ammeter that its full scale is more than 3A.)
- (4) Turn DC24V Power Supply ON.
- (5) Set the current using adjustment trimmers (Single rotation) (at your left side).
- (6) Rotating the trimmer in CW direction increases the current value and rotating it in CCW direction decreases the current value.
- (7) Current for two phases flows in the ammeter. Therefore, half of the current value is rated current for one phase. An ammeter shows the setting value is 0.1A lower than the control current value in the driver. Therefore, set current value with deleting 0.1A.

(Example) In the case to adjust to 0.5A / phase
 $(0.5 \times 2) - 0.1 = 0.9A$

Set the rated current adjustment trimmer so that the ammeter needle shows 0.9A.

- * In the case that the current value per phase is lower than 0.5A, the difference between the value of an ammeter and the control current value is small.
 Set the value of an ammeter = rated current / phase x 2

- (8) The following is an example to show a relation between the trimmer scale and setting current. Please refer to this table.

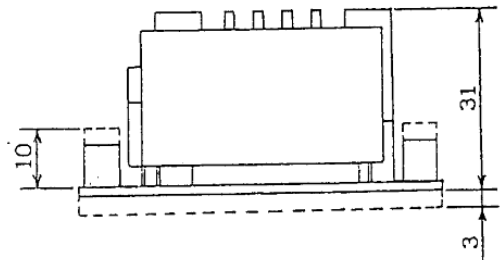
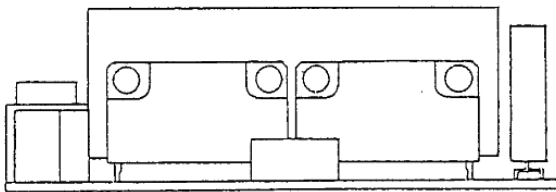
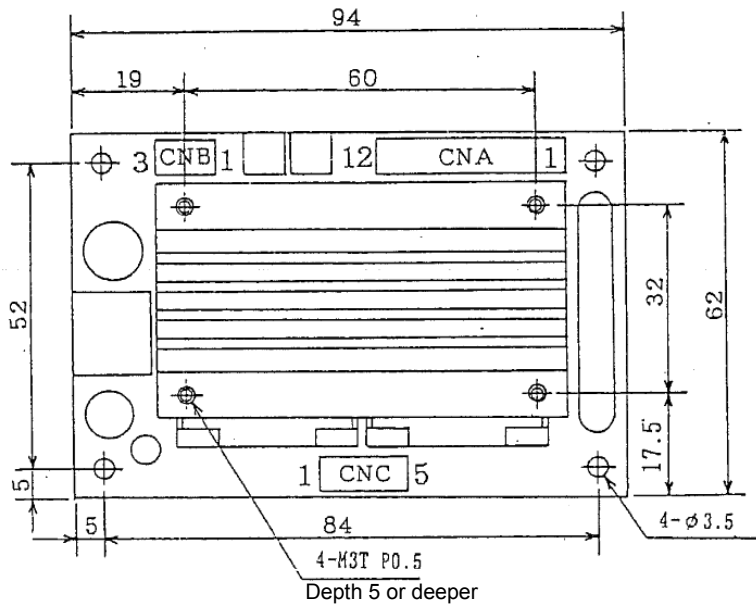
Trimmer scale	0	1	2	3	4	5	6	7	8	9	10
Current value (A) (for two phases)	0	0	0.9	1.4	1.85	2.2	2.5	2.6	2.8	2.85	2.9

3. Current Adjustment During Current-Down

- (1) Turn ON SW1 and make Auto current down invalid by photocoupler ON. (Refer to Figure 4.)
- (2) Turn DC24V Power Supply ON.
- (3) Set the current using the trimmer (at your right side).
- (4) Rotating the trimmer in CW direction increases the current value and rotating it in CCW direction decreases the current value.
- (5) In default, the trimmer is set to 50% value of the current value (for two phases).
- (6) The following is an example to show a relation between the trimmer scale and the setting current. Please refer to the following table.

Trimmer scale	0	1	2	3	4	5	6	7	8	9	10
Current value (A) (for two phases)	0	0	0.8	1.3	1.55	1.8	2.0	2.1	2.15	2.2	2.25

5. External Dimensions



Connector List (JST Mfg. Co., Ltd)

	Board side (male)	Lead wire side (female)
CNA	B12B-XH-A	XHP-12
CNB	B3B-XH-A	XHP-3
CNC	B5B-XH-A	XHP-5

Applicable connector: BXH-001T-0.6 or BXH-001T-P0.6

Applicable wire range: 0.08 to 0.33 mm²
 AWG#28 to 22
 Outside diameter of wire covering 1.2 to 1.9 mm

Applicable crimp tool: YC-11

6. Notes

1. Operating precautions

- (1) This driver is a natural ventilation type, so it must be placed in a well-ventilated environment. Space out 25mm to 30mm around the driver.
- (2) The motor and driver can be heated by a certain usage or surroundings. Use the following temperature as your guide: Motor case - 100°C, Heat Sink - 80°C Max. You need an additional cooling system for the higher temperature.
- (3) This driver must be away from dust, oil-mist, corrosive gas and metal fragment incorporation, etc.
- (4) This driver must be away from excessive vibration and impact.
- (5) Signal lines (CNA), power lines (CNB) and motor lines of this driver must keep separated from each other.
- (6) Do not place this driver near other relays, switches, drilling machine, etc. which can cause noise to be produced. If this driver is placed near such equipments, inductive noise and radiation noise can be added to this driver and it causes malfunction. Place this driver, signal lines, power lines and motor lines away from noise source as possible.

CAUTION	The descriptions in this manual may be changed without prior notice to improve performance or quality.
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Issued in December 2010