

# TBC4

Magnetic brake controller

## Operating manual



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Thank you for purchasing the Digital Magnetic Brake Controller. This manual is intended to describe the basic installation, setup and operation procedures. Please read this manual thoroughly before use to ensure proper use.

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## 1. Introduction

The Digital Magnetic Brake Controller (TBC4) is a controller for braking devices (brakes) installed in a system that uses an electric motor as the main power source, such as an industrial crane. It is a product developed exclusively for an electromagnetically driven braking device (magnetic brake).

The TBC4 is a device that controls DC using a power thyristor. Advanced MCU is used to control basic braking device operation. In addition, it monitors and protects the status of the magnet coil in real time to provide the optimal operating environment.

## 2. Features

- ◆ Selectable current or voltage control method - Can be set separately for starting / holding current
- ◆ Optimal control with output current and voltage feedback control
- ◆ High power usage efficiency and short recovery time due to regenerative action of exciting current
- ◆ Brake coil abnormality detection function (disconnection, partial short circuit, etc.)
- ◆ Output limit function of overvoltage due to temperature rise of brake coil
- ◆ Voltage control automatic switching function to prevent overheat of brake coil
- ◆ Output short-circuit status detection function (device protection function)
- ◆ Circuit that is safe even for emergency power-off such as power failure (device protection function)
- ◆ Function to prevent burnout due to overheating of control element
- ◆ Wide setting range (voltage: 5 to 600 V, current: 0.1 to 5 A, starting current time: 0 to 10 seconds)
- ◆ Built-in operation switch for brake operation test

## 3. Application

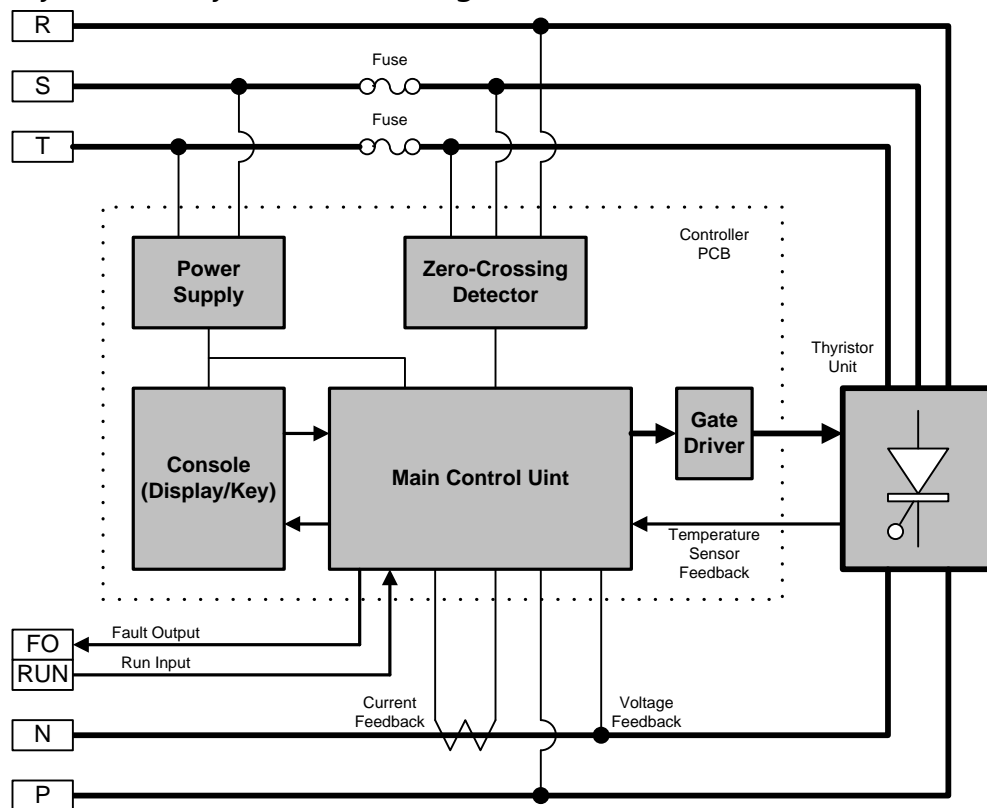
- ◆ Magnetic brake control
- ◆ Control of other electromagnet devices

#### 4. Specification

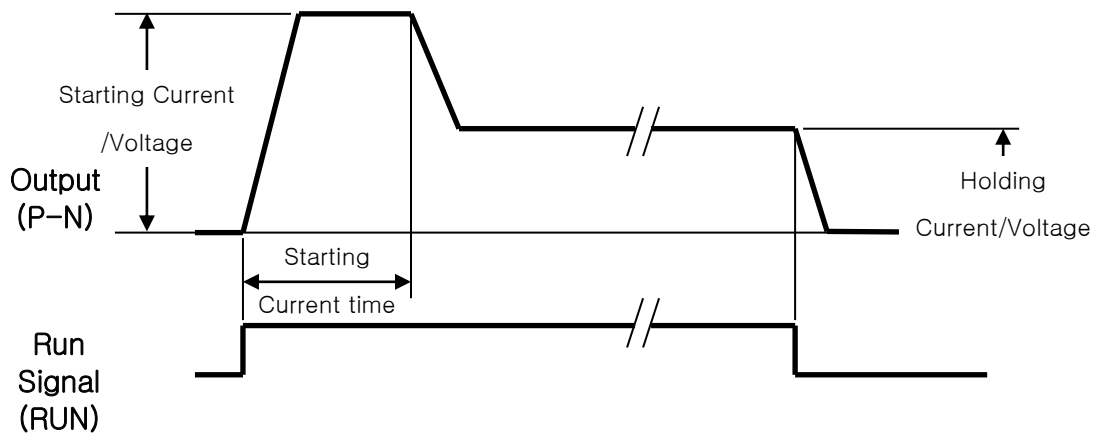
- ◆ Power supply: 3-phase AC 200 ~ 460 [V] (free voltage), 50/60 [Hz]
- ◆ Output current control range: DC 0.1 ~ 5 [A]  
(starting / holding current common)
- ◆ Output voltage control range: DC 5 ~ 600 [V]  
(Maximum voltage depends on the used power)
- ◆ Starting Current Time Setting Range : 0~10(Sec)
- ◆ Operation Signal Input : RUN INPUT (Contact)
- ◆ Output Fault signal : FAULT OUTPUT  
(Mechanical contact : AC250V/DC30V, 5A)
- ◆ Fuse rating : WEBE E165SA gG30A or equivalent
- ◆ Operating temperature : -20~85[°C]

#### 5. Configuration and Principles

Internal of TBC4 is shown as Pic. 1. The MCU, which is the core control device, controls the output according to various setting values set by the user. And the thyristor, which is a power control element, synchronizes precisely with the cycle of alternating current.



[Pic.1] Block Diagram



[Pic. 2] Overview

### 1) Operating Starting Current

- ① When operation signal turns on, set starting current or starting voltage start to output. At the point, current control mode should be outputted voltage more than rated voltage temporally due to characteristic of brake coil which the current should not be changed quickly.

### 2) Operating Holding Current

- ① If set starting time passed, it automatically outputs holding current or holding voltage. At the point, current control mode should be outputted voltage less than rated voltage temporally due to characteristic of brake coil.
- ② Output voltage and current are in stable during holding current, it could display dynamic resistance and temperature of coil etc. with using buttons from referring to voltage and current.(Refer to No. 6).
- ③ HC Lamp flicks during holding current.

### 3) Regeneration of exciting current

- ① When TBC4 turns off, exciting current of coil extinct quickly to deliver it to power side. In other word, if using a disconnection circuit for current route, please late close situation could be occur due to blocking revival motion.(Refer to No. 8)
- ② SC and HC lamp flicks during revival motion.

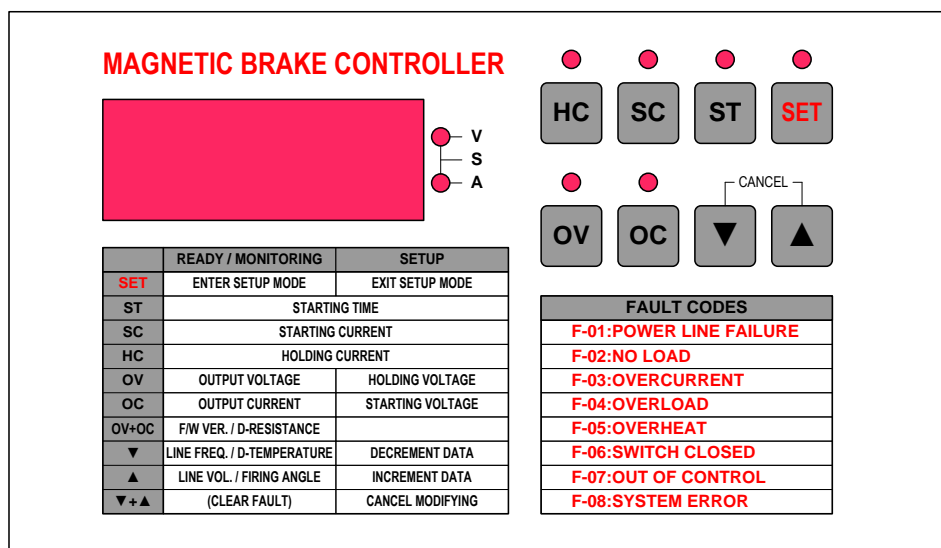
### 4) Completion of operation

When TBC4 completes revival motion, all flicking lamp will be turned off.

5) Noted item













- ① If operating signal turns off during starting current, it enter into revival motion of exciting current directly.
- ② When TBC4 turn on during the revival motion of exciting current, it enter into starting current stage. (Exclude 0.0 of starting current time).
- ③ When starting current time sets 0.0 sec, equal current or voltage outputs because operation enters holding current stage directly.
- ④ Brake coil temperature should be increased if starting current operates frequency due to high duty cycle of brake. For reducing this situation, TBC4 will be automatically changed to voltage control mode when 143% of rating coil voltage(130°C of coil temperature) for reducing above situation(for operating holding current). Therefore, current could be output less than setting value. If setting value could not meet 61% of setting value(coil temperature approximately less than 180°C), fault will occurs [**F-07**](OUT OF CONTROL).
- ⑤ Displayed number flicks during the voltage control mode.

6. Console and display













[Pic. 3] Console

### 6-1 Function of button (Standby/Monitoring)

	Stand-by	Operating
	Press & hold to enter set-up mode Press to show brake type.	-
	Display starting current time of output at present.	
	Display starting current value of output at present.	
	Display holding current value of output at present.	
	Display voltage value of output at present.	
	Display current value of output at present.	
 	Display version of firmware	Display dynamic resistance of brake coil
	Display frequency of input power source	Display dynamic temperature of brake coil
	Display voltage of input power source	Display firing angle for control (~180.0)
 	Return to standby mode after reset, when fault occurs.	-

### 6-2 Function of button (Set-up mode)

	Basic settings	Extended settings
	Press and hold SET button(more than 1 sec) to enter set-up mode Press SET button to exit standby mode.	Press SET button to exit set-up mode

	Using ▼, ▲ button to set starting time(0~10[sec])	Select brake type <sup>1)</sup> (※Only HANMI TECHWIN standard brake.)
	Using ▼, ▲ button to set starting current (0.1~45[A])	Select starting control mode (CC : current control, CV : voltage control)
	Using ▼, ▲ button to set holding current (0.1~45[A])	Select holding control mode (CC : current control, CV : voltage control)
	Using ▼, ▲ button to set holding voltage (5~300[V])	Set P value(kp) of PI control(0~20) <sup>2)</sup> (default value : 10)
	Using ▼, ▲ button to set starting voltage (5~300[V])	Set P value(kp) of PI control(0~20) <sup>2)</sup> (default value : 10)
	Using ▼, ▲ button / Changed Relay Output <b>F On</b> : Relay On - fault <b>P rn</b> : Relay On - Power On Relay Off - fault	Using ▼, ▲ button to set Fault Light on the top of Display(FND) set fault Light on the bottom of Display(FND) cancel fault
	Decrease Selected value at present.	
	Increase Selected value at present.	
	Reset value of display(cancel setting)	

1) It displayed four(4) digit number, first digit number show as follow; [1]:AN type AC100V, [2]:AN type AC200V, [3]:DN type DC110V, [4]:DN type DC220V, left three(3) digit number indicates brake frame number.(ex: [2400] → AC200V AN400). If it sets parameter beside HANMI TECHWIN's standard, it displays as [----].









Please refer to appendix for more details.

2) It could control the characteristic of output voltage and current control. If kp value is bigger, quick response are better. However, if kp value is too big, could be caused of occurring the vibration.

3) It could control the characteristic of output voltage and current control. However, if ki value is bigger, it could meet control target value. If it is too big, vibration could be occurred. In addition, smaller value are stable with vibration, too small value could be occurred controlled deviation.



### 6-3 Explanation of Fault

Display	Causes and Solutions
	<b>POWER LINE FAILURE</b> Instability of power or disconnected fuse. ☞ Please check power cable or fuse.
	<b>NO LOAD</b> Don't flow output current.(disconnected coil or omission of wiring) ☞ Check wiring of loaded side.
	<b>OVERCURRENT</b> Over flow current(disconnected output terminal) ☞ To Check loaded side wiring connects correctly.
	<b>OVERLOAD</b> Output voltage is blow than 75% of rated voltage. (overload, partial disconnection) ☞ Please check status of brake coil.
	<b>OVERHEAT</b> Temperature of heatproof plate is more than 85℃(celcius)(device overheating) ☞ When temperature declined, it automatically returns to work.
	<b>SWITCH CLOSED</b> Input power while the switch turned on. ☞ Please turn off the switch before input power.
	<b>OUT OF CONTROL</b> ① Could not control with setting current.(Overdrive) 1) ② Rating of output current is blow 61%(overheated coil) 2)
	<b>SYSTEM ERROR</b> Reset due to abnormal operating. ☞ Please check power source whether it is bad.

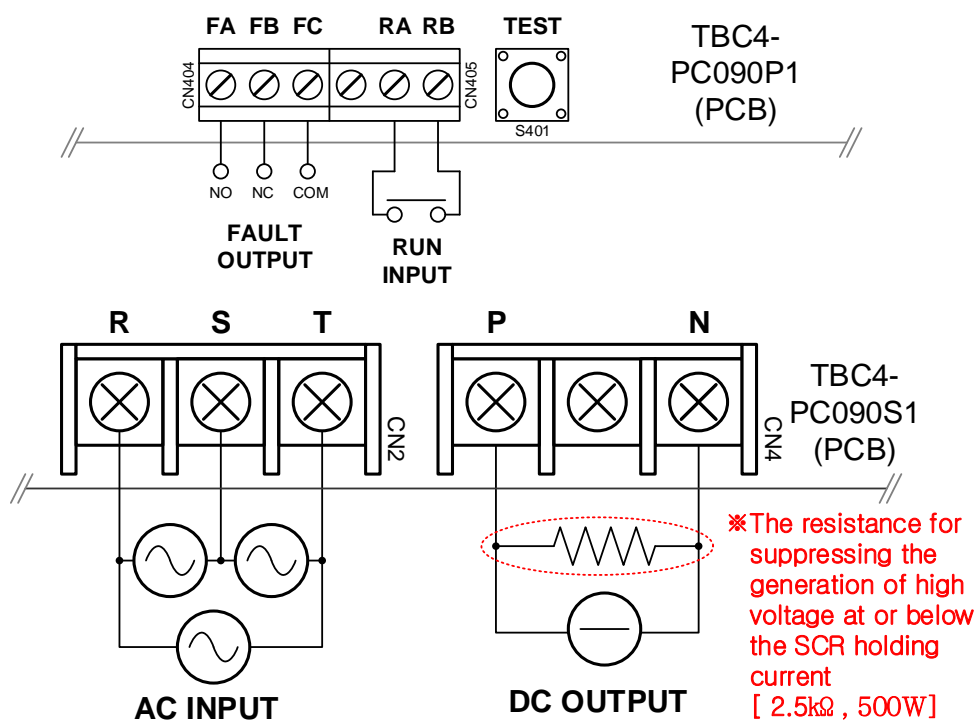
1) It does not work till output current reaches setting value even though the maximum voltage outputs. Please check electrical specification such as power source or voltage.

2) When brake coil reaches 180℃, resistance will increase 163% than 20℃ of brake coil. TCB4 will stop preventing damage of brake coil. If TBC4 is already working to meet above condition (output current), the fault signal will occur after operating signal turned off.

※ When temperature of coil is more than 130℃, constant rating voltage outputs; therefore, the temperature keep rising output current is reduced.

## 7. CONNECTION TERMINAL BLOCK

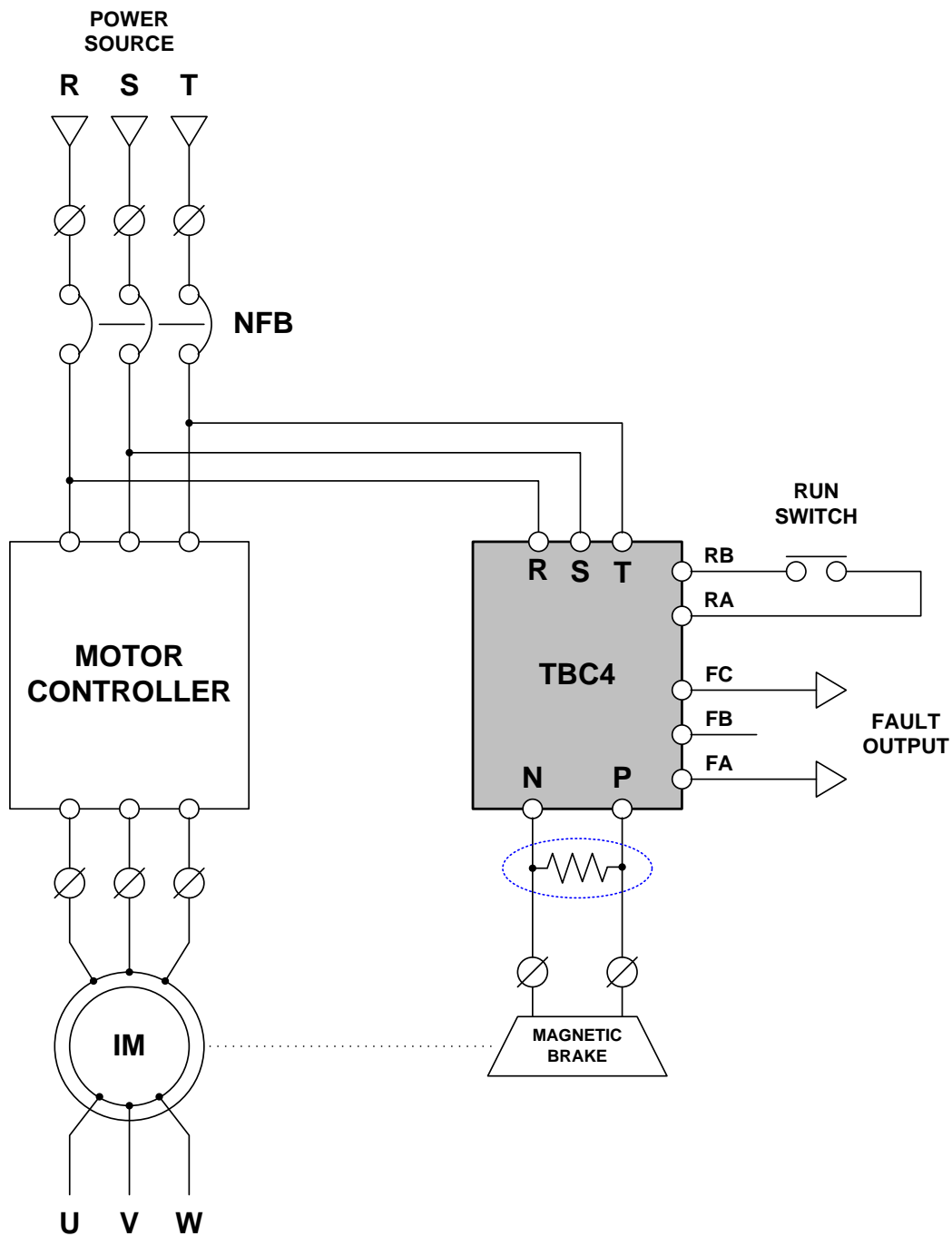
### 7-1 Exterior of terminal block



### 7-2 Explanation of terminals

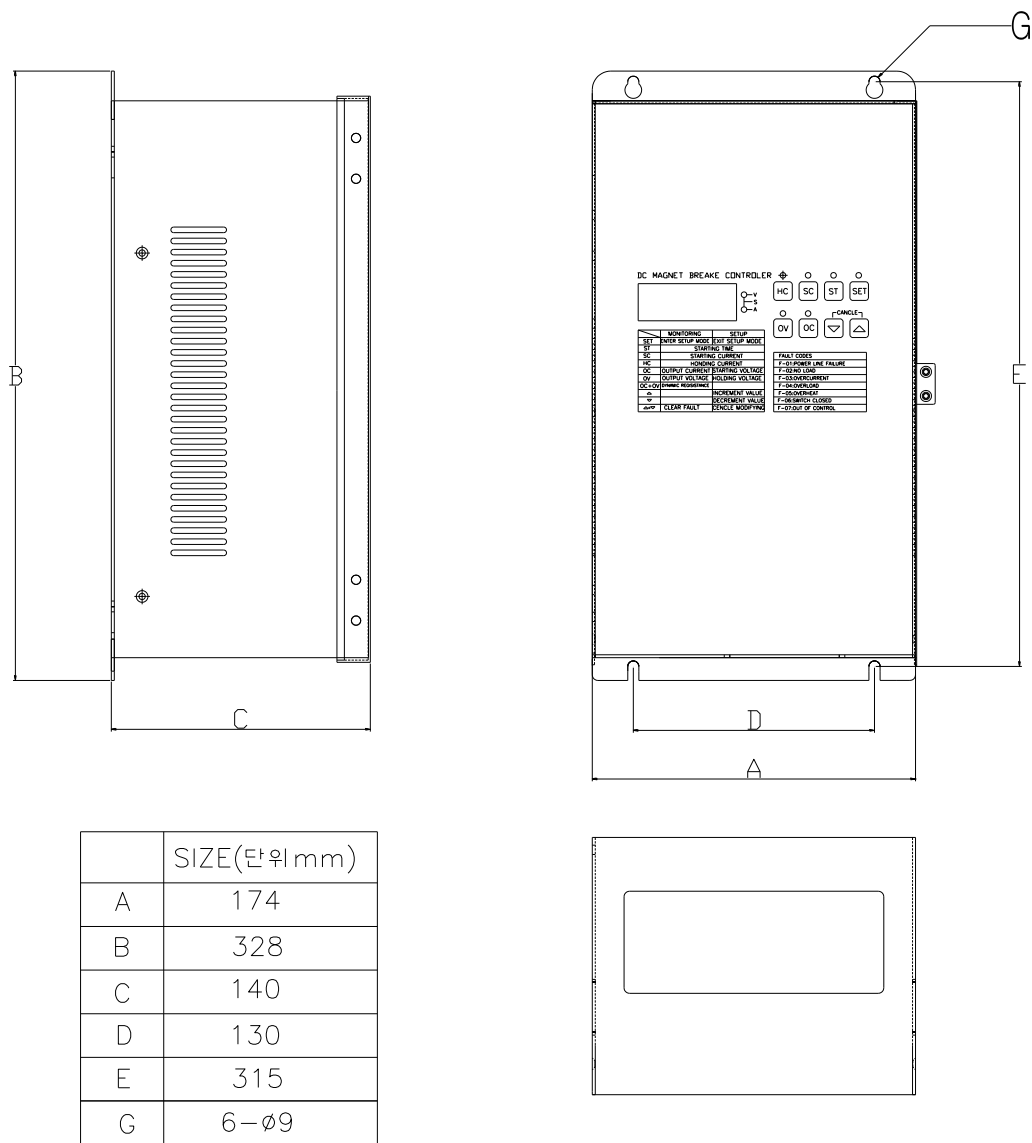
Terminal	Symbol	Name	Function	Rating
<b>CN404</b>	1	FA	NORMAL OPEN	AC250V/ DC30V, 5A
	2	FB	NORMAL CLOSE	
	3	FC	COMMON	
<b>CN405</b>	2	RA	RUN-A	RUN INPUT Operating Input Signal
	3	RB	RUN-B	
<b>TB1</b>	1			
	2	R	AC INPUT	3-phase AC input power
	3			
	4	S	AC INPUT	3-phase AC input power
	5			
	6	T	AC INPUT	3-phase AC input power
	7			
	8	P	DC OUTPUT (+)	Brake Coil (+)
	9			
	10	N	DC OUTPUT (-)	Brake Coil (-)

## 8. Electrical wiring



- ① This wiring method use only for small capacity of brake which extinct exciting current quickly and close brake quickly when electrical failure occurs.

9. Dimension



※ It can be changed to enhance the product without notice.

**10. CAUTION FOR OPERATION**

- ◆ TBC4 has sensitive electronic components inside. Don't open TBC4 don't attempt to repair by yourself. It may cause injury and serious damage.
- ◆ Please installs TBC4 with normal circuit. Especially, brake operates with actuation signal, and TBC4 could not operate while operating switch turned off.
- ◆ Installation of TBC4 choose appropriate circuit(basic circuit or extended circuit) refer to electrical specification of magnetic brake.
- ◆ TBC4 design to bear noise and serge from the power source; however, excessive noise and serge could be caused abnormal operation, so that use stable power source.
- ◆ Please caution for wiring if input terminal of operating switch intermixes for either leakage of voltage stray voltage it causes malfunction of TBC4.
- ◆ Please supply stable power source even if TBC4 prepare stable operation when electrical failure occurs. TBC4 stops its operation with fault signal if unstable power source supplies more than 1 sec.
- ◆ MCU could be reset after abnormal operation if power source is unstable. Display shows [**F-08**].
- ◆ TBC4 scans it short circuit when the operational switch turns on; if the short circuit occurs, it does not work(displaying [**F-03**]). However, output terminal occurs the short circuit during outputting current, fuse could be blocked(displaying [**F-01**](POWER LINE FAILURE)).
- ◆ When fault occurs, please solve causes of fault then return to operate. Push ▼+▲ button after clearing fault return to stand-by mode.
- ◆ Please caution for setting value of unsuitableness specification before operating brake to check electrical specification of TBC4. Especially, check the input power voltage is enough to operating coil.
- ◆ Please uses rated products for fuse to protect device.