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User Guide

NE Braking modules

Part Number: 0478-0723-01
Issue Number: 1

CTB Series Dynamic Braking Unit User guide

Nidec Control Techniques customers with technical support. Users may contact the nearest Nidec Control Techniques local sales office or service center.

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1 Introduction

1.1 Introduction

CTB Series braking unit is designed to feed the regenerative energy from the drive during braking to the braking resistor to improve the drive performance and decrease braking time.

1.2 Inspection before installation

The regenerative unit has been tested before delivery, please confirm below before installation. If any problem, please contact us.

- Check the model dispatched is the same as your order.
- Any damage for the unit during transportation.

2 Safety information

2.1 Warnings, Cautions and Notes



DANGER

- Abuse may cause danger, personal injury & device damage.Make sure the input power disconnected before wiring, wait for 10 minutes after the drive turns off.
- Wiring can only be done by electrical professionals.
- Do not touch the terminals of the braking unit during operation. Do not connect the terminals with enclosure of the braking unit. Short circuit not allowed between terminals.
- Enclosure (aluminum radiator) should be properly grounded.



CAUTION

- Read the manual before using the braking unit

NOTE A Note contains information which helps to ensure correct operation of the product.

3 Dynamic Braking Unit

3.1 Product Profile

The function of the Dynamic braking unit is to divert in to a braking resistor, the regenerative energy produced in the process of decelerating the motor, converting that energy into heat.Regenerative energy flows from the motor into the drive DC Bus, causing rise of bus voltage. The advantage gained using the DBU is improved braking performance and shorter deceleration time of the load.

3.2 Product Parameters

SAFETY

Short circuit protection of the braking IGBT prevents the fire risk associated with overloading the braking resistor that could occur if the IGBT failed short circuit.

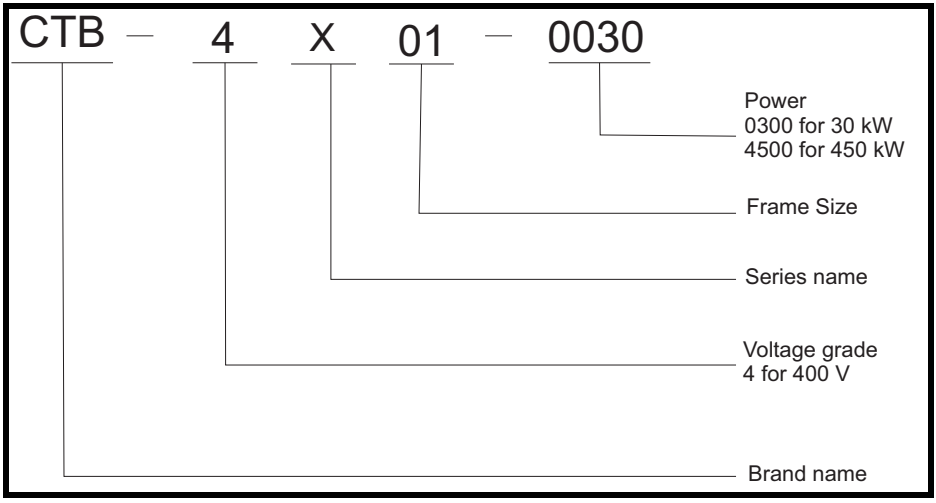
WIDE COMPATIBILITY

It's special design makes it compatible with general resistance rather than non-inductive resistance. It's adjustable chopper voltage 630 Vdc 760 Vdc is applicable to various low-voltage drives.

ADAPATABLE TO CONNECTIONS IN PARALLEL

It adopts a book-shape design and can be installed in parallel connection with zero clearance. It is recommended that up to 3 units can be connected in parallel.

3.3 Product Model Description



3.4 Product Size

All dimensions in mm

Figure 3-1

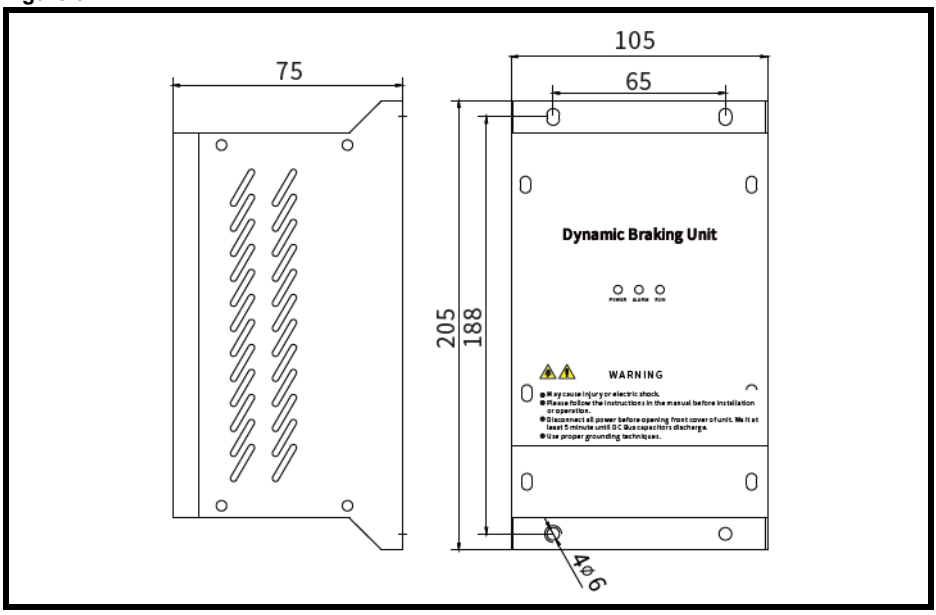


Figure 3-2

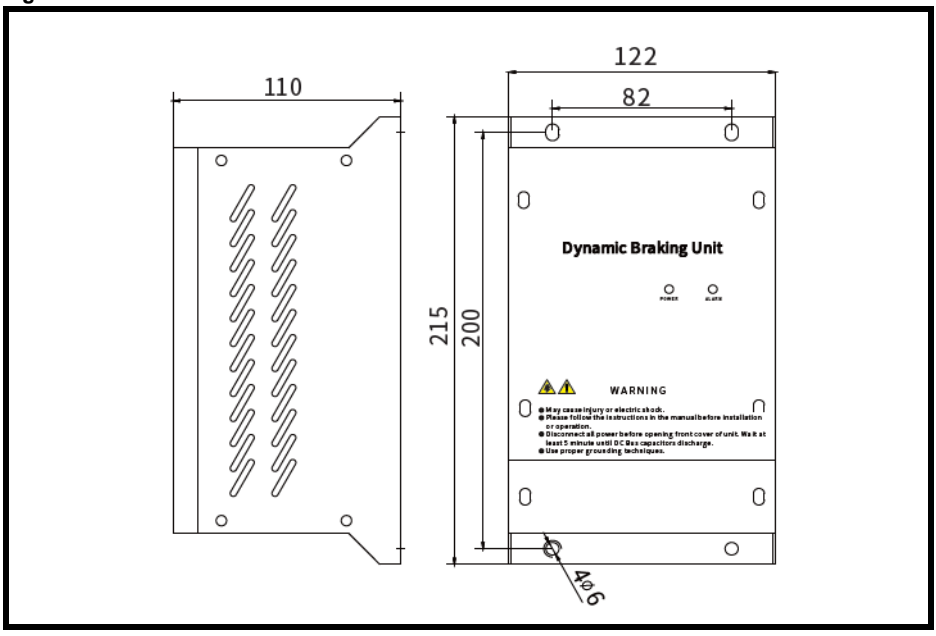


Figure 3-3

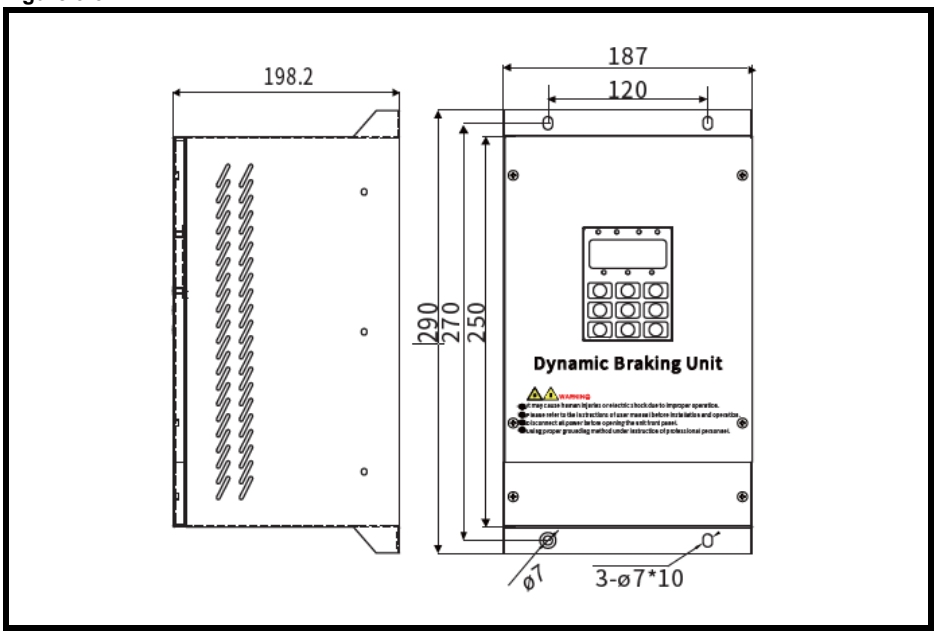
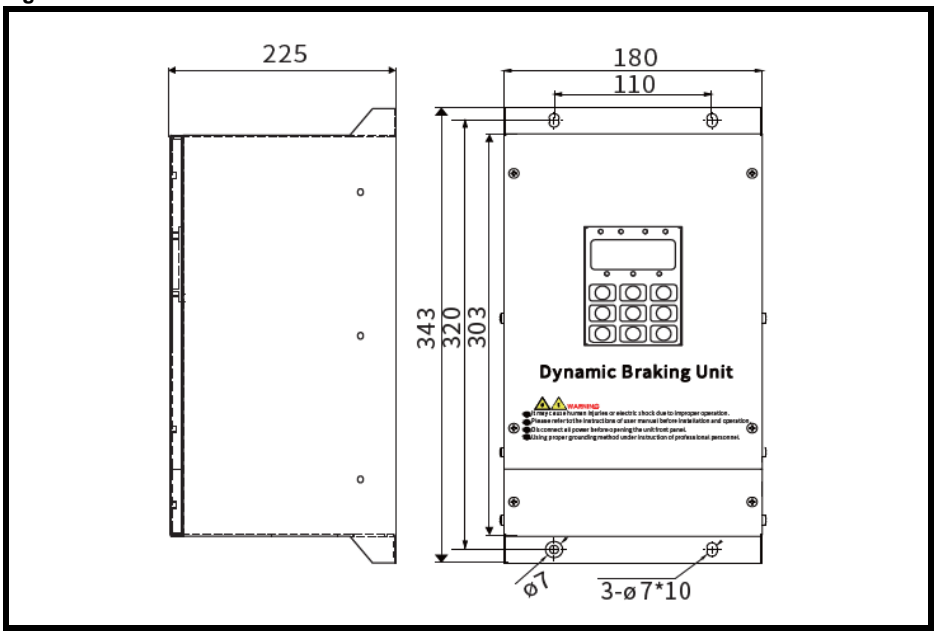


Figure 3-4



3.5 Selection Table

Type	Drive Power (kW)	Voltage Grade (V)	Peak Current (A)	Default Chopper Voltage	Braking Torque	Figure	Terminal	Cable (mm^2)	Weight (kg)
CTB-4X01-0300	30	400	50	DC660 V ±5 V (600-760 V Ajustable)	120 %	2-1	M4	6-8	1.5
CTB-4X02-0550	45-55		75		120 %	2-2	M4		2.5
CTB-4X02-0750	75		100		120 %	2-2	M4	10-16	2.5
CTB-4X03-1100	90-110		150		120%	2-3	M5		5.2
CTB-4X04-1100	55-110		150		150 %	2-4	M5	25-35	8.5
CTB-4X04-2000	132-200		200		150%	2-4			
CTB-4X04-2800	220-280		300		150 %	2-4			
CTB-4X04-4500	315-450		450		150 %	2-4		50-70	



- Units must never be mounted with the terminal area or base uppermost.

4 Dynamic Braking Resistor Calculation

4.1 Braking Resistor's Resistance Value: R

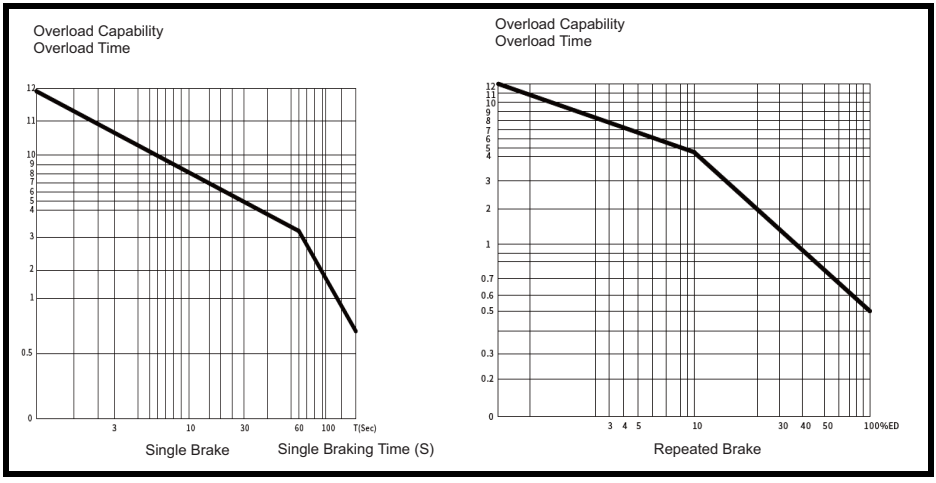
Braking Resistor's Resistance Value: $R = \frac{Udc^2}{KxP}$

Udc Voltage value of chopper wave of drives braking circuit
K: Braking torque factor 1.2-1.5
P: Drive power
Braking Resistor's power: Pr

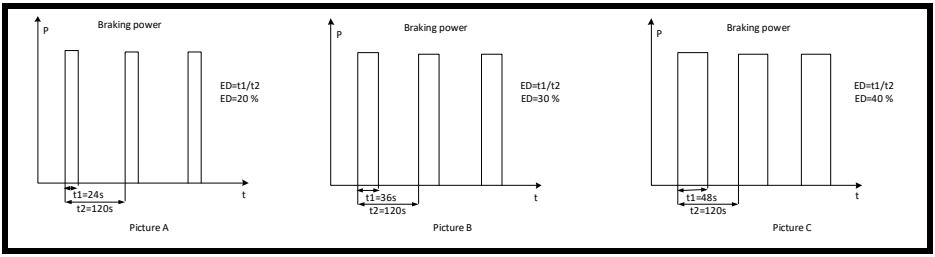
Braking Resistor's power: $Pr = \frac{Po}{\Delta K} = \frac{P1x(1-0.2)}{\Delta K} x\eta$

Po: the power of electric motor
ΔK: resistor transient overload factor
The exact value shall be determined by referring to the chart according to operating conditions.
P1: the average braking power that the system requires.
η: transmission efficiency. The mechanical system of transmission provides braking damp corresponding to the efficiency when it is functioning.
0.2: the internal resistance consumes 20 % braking energy.

ED brake ratio is the percentage of braking time based on a 100-second operating cycle.The selection of brake unit shall be carried out in accordance with brake current Udc/R and brake ratio
ED.



4.2 Efficiency of duty (EU)



4.3 How to select braking resistor to match braking unit

ED 20 % Braking chopper voltage = 660 vdc. Suitable applications include elevators (less than 10 floors) and crane trolley.

Drive Power	Type	Quantity of Braking Unit	Resistor	Quantity of Resistor	Braking torque	Usage	Resistance form
30	CTB-4X01-0300	1	6000 W / 22 Ω	1	100 %	20 %	Braking resistor box
37	CTB-4X02-0550	1	7500 W / 18 Ω	1	100 %	20 %	
45		1	9000 W / 18 Ω	1	100 %	20 %	
55		1	10 kW / 12 Ω	1	100 %	20 %	
75	CTB-4X02-0750	1	15 kW / 9 Ω	1	100 %	20 %	
90	CTB-4X03-1100	1	18 kW / 7.5 Ω	1	100 %	20 %	
110		1	20 kW / 6 Ω	1	100 %	20 %	
132	CTB-4X04-2000	1	26 kW / 5 Ω	1	100 %	20 %	
160		1	30 kW / 4.2 Ω	1	100 %	20 %	
187		1	35 kW / 3.6 Ω	1	100 %	20 %	
200	CTB-4X04-2800	1	40 kW / 3.35 Ω	1	100 %	20 %	Braking resistor cabinet
220		1	45 kW / 3 Ω	1	100 %	20 %	
250		1	50 kW / 2.68 Ω	1	100 %	20 %	
280		1	55 kW / 2.4 Ω	1	100 %	20 %	
315	CTB-4X04-4500	1	60 kW / 2.12 Ω	1	100 %	20 %	
350		1	70 kW / 2 Ω	1	100 %	20 %	
400		1	80 kW / 1.68 Ω	1	100 %	20 %	
500	CTB-4X04-2800	2	100 kW / 1.35 Ω	1	100 %	20 %	
630	CTB-4X04-4500	2	130 kW / 1 Ω	1	100 %	20 %	

ED 30 % Braking activation voltage = 660 vdc. Suitable applications include elevator (less than 20 floors).

Drive Power	Type	Quantity of Braking Unit	Resistor	Quantity of Resistor	Braking torque	Usage	Resistance form
30	CTB-4X02-0550	1	9000 W / 18 Ω	1	120 %	30 %	Braking resistor box
37		1	11 kW / 15 Ω	1	120 %	30 %	
45		1	13.5 kW / 12 Ω	1	120 %	30 %	
55		1	16 kW / 10 Ω	1	120 %	30 %	
75	CTB-4X02-0750	1	22 kW / 7.5 Ω	1	120 %	30 %	
90	CTB-4X04-1100	1	27 kW / 6.2 Ω	1	120 %	30 %	
110		1	33 kW / 5 Ω	1	120 %	30 %	
132	CTB-4X04-2000	1	40 kW / 4.2 Ω	1	120 %	30 %	Braking resistor cabinet
160	CTB-4X04-2800	1	48 kW / 3.5 Ω	1	120 %	30 %	
187		1	55 kW / 3 Ω	1	120 %	30 %	
200		1	60 kW / 2.8 Ω	1	120 %	30 %	
220		1	65 kW / 2.5 Ω	1	120 %	30 %	
250	CTB-4X04-4500	1	75 kW / 2.3 Ω	1	120 %	30 %	
280		1	85 kW / 2 Ω	1	120 %	30 %	
315		1	95 kW / 1.8 Ω	1	120 %	30 %	
350		1	105 kW / 1.6 Ω	1	120 %	30 %	
400	CTB-4X04-2800	2	120 kW / 1.4 Ω	1	120 %	30 %	
500	CTB-4X04-4500	2	150 kW / 1.2 Ω	1	120 %	30 %	
630		2	190 kW / 0.9 Ω	1	120 %	30 %	

ED 40 % Braking activation voltage = 660 vdc. Typical applications include elevators (more than 30 floors) and main hook for light cranes.

Drive Power	Type	Quantity of Braking Unit	Resistor	Quantity of Resistor	Braking torque	Usage	Resistance form
30	CTB-4X02-0750	1	12 kW / 15 Ω	1	150 %	40 %	Braking resistor box
37		1	15 kW / 12 Ω	1	150 %	40 %	
45	CTB-4X03-1100	1	18 kW / 9.9 Ω	1	150 %	40 %	
55	CTB-4X04-1100	1	22 kW / 8.1 Ω	1	150 %	40 %	
75		1	30 kW / 6 Ω	1	150 %	40 %	
90		1	36 kW / 5 Ω	1	150 %	40 %	
110	CTB-4X04-2000	1	45 kW / 4.1 Ω	1	150 %	40 %	Braking resistor cabinet
132	CTB-4X04-2800	1	55 kW / 3.4 Ω	1	150 %	40 %	
160		1	65 kW / 2.8 Ω	1	150 %	40 %	
187		1	75 kW / 2.4 Ω	1	150 %	40 %	
200	CTB-4X04-4500	1	80 kW / 2.3 Ω	1	150 %	40 %	
220		1	90 kW / 2.1 Ω	1	150 %	40 %	
250		1	100 kW / 1.8 Ω	1	150 %	40 %	
280		1	110 kW / 1.6 Ω	1	150 %	40 %	
315	CTB-4X04-2800	2	130 kW / 1.4 Ω	1	150 %	40 %	
350		2	140 kW / 1.28 Ω	1	150 %	40 %	
400	CTB-4X04-4500	2	160 kW / 1.15 Ω	1	150 %	40 %	
500		2	200 kW / 0.9 Ω	1	150 %	40 %	
630		3	260 kW / 0.72 Ω	1	150 %	40 %	

NOTE

For port crane applications or other applications requiring a high frequency of stops, resulting in ED of greater than 60 % please contact your supplier.

5 Installation and Wiring

5.1 Internal terminals and wiring diagrams

Figure 5-1 Terminals for CTB-4X01-0300

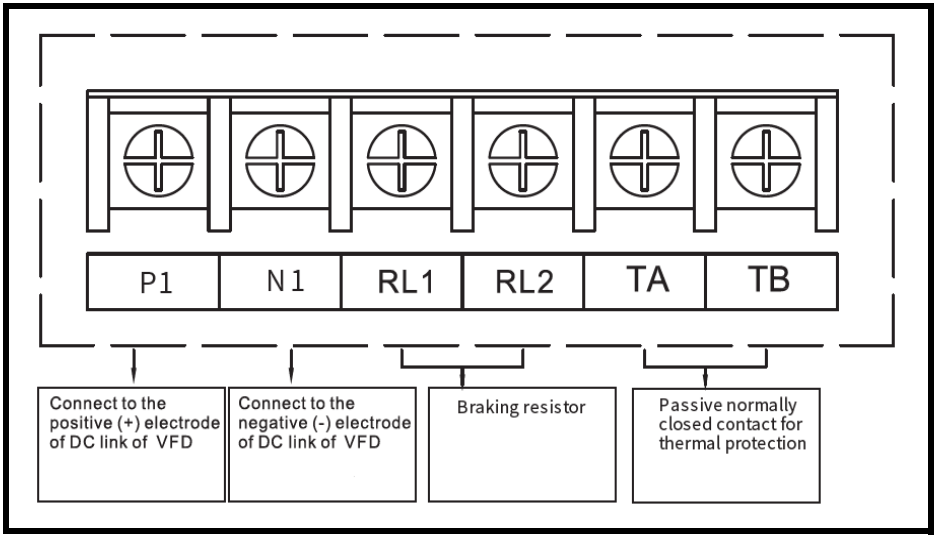


Figure 5-2 Wiring diagram for CTB-4X01-0300

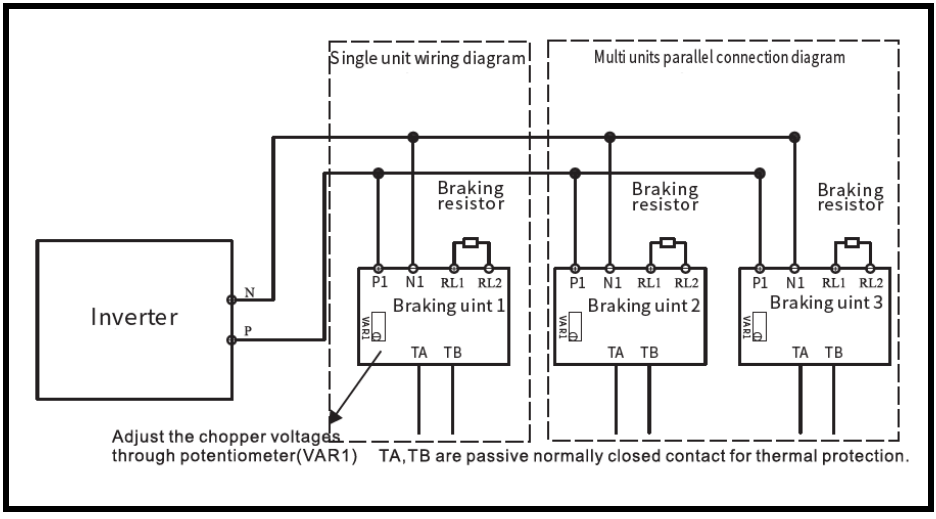


Figure 5-3 Terminal for CTB-4X02-0550, CTB-4X02-0750

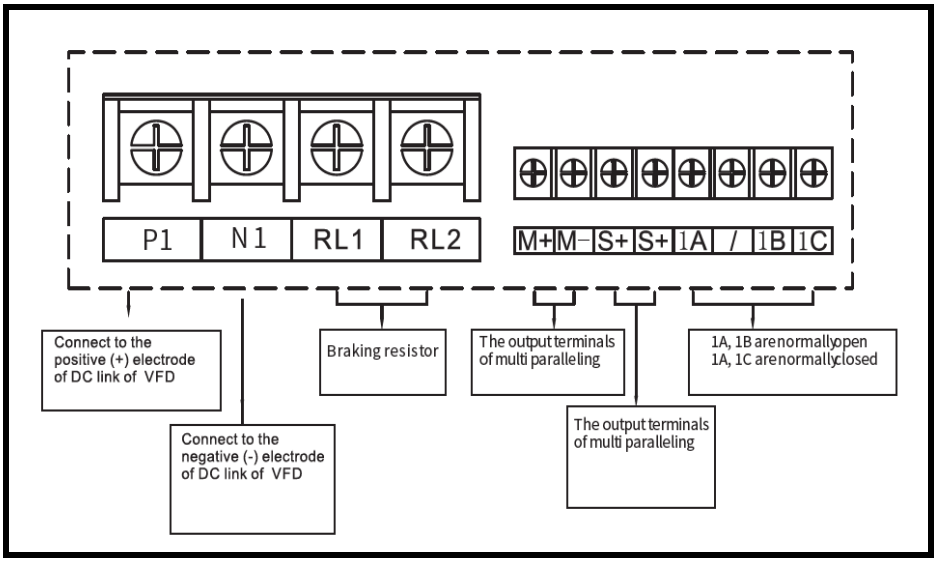


Figure 5-4 Wiring diagram for CTB-4X02-0550, CTB-4X02-0750

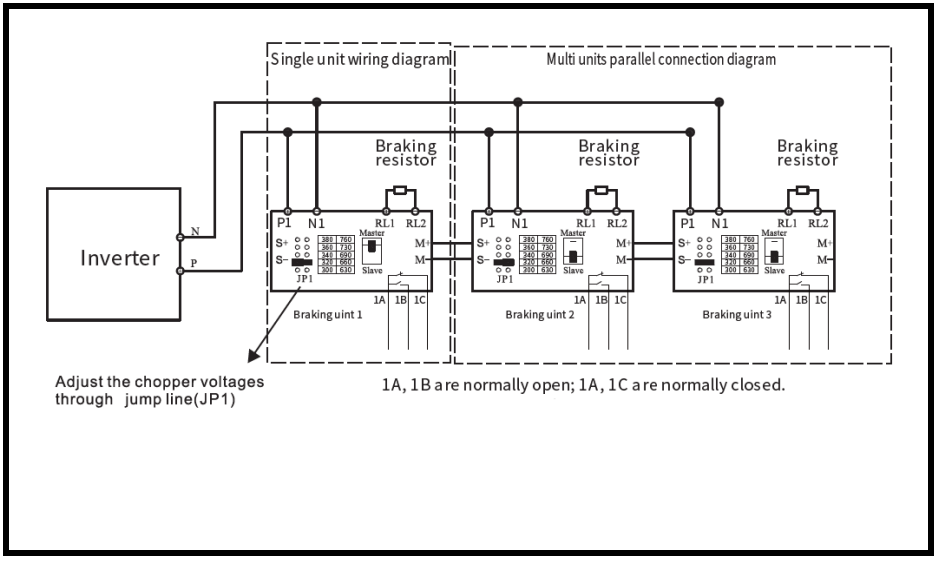


Figure 5-5 Terminals for CTB- 4X0 3-1100, CTB-4X04-1100,CTB-4X04-2000, CTB-4X04-2800, CTB-4X04-45Wiring diagram for 00

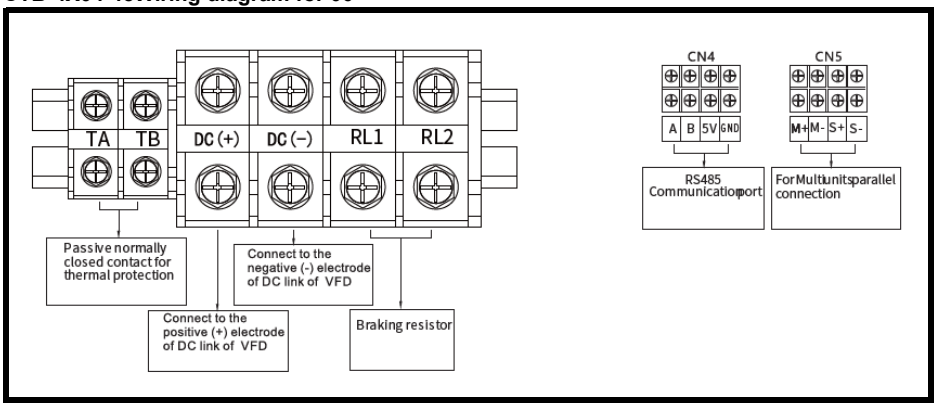
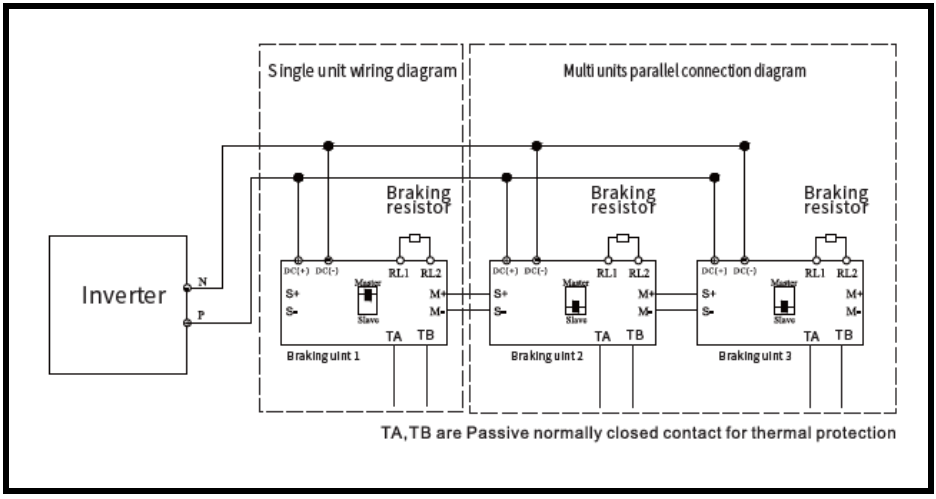


Figure 5-6 Wiring diagram for CTB-4X03-1100, CTB-4X04-1100, CTB-4X04-2000, CTB-4X04-2800, CTB-4X04-4500



5.2 Safety precautions & installation environment

Safety

Braking unit are working at high DC voltage, wrong operation & installation may cause human injury and financial loss.

When doing installation and wiring, remove the power supply of VFD and WAIT 5 ~10 MINUTES,to allow the VFD build in capacitors to fully discharge. If the red led is on then the dc bus voltage has not discharged and touching the terminals must be avoided.

Heat radiation

The braking unit and associated braking resistor generates heat when working and should be kept away from explosive or flammable items. Proper ventilation space should be left for radiation, minimum size, 100 mm up & down, 30 mm left & right.

Please install the unit on the metal board, when more than two Braking unit installed in one control cabinet, please install cooling fan and make sure air inlet temperature ≤ +40 °C.

Grounding

Ground connection is to prevent damage due to current leakage and malfunction and reduce interference between equipment.

Cable

Insulation grade and cross-section that meet the local wiring standards must be selected. Suggest using Heat-resisting flexible cable or flame-retardant cable.

Protection

Please add over heat protection device for the load resistor when installing Braking unit, in case IGBT problem create high current and damage the VFD or cause fire danger.

Environment Requirement

This device will have best performance & service life under below condition.
Indoor Aplication +14 °F to 104 °F (-10 °C to +40 °C) No frost; Humidity 90 % RH.
Vibration 1 G at 10-20 Hz, 0.2 G at 20-50 Hz.
No solids; No corrosive gas; No metal powder.
This device is NOT EXPLOSION PROOF IP20 protection class.

5.3 Operation Instruction

Check cable wiring before power on (wrong wiring for + and - may cause damage to the drive and braking unit) Check if terminals are fixed tightly.

Please refer to diagrams above for parallel connection, after connect the signal cable between master unit and slave unit, put the N pin at SLAVE position of the Unit 2.



- Do not touch the Braking unit after power on, high voltage shock risk.

Reference table for chopper voltage range of our braking unit

Voltage grade	Default chopper voltage	Chopper voltage range
400 V	DC660 V ±5 V	600 - 760 V

5.4 Setting method for the chopper voltages of braking units without keyboard

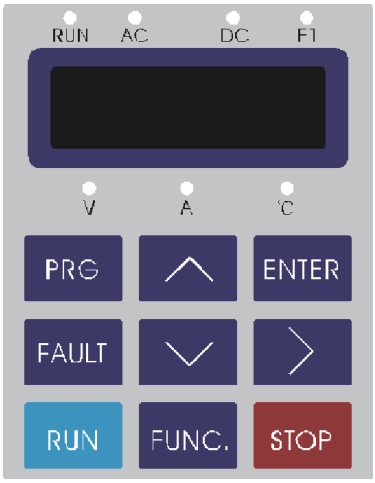
The chopper voltages are factory set to the suitable values, it is unnecessary to modify the values in case of normal working situation.

To set chopper voltage it is necessary to remove braking module cover. The braking unit has five working range (300/630 V, 320/660 V, 340/690 V, 360/730 V, 380/760 V), put the pin at the closed position to your power grid (default set 320/660 V).

then adjust the chopper voltages through potentiometer (VAR1) or jump line (JP1) on the control panel.

5.5 Keypad description. Only for braking units with keypad

Light	Function
DC	Running status monitoring
V	Data checking status
AC	Device ready for work
RUN	Device running
A	Device fault, running problem
F1	Keyboard lock



5.6 LED display

Different codes will show to indicate current status.

5.7 Keyboard button description

Button	Function
PRG	Shift between "Running monitoring" "data checking" status, hold button for 2 sec for status display
▲	To add value of the parameter, hold to increase continuously
▼	To reduce value of the parameter, hold to decrease continuously
ENTER	Read or save set data
FAULT	Page turning forward, hold for continuously
RUN	Page turning backward, hold for continuously
STOP	When device malfunction, press button for restart
FUNC.	Function 1: Hold 2 sec. for locking and unlocking the keyboard; function 2: changing parameter when setting

5.8 Common keyboard operation

Operation	Method
Shift display status	Press "PRG"
Change monitor item	Press "FAULT" or "RUN" to change
Read monitor item data	Monitor status, after data changed, system will show current data after one sec. Press "ENTER" to review current data immediately to cross check with setting data
Review data	Press "FAULT" or "RUN" during data view status
Read setting data	Press "ENTER" during data setting page
Change setting parameter	During parameter setting status press "ENTER", data will flash, press "▼" or "▲" to change value, press "FUNC." can change flash position to edit. After finish editing, press "ENTER" to save.
Save setting	Press "ENTER" during setting status

5.9 Monitor data description

Code	Units	Monitor content
C1000	V	Current DC input voltage
C1001	°C	Current temperature inside unit

5.10 Setting data description

Code	Function	Unit	Range/ Default value	Change
D1000	Voltage	V (AC)	Depending on model	N/A
D1001	Chopper voltage	V (DC)		Allowed

NOTE

Default chopper voltage and Chopper voltage range see the table on page 23.

5.11 Example of keyboard operation (setting chopper voltage)

Press FUNC.and hold 2 sec.(Unlock the keyboard, F1 indicator goes off) ⟶ Press PRG (display C1000) ⟶ Press PRG again (display D1000) ⟶ Press FAULT (display D1001) ⟶ Press ENTER (display default chopper voltage) ⟶ Press ▲ or ▼ (modify chopper voltage) ⟶ Press ENTER (Save the setting) ⟶ Press PRG (Display the current bus voltage) ⟶ Press FUNC.and hold 2 sec. (Lock the keyboard).

5.12 Wiring recommendations

Wiring access	Lead wire should be through the hole on the bottom of the Braking unit.
Unit isolation from signal line	Because of harmonic and noise created by unit, the DC side cable should be stranded to reduce radiation and inductance. Signal cable nearby should be shielded.
Wire connection distance	The cable between VFD and Braking unit should less than 5 Meters. Enclosure (aluminum radiator) should be grounded securely.

5.13 Faults & Solutions

Problem	Solution
Braking unit power light is on, but braking unit is not working.	Please remove control panel, check if the Pin position on MASTER (for single usage, must put on MASTER position).
When braking unit inactive, resistor temperature very high.	IGBT of the braking unit is broken, please change new braking unit.



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