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## Basic Characteristics Data

| Model | Circuit method | Switching frequency [kHz] | Input current [A] | Rated input fuse | Inrush current protection | PCB/Pattern | | | Series/Parallel operation availability | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Material | Single sided | Double sided | Series operation | Parallel operation |
| P15E | Flyback converter | 45 - 340 | 0.3 | 250V 2A | Thermistor | CEM-1 | Yes | | Yes ✻1 | ✻1 |
| P30E | Flyback converter | 45 - 400 | 0.6 | 250V 3A | Thermistor | CEM-1 | Yes | | Yes ✻1 | ✻1 |
| P50E | Flyback converter | 65 - 350 | 1.2 | 250V 3A | Thermistor | CEM-1 | Yes | | Yes ✻1 | ✻1 |
| P100E | Forward converter | 200 | 2.2 | 250V 5A | Triac | CEM-1 | Yes | | Yes | ✻1 |
| P150E | Forward converter | 200 | 3.2 | 250V 6.3A | Triac | FR-4 | | Yes | Yes | ✻1 |
| P300E | Forward converter | 300 | 5.5 | 250V 15A | Triac | FR-4 | | Yes | Yes | Yes |
| P600E | Forward converter | 210 | 11 | 250V 20A | Triac | FR-4 | | Yes | Yes | Yes |
| P1500E | Forward converter | 150 | 29 | 250V 50A | SCR | FR-4 | | Yes | Yes | Yes |
| PT1500U | Forward converter | 140 | 6 | 250V 20A | SCR | FR-4 | | Yes | Yes | Yes |

✻1 Refer to Instruction Manual.
✻ Switching frequency of flyback converter depends on input voltage and load factor.
✻ The value of input current is at ACIN100V and rated load (As for PT1500U, ACIN200V and rated load).



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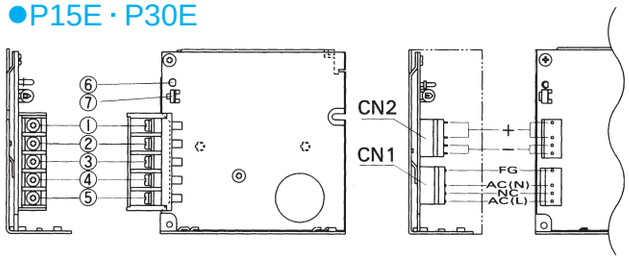
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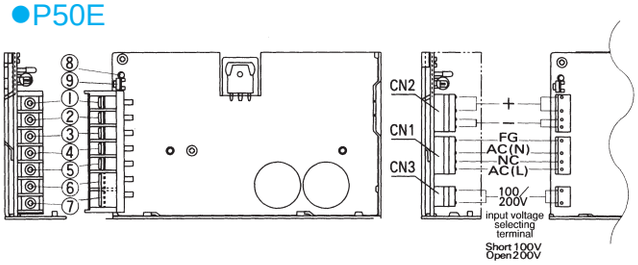
# 1 Terminal Block

## ●P15E · P30E



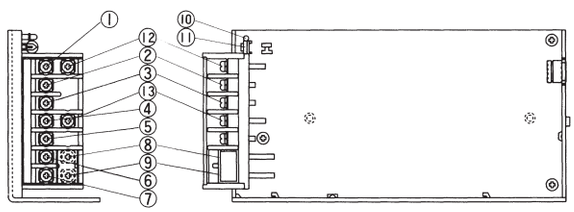

①+Output
②-Output
③Frame ground
④AC(N)
⑤AC(L)
⑥LED
⑦Output voltage adjustable potentiometer

## ●P50E



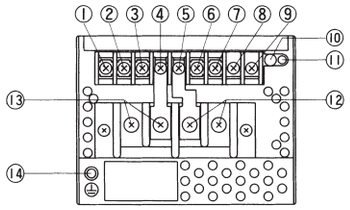

①+Output
②-Output
③Frame ground
④AC(N)
⑤AC(L)
⑥ } Input voltage selecting terminal ⑦ Short: AC 85 - 132V Open: AC170 - 264V
⑧LED
⑨Output voltage adjustable potentiometer

## ●P100E · P150E



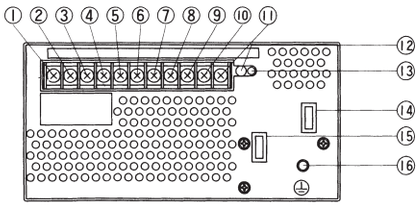

①②+Output
③④-Output
⑤Frame ground
⑥AC(L)
⑦AC(N)
⑧ } Input voltage selecting terminal ⑨ Short: AC 85 - 132V Open: AC170 - 264V
⑩LED
⑪Output voltage adjustable potentiometer
⑫+Remote sensing(+S)
⑬-Remote sensing(-S)

## ●P300E



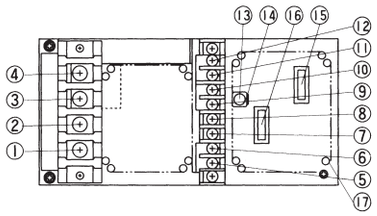

①AC(L)
②AC(N)
③Frame ground
④-Remote sensing(-S)
⑤+Remote sensing(+S)
⑥Current balance(CB)
⑦Voltage balance(VB)
⑧Remote ON/OFF(RCG)
⑨Remote ON/OFF(RC)
⑩Output voltage adjustable potentiometer
⑪LED
⑫+Output
⑬-Output
⑭Frame ground

## ●P600E




①AC(L)
②AC(N)
③Frame ground
④Remote ON/OFF(RCG)
⑤Remote ON/OFF(RC)
⑥Current balance(CB)
⑦Voltage balance(VB)
⑧-Remote sensing(-S)
⑨-Output voltage monitoring(-M)
⑩+Output voltage monitoring(+M)
⑪+Remote sensing(+S)
⑫Output voltage adjustable potentiometer
⑬LED
⑭+Output
⑮-Output
⑯Frame ground

## ●P1500E

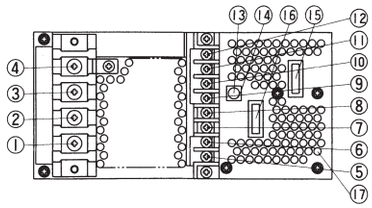



①AC(N)
②AC(L)
③ } Input voltage ④ selecting terminal Short: AC85 - 132V Open: AC170 - 264V
⑤Remote ON/OFF(RCG)
⑥Remote ON/OFF(RC)
⑦Current balance(CB)
⑧Voltage balance(VB)
⑨-Remote sensing(-S)
⑩-Output voltage monitoring(-M)
⑪+Output voltage monitoring(+M)
⑫+Remote sensing(+S)
⑬Output voltage adjustable potentiometer
⑭LED
⑮+Output
⑯-Output
⑰Frame ground



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●PT1500U




①AC(L3)
②AC(L2)
③AC(L1)
④Frame ground
⑤Remote ON/OFF(RCG)
⑥Remote ON/OFF(RC)
⑦Current balance(CB)
⑧Voltage balance(VB)
⑨-Remote sensing(-S)
⑩-Output voltage monitoring(-M)
⑪+Output voltage monitoring(+M)
⑫+Remote sensing(+S)
⑬Output voltage adjustable potentiometer
⑭LED
⑮+Output
⑯-Output
⑰Frame ground

# 2 Function

## 2.1 Input voltage range

### ●P15E · P30E

■The range is from AC85V to AC264V or DC110V to DC370V.

■AC input voltage must have a range from AC85V to AC264V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.

■In cases that conform with safety standard, input voltage range is AC100-AC240V(50/60Hz).

### ●P50E · P100E · P150E · P1500E

■The range is from AC 85V to AC132V or AC170 to AC264V (User selectable).

■By changing the input voltage selector (short or open), either AC100V or AC200V is possible.

・Short —— AC85V to AC132V

・Open —— AC170V to AC264V or DC220V to DC370V

■If the wrong connection is made for short/open, the power supply may be damaged. The input voltage should be within the above range.

■In cases that conform with safety standard, input voltage range is AC100-AC120V, AC200-AC240V(50/60Hz).

### ●P300E · P600E

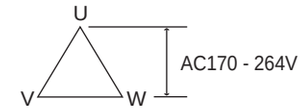
■The range is from AC85V to AC132V/AC170V to AC264V which is automatically selected internally. But after the input voltage is applied, avoid changing AC100V↔AC200V.

■AC input voltage must have a range from AC85V to AC132V/AC170V to AC264V for normal operation. If the wrong input is applied, the unit will not operate properly and/or may be damaged.

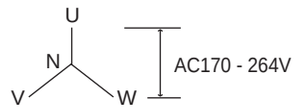
■In cases that conform with safety standard, input voltage range is AC100-AC120V, AC200-AC240V(50/60Hz).

### ●PT1500U

■The range is from AC170V to AC264V by 3 phase.




Delte connection




Star connection

■"Open Phase Protection" for three phases input circuit is built-in. If the failure condition(open phase)continues over 5 sec., the unit shuts down. AC recycling should be carried out after 3 1/2 minutes to recover the output voltage automatically.

■In cases that conform with safety standard, input voltage range is AC200-AC240V(50/60Hz).

## 2.2 Inrush current limiting

■Inrush current limiting is built-in.

■If a switch on the input side is installed, it has to be the one handling the input inrush current.

### ●P15E · P30E · P50E

■The thermistor is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time for power supply to cool down.

### ●P100E · P150E · P300E · P600E · P1500E PT1500U

■The thyristor technique is used for protection from inrush current. When power is turned ON/OFF repeatedly within a short period of time, it is necessary to have enough time between power ON and OFF to operate resistance circuit for inrush current.

## 2.3 Overcurrent protection

### ●P15E · P30E · P50E · P100E · P150E P300E · P600E

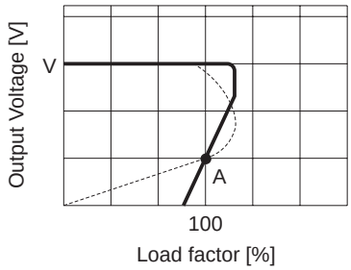
■Overcurrent protection is built-in and comes into effect at over 105% of the rated current. Overcurrent protection prevents the unit from short circuit and overcurrent condition of less than 20 sec. The unit automatically recovers when the fault condition is cleared.



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### ●P15E · P30E · P50E

■The power supply which has a current foldback characteristics may not start up when connected to nonlinear load such as lamp, motor or constant current load. See the characteristics below.




——: Load characteristics of power supply.
---------: Characteristics of load (lamp, motor, constant current load, etc.)
Note: In case of nonlinear load, the output is locked out at A point.

Fig.2.1 Current foldback characteristics

### ●P1500E · PT1500U

■Overcurrent protection is built-in and comes into effect at over 105% of the rated current. Output power is shut down if overcurrent condition continues more than 5 sec. The fault condition needs to be removed, and AC input should be shut down. The minimum interval of AC recycling for the recovery is 2 1/2 minutes(3 1/2 for PT1500U).

## 2.4 Overvoltage protection

■The overvoltage protection circuit is built-in and comes into effect at 115 - 140% of the rated voltage.
The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is 1 1/2 minutes to 3 1/2 minutes.
✱ The recovery time varies depending on input voltage.

Remarks:
Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail.In case of operating a motor etc. , please install an external diode on the output terminal to protect the unit.

## 2.5 Output voltage adjustment range

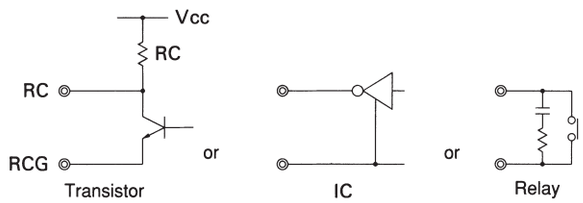
■Adjustment of output voltage is possible by using potentiometer.
■Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.
■When potentiometer is over-turned clockwise, overvoltage protection function activates. To set up output voltage, first turn potentiometer counterclockwise to the end, then turn back clockwise gradually until reaching the level of required voltage.

## 2.6 Remote ON/OFF

### ●P300E · P600E · P1500E · PT1500U

■Remote ON/OFF circuit (RC, RCG) is isolated from input, output and FG.
Between RC and RCG: Output voltage is ON at ”Low” level or short circuit (0 - 0.8V).
Between RC and RCG: Output voltage is OFF at ”High” level or open circuit (2.7 - 5.0 V).

Connection example:




When RC terminal is ”Low” level, fan out current is 1mA typ. When Vcc is applied, use 5V ≦ Vcc ≦ 24V. When remote ON/OFF function is not used, please short between RC and RCG terminals.

## 2.7 Remote sensing

### ●P100E · P150E · P300E · P600E · P1500E PT1500U

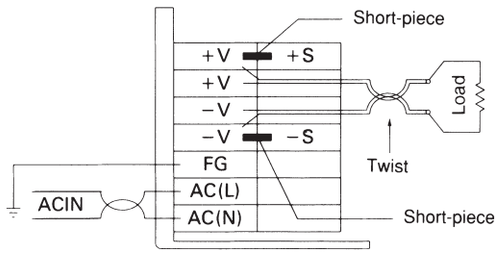
■When not using this function, confirm that terminals are shorted between +S and +V, and between -S and -V with short pieces. For P600E, P(T)1500 model, connect between +S and +M, and between -S and -M.
■When using this function, wiring should be done without short pieces.
■Devices inside power supply might be damaged when poor connection on load lines occurs, e.g. because of loose connector screws.
■Thick wire should be used for wiring between power supply and load, and line voltage drop should be less than 0.3V.
■When long sensing wire is required, use C1, C2 and C3.
■Please do not draw output current from +M, -M terminal (P600E, P1500E, PT1500U).
■Maximum current per a terminal is 15A, and when current exceeds more than 15A, two terminals are required (P100E, P150E).
■Twisted-pair wire or shield wire should be used for sensing wire.
■When remote sensing function is used, output voltage might become unstable because of a impedance of wiring and load condition. And the power supply should be evaluated enough. Following are examples to improve it.
✱ -S sensing wire is removed and terminals between -M and -S are shorted.
✱ C1, C2, C3 and R1 are connected as above figure.



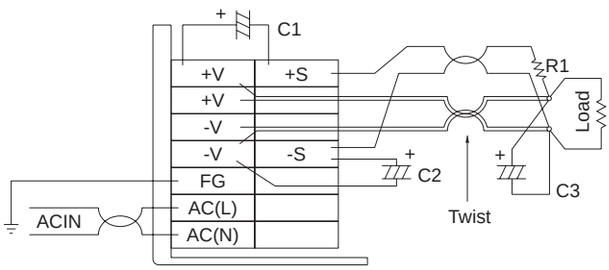
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## ●P100E · P150E

(1)When not using remote sensing function

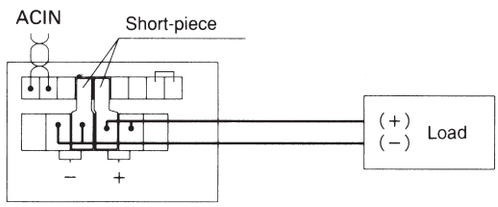



(2)When using remote sensing function

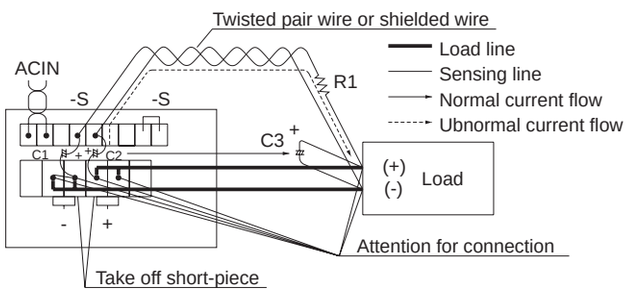



## ●P300E

(1)When not using remote sensing function

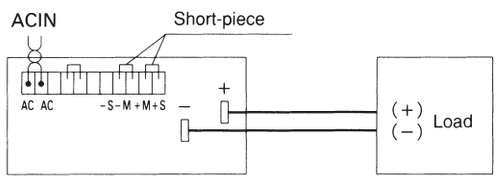



(2)When using remote sensing function

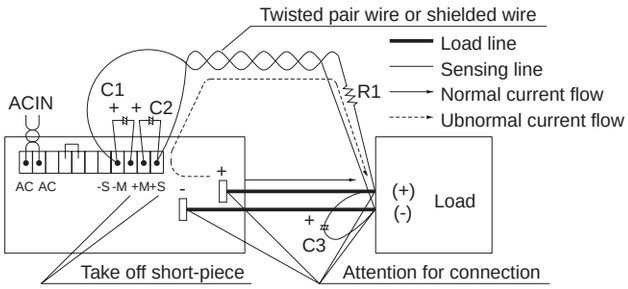



## ●P600E

(1)When not using remote sensing function

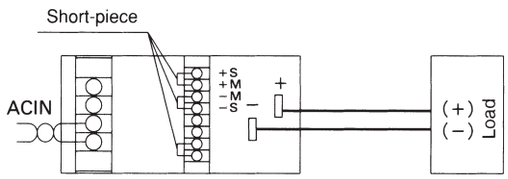



(2)When using remote sensing function

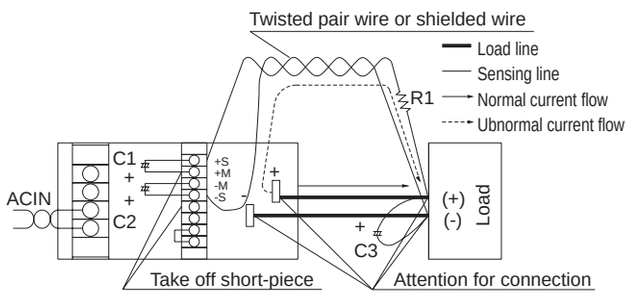



## ●P1500E · PT1500U

(1)When not using remote sensing function




(2)When using remote sensing function




## 2.8 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase(decrease)the voltage for the start(shut down). A void using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON/OFF of a timer.

If the unit is tested on the isolation between input & output and output & FG, remote ON/OFF must be shorted to output.

## 2.9 Thermal protection

### ●P1500E · PT1500U

■Thermal protection is built-in. If this function comes into effect, shut down the output, eliminate all possible causes of overheating, and drop the temperature to normal level. Output voltage recovers after applying input voltage. To prevent the unit from overheating, avoid using the unit in a dusty, poorly ventilated environment.



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## 2.10 Internal fan stop function

■Forced air cooling is performed by internal fan, so avoid poorly ventilated environment and avoid closing air flow holes.

■When unit operates at dusty place, attach air-filter to avoid dust into the unit. In this case, avoid poorly ventilated environment.

■When internal fan stops, the output stops. To keep the reliability of unit, periodic maintenance of the fan is preferable.

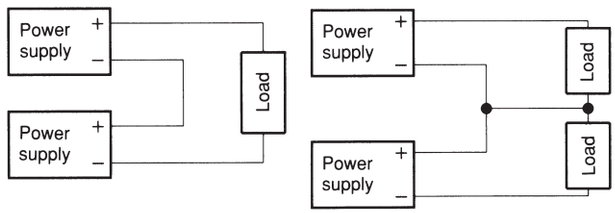
# 3 Series Operation and Parallel Operation

## 3.1 Series operation

■Series operation is available by connecting the outputs of two or more power supplies, as shown below.

Output current in series connection should be lower than the lowest rated current in each unit.

(a) (b)

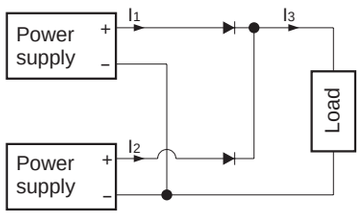



## 3.2 Parallel operation/master-slave operation

### ●P15E · P30E · P50E · P100E · P150E

■Parallel operation is not possible.

■Redundancy operation is available by wiring as shown below.




■Even a slight difference in output voltage can affect the balance between the values of $I_1$ and $I_2$.

Please make sure that the value of $I_3$ does not exceed the rated current of a power supply.

$I_3 \leqq$ the rated current value

### ●P300E · P600E · P1500E · PT1500U

■Parallel operation is available by connecting the units as shown below.

■As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current at parallel operation)
= (the rated current per unit) × (number of unit) × 0.9

When the number of units in parallel operation increases, input current increases at the same time.
Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

In parallel operation, the maximum operative number of units is 5.

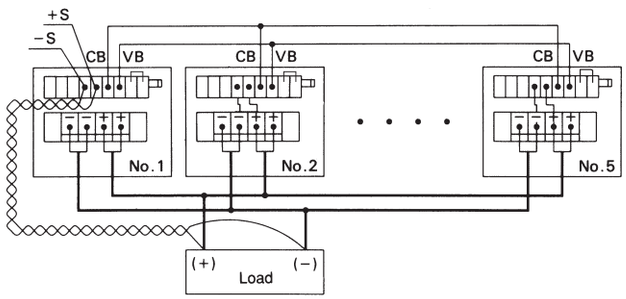
■Output voltage in parallel operation is adjustable by using the potentiometer of the ”master” unit.

Select one power supply to be the master, and turn the potentiometer of the other, ”slave” power supplies, clockwise to the end. Then use the potentiometer of the mater to adjust output voltage.

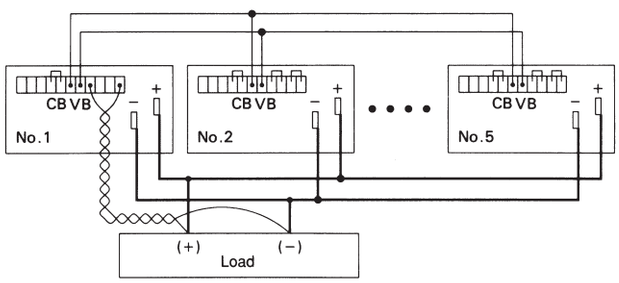
■When remote sensing is used in parallel operation, the sensing wire must be connected ONLY to master.

Terminals +S & +M and -S & -M of ”slave” power supplies must be shorted.

### ●P300E



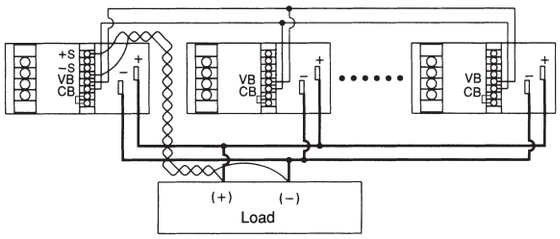

### ●P600E



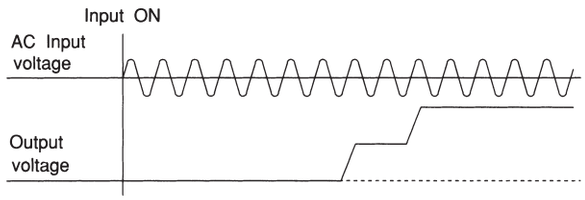



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●P1500E · PT1500U

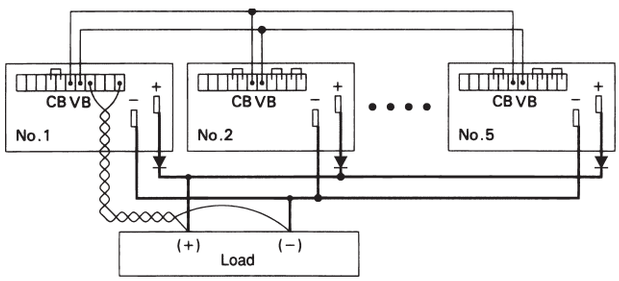



■In parallel operation, output voltage increases like stairs due to a delay of the rise time of output voltage at turn on.

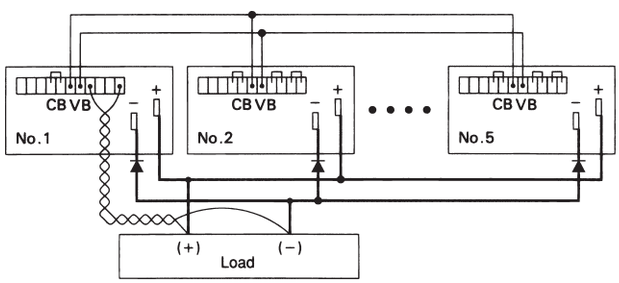



■In parallel operation, please connect diode to the + side of the output circuit. If diode is connected to the -side, it will damage the unit or/and, the balancing function will not work.

●P600E (Example)




YES




NO

# 4 Assembling and Installation Method

## 4.1 Installation method

●P15E · P30E · P50E · P100E · P150E

■When two or more power supplies are used side by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

●P300E · P600E · P1500E · PT1500U

■Fan for forced cooling is built-in. Do not block the ventilation at suction side (terminal block side) and its opposite side.

■When unit operates at dusty place, attach air-filter to avoid dust into the unit. In this case, avoid poorly ventilated environment.

■When internal fan stops, thermal protection circuit works which stops the output (P1500E, PT1500U). To keep reliability of the unit, periodic maintenance of the fan is required.

■The expected life time of fan is different by operating condition.

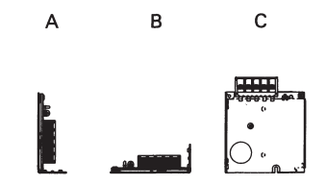
## 4.2 Derating

■The operative ambient temperature is different by with/without case cover or mounting position. Please refer drawings as below.

■When unit mounted except below drawings, it is required to consider ventilated environment by forced air cooling or temperature/load derating. For details, please consult our sales or engineering departments.

●P15E

(1)Mounting method

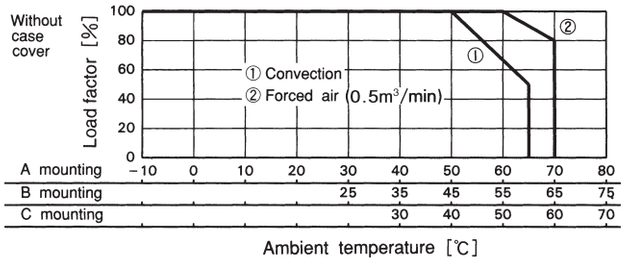


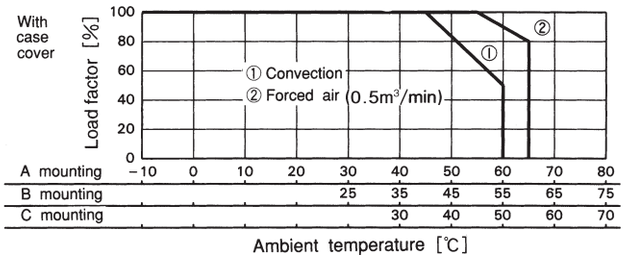

Normal position



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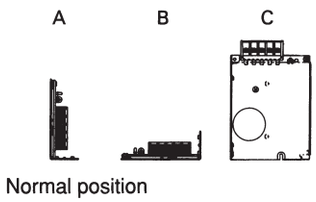
(2)Derating curve



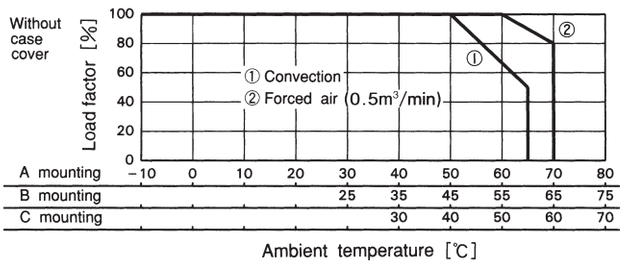



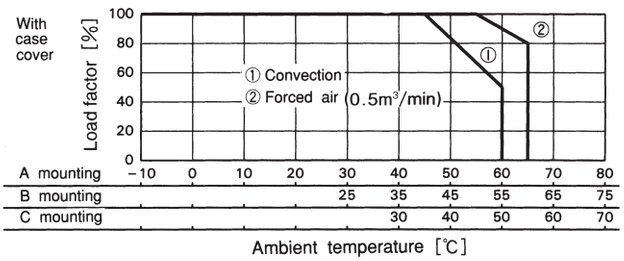

## ●P30E

(1)Mounting method



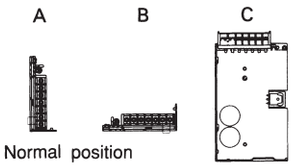

(2)Derating curve



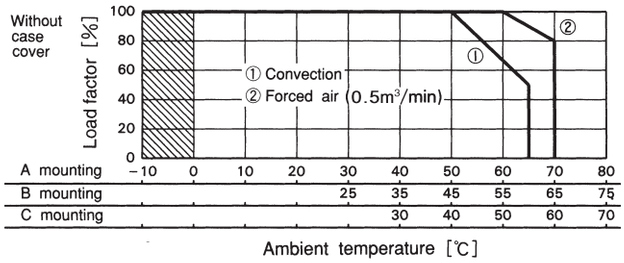



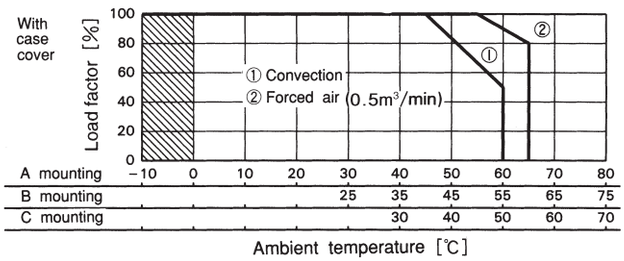

## ●P50E

(1)Mounting method



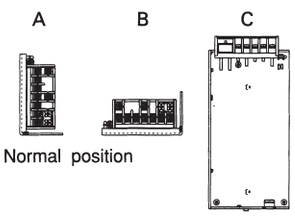

(2)Derating curve



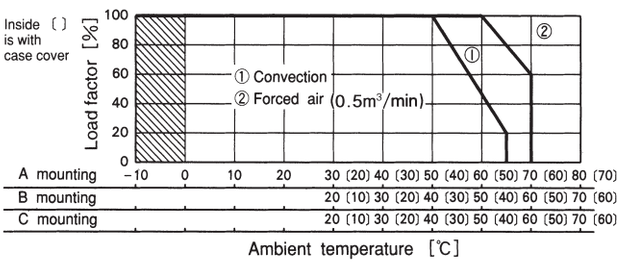




## ●P100E

(1)Mounting method




(2)Derating curve




Note:

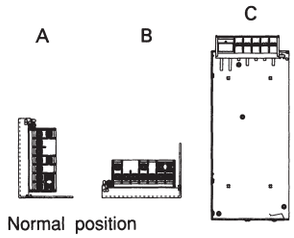
In the hatched area, the specification of Ripple, Ripple Noise is different from other area.



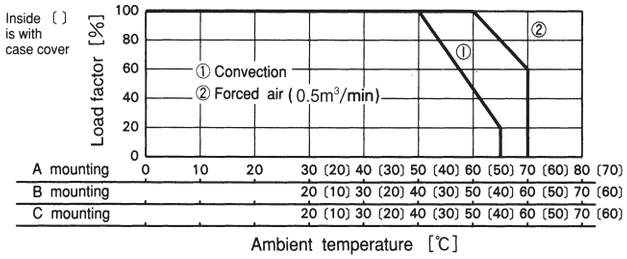
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## ●P150E

(1)Mounting method

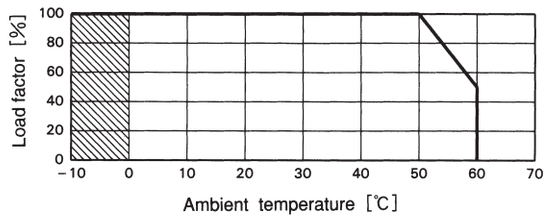



(2)Derating curve



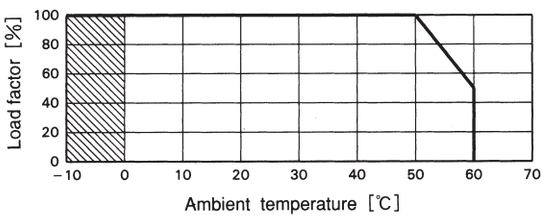

## ●P300E

Derating curve



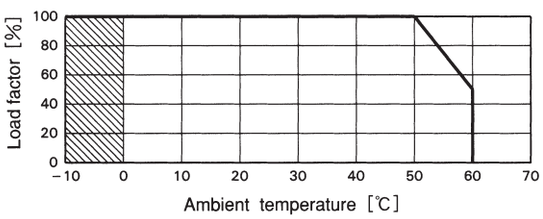

## ●P600E

Derating curve



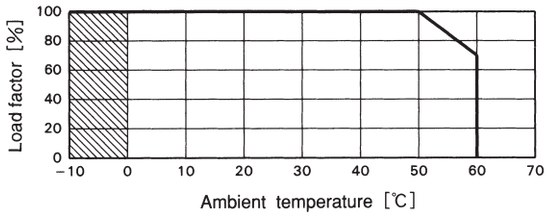

## ●P1500E

Derating curve




## ●PT1500U

Derating curve

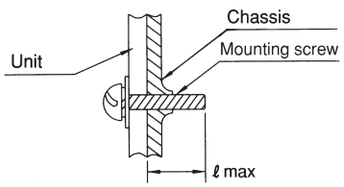



Note:

In the hatched area, the specification of Ripple, Ripple Noise is different from other area.

## 4.3 Mounting screw

■Keep isolation distance between screw and internal components as below chart.




Unit:[mm]

| Model | ℓ max | Model | ℓ max |
|---|---|---|---|
| P15E | 6 | P300E | 8 |
| P30E | 6 | P600E | 8 |
| P50E | 6 | P1500E | 8 |
| P100E | 8 | PT1500U | 8 |
| P150E | 8 | | |



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