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# 1 Functions

## 1.1 Input Voltage Range

■ Input voltage range of the power supplies is from AC85V to AC264V or DC (please see SPECIFICATIONS for details).

■ If input value doesn't fall within above range, a unit may not operate in accordance with specifications and/or start hunting or operate protection circuit or fail.

If you need to apply a square waveform input voltage, which is commonly used in UPS and inverters, please contact us.

■ When the input voltage changes suddenly, the output voltage accuracy might exceed the specification. Please contact us.

■ To comply with safety standards, input voltage range is shown in Table 1.1.

Table 1.1 Input voltage range of safety standards

| No. | Series             | Input Voltage range    |          |
|-----|--------------------|------------------------|----------|
|     |                    | AC input               | DC input |
| 1   | KHEA30F, KHNA30F   | 100V-240V<br>(50/60Hz) | 88V-250V |
| 2   | KHEA60F, KHNA60F   |                        |          |
| 3   | KHEA90F, KHNA90F   |                        |          |
| 4   | KHEA120F, KHNA120F |                        | 88V-350V |
| 5   | KHEA240F, KHNA240F |                        |          |
| 6   | KHEA480F, KHNA480F |                        |          |

### ● KHEA30F/60F/90F, KHNA30F/60F/90F

■ Operation stop voltage is set at a lower value than of a standard version (derating is needed).

· Use Conditions

|                  | Output |
|------------------|--------|
| KHEA30F, KHNA30F | 10W    |
| KHEA60F, KHNA60F | 20W    |
| KHEA90F, KHNA90F | 30W    |

Input AC50V or DC70V  
Duty 1s/30s

\*Please avoid using continuously for more than 1 second under above conditions. Doing so may cause a failure.

## 1.2 Inrush Current Limiting

■ An inrush current limiting circuit is built-in.

■ If you need to use a switch on the input side, please select one that can withstand an input inrush current.

### ● KHEA30F/60F/90F/120F, KHNA30F/60F/90F/120F

■ Thermistor is used in the inrush current limiting circuit. When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that a power supply cools down before being turned on.

### ● KHEA240F/480F, KHNA240F/480F

■ Thyristor technique (KHEA/KHNA240F) and power relay technique (KHEA/KHNA480F) is used in the inrush current limiting circuit.

■ When you turn the power ON/OFF repeatedly within a short period of time, please have enough intervals so that the inrush current limiting circuit becomes operative.

■ When the switch of the input is turned on, the primary inrush current and secondary inrush current will be generated.

## 1.3 Overcurrent Protection

### ● KHEA30F/60F/90F, KHNA30F/60F/90F

■ An overcurrent protection circuit is built-in and activated over 105% of the rated current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.

■ Hiccup Operation Mode (except KHEA/KHNA90F)

When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes hiccup so that the average current will also decrease.

■ Output Voltage Shutdown

If the output voltage drops according to the overcurrent protection circuit operating continuously for about 0.5 second, the output voltage may shut down. To recover the output voltage, remove a condition that is causing an overcurrent, shut down the input voltage, wait more than 3 minutes and turn on the AC input again.

### ● KHEA120F/240F/480F, KHNA120F/240F/480F

■ An overcurrent protection circuit is built-in and activated over 101% of the peak current. A unit automatically recovers when a fault condition is removed. Please do not use a unit in short circuit and/or under an overcurrent condition.

■ Hiccup Operation Mode

When the overcurrent protection circuit is activated and the output voltage drops to a certain extent, the output becomes hiccup so that the average current will also decrease.

## 1.4 Peakcurrent Protection

### ● KHEA120F/240F/480F, KHNA120F/240F/480F

■ Peakcurrent protection is built-in (refer to Instruction Manual 3 for Peak loading).

If this function comes into effect, the output is shut down.

A few seconds later, A unit automatically recovers.

But if the overcurrent condition has not been released, the output will stop again (hiccup Operation Mode).

\*The recovery time varies depending on input voltage and load condition.

## 1.5 Overvoltage Protection

### ● KHEA30F/60F/90F, KHNA30F/60F/90F

■ An overvoltage protection circuit is built-in. If the overvoltage protection circuit is activated, shut down the input voltage, wait more than 3 minutes and turn on the AC input again to recover the output voltage. Recovery time varies depending on such factors as input voltage value at the time of the operation.

### ● KHEA120F/240F/480F, KHNA120F/240F/480F

■ An overvoltage protection circuit is built-in.

A unit automatically recovers when the fault condition is removed.

**Note :**

Please avoid applying a voltage exceeding the rated voltage to an output terminal. Doing so may cause a power supply to malfunction or fail. If you cannot avoid doing so, for example, if you need to operate a motor, etc., please install an external diode on the output terminal to protect the unit.

### 1.6 Thermal Protection

**● KHEA120F/240F/480F, KHNA120F/240F/480F**

■ A thermal protection circuit is built-in.

The thermal protection circuit may be activated under the following conditions and shut down the output.

- ① When a temperature continue to exceed the values determined by the derating curve.
- ② When a current exceeding the rated current is applied.
- ③ When convection stops.
- ④ When peak load is applied in conditions other than those shown in Section 3.

A unit automatically recovers when the fault condition is removed.

### 1.7 Output Ripple and Ripple Noise

■ Output ripple noise may be influenced by measurement environment, measuring method fig 1.1 is recommended.

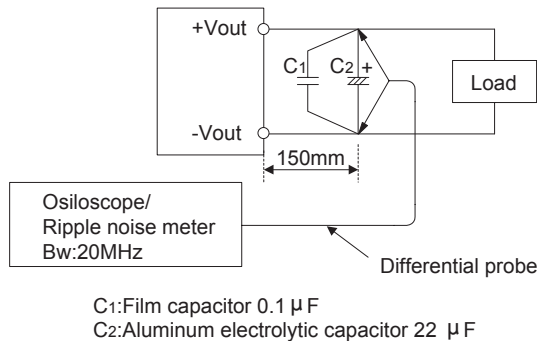


Fig.1.1 Measuring method of Ripple and Ripple Noise

### 1.8 Remote ON/OFF

**● KHEA120F/240F/480F, KHNA120F/240F/480F**

■ You can reduce the standby power by Remote ON/OFF.

To do so, connect an external DC power supply and apply a voltage to a remote ON/OFF connector.

Table 1.2 Remote ON/OFF Specifications

| ON/OFF logic | Between +RC and -RC         | Output voltage |
|--------------|-----------------------------|----------------|
| Negative     | L level (0 to 0.5V) or open | ON             |
|              | H level (4.5 to 29.5V)      | OFF            |

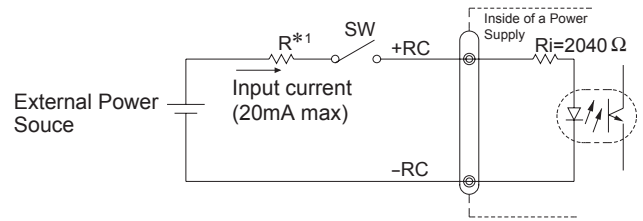


Fig.1.2 Example of use with remote ON/OFF

\*1 If the output of an external power supply is within the range of 4.5 - 29.5V, you do not need a current limiting resistor R. If the output exceeds 29.5V, however, please connect the current limiting resistor R.

To calculate a current limiting resistance value, please use the following equation.

$$R [\Omega] = \frac{V_{cc} - (1.1 + R_i \times 0.005)}{0.005}$$

- Please wire carefully. If you wire wrongly, the internal components of a unit may be damaged.
- Remote ON/OFF circuits (+RC and -RC) are isolated from input, output and PE.
- Restart time is 750 ms max .

### 1.9 Output Voltage Adjustment Range

■ To increase an output voltage, turn a built-in potentiometer clockwise. To decrease the output voltage, turn it counterclockwise.

### 1.10 Isolation

- When you run a Hi-Pot test as receiving inspection, gradually increase the voltage to start. When you shut down, decrease the voltage gradually by using a dial. Please avoid a Hi-Pot tester with a timer because, when the timer is turned ON or OFF, it may generate a voltage a few times higher than the applied voltage.
- When you test a unit for isolation between the output and the DC\_OK, short all terminals of DC\_OK.

### 1.11 Signal Output

Functions of LED indicators and signal output (KHEA series)

**● KHEA120F/240F/480F, KHNA120F/240F/480F**

■ Functions of LED indicators and signal output in the form of relay contact are shown below. Checking the presence/absence of voltage at the output terminal of a power supply is possible.

Table 1.3 Description of the signal output

| Signal Output           | Normal | Output is decreasing |
|-------------------------|--------|----------------------|
| DC_OK (LED: Green)      | ON     | OFF                  |
| ALARM (LED: Red)        | OFF    | ON                   |
| DC_OK (Relay Contact) * | Short  | Open                 |

\*DC\_OK signal (relay contact) is built in KHEA series. This circuit is insulated from other circuits (input and output circuits).

**Caution on signal outputs :**

■ The timing of signals might be very depending on models, input and load conditions. Please make sure enough evaluation.

### 1.12 Derating for low temperature start-up

Derating shown in Table 5.5 is required for low temperature start-up.

Table 1.4 Derating for low temperature start-up

| No. | Model              | temperature range | Load factor |
|-----|--------------------|-------------------|-------------|
| 1   | KHEA30F, KHNA30F   | -40°C to -20°C    | 50%         |
| 2   | KHEA60F, KHNA60F   |                   |             |
| 3   | KHEA90F, KHNA90F   |                   |             |
| 4   | KHEA120F, KHNA120F | -40°C to -25°C    | 75%         |
| 5   | KHEA240F, KHNA240F |                   |             |
| 6   | KHEA480F, KHNA480F |                   |             |

## 2 Peak Current

### KHEA120F/240F/480F, KHNA120F/240F/480F

The units can generate the peak current under the following conditions.

- $t1 \leq 5\text{sec}$
- $I_p \leq \text{Rated peak current}$
- $I_{ave} \leq \text{Rated current}$

\*Please use a maximum of Duty following shown in Table 2.1.

$$\text{Duty} = \frac{t1}{t1+t2} \times 100 [\%]$$

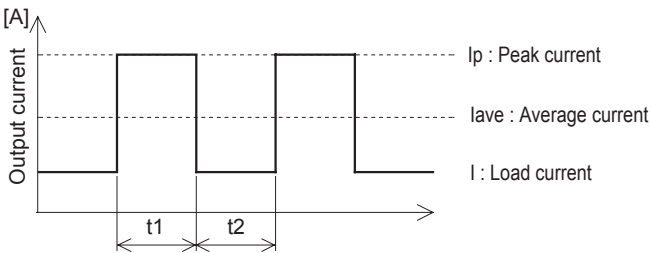


Fig.2.1 Peak current

Table 2.1 Maximum Duty by the mounting orientation

| Mounting orientation | Input Voltage | Maximum Duty         |                      |                            |                            |
|----------------------|---------------|----------------------|----------------------|----------------------------|----------------------------|
|                      |               | KHEA120F<br>KHNA120F | KHEA240F<br>KHNA240F | KHEA480F-24<br>KHNA480F-24 | KHEA480F-48<br>KHNA480F-48 |
| A                    | AC85 - 170V   | 35%                  | 35%                  | 20%                        | 20%                        |
|                      | AC170 - 264V  |                      |                      |                            | 15%                        |
| B                    | AC85 - 264V   |                      |                      | 20%                        |                            |
| C                    | AC85 - 264V   |                      |                      | 5%                         |                            |
| D                    | AC85 - 264V   |                      |                      | 20%                        |                            |
| E                    | AC85 - 264V   |                      |                      |                            |                            |

## 3 Series/Parallel Operation

### 3.1 Series Operation

You can use a power supply in series operation. The output current in series operation should be lower than the rated current of a power supply with the lowest rated current among the power supplies that are serially connected. Please make sure that no current exceeding the rated current flows into a power supply.

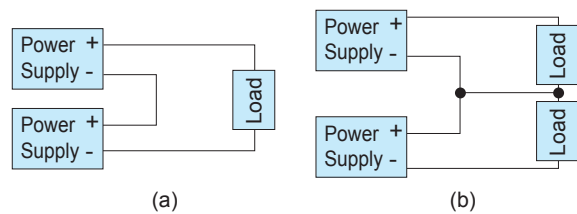


Fig.3.1 Examples of connecting in series operation

### 3.2 Parallel Operation

There is no current balance function.

When operating in parallel, such as diode-OR, please use on the output voltage was adjusted enough to balance the current. Exceeds the rated output current, the output is shut down.

Redundancy operation is available by wiring as shown below.

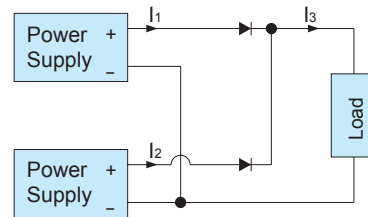


Fig.3.2 Example of connecting in redundancy operation

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.

$$I_3 \leq \text{rated current value}$$

# 4 Temperature Measurement Point

■ Ambient temperature indicates the temperature of the inlet of the air.

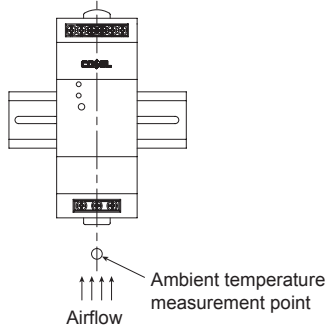


Fig.4.1 Ambient temperature measurement point

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig.4.2 to 4.3. Please use at the temperature dose not exceed the values in Table 4.1. Please also make sure that the ambient temperature does not exceed 70°C.

## ● KHEA30F, KHNA30F

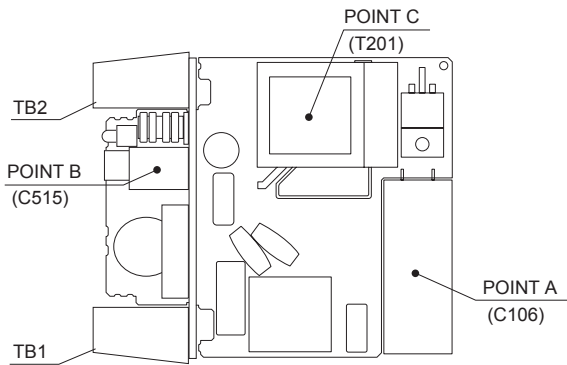


Fig.4.2 Temperature measurement point (Forced air)

## ● KHEA60F, KHNA60F

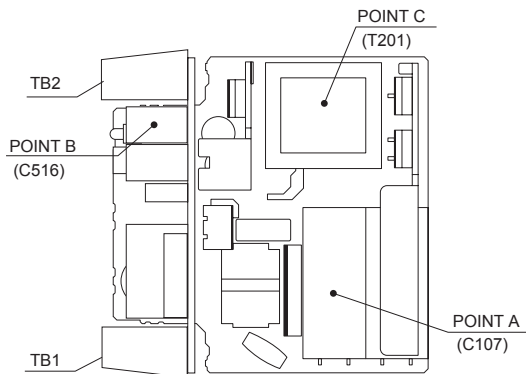
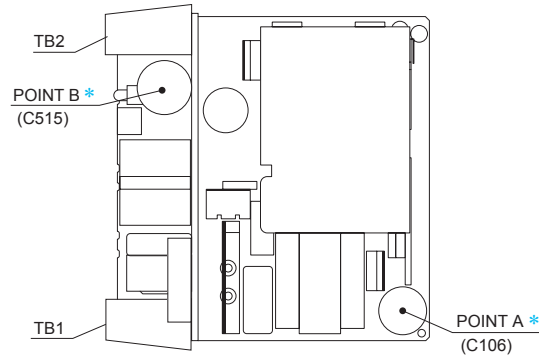


Fig.4.3 Temperature measurement point (Forced air)

## ● KHEA90F, KHNA90F



\* Please be careful of electric shock or earth leakage in case of temperature measurement, because POINT A and POINT B is live potential.

Fig.4.4 Temperature measurement point (Forced air)

Table 4.1 Specified temperature of the measurement point

| No. | Model            | Temperature measurement point |         |         |
|-----|------------------|-------------------------------|---------|---------|
|     |                  | Point A                       | Point B | Point C |
| 1   | KHEA30F, KHNA30F | 80°C                          | 80°C    | 105°C   |
| 2   | KHEA60F, KHNA60F | 80°C                          | 80°C    | 105°C   |
| 3   | KHEA90F, KHNA90F | 80°C                          | 80°C    |         |

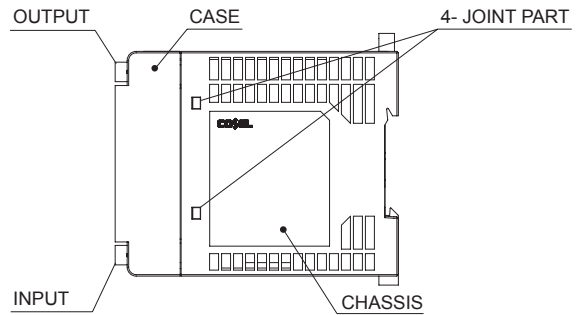


Fig.4.5 Installation removing chassis and case

Thermocouple for temperature checking must be added into temperature measuring point after removing chassis and case.

Then assembling chassis and case again, the temperature can be measured.

Chassis and case are fixed in 4 parts which are shown in the figure. Please contact us about detail.

■ Temperature of Forced air

Use the temperature measurement point as shown in Fig 4.6.

Please use at the temperature does not exceed the values in Table 4.2.

Please also make sure that the ambient temperature does not exceed 70°C.

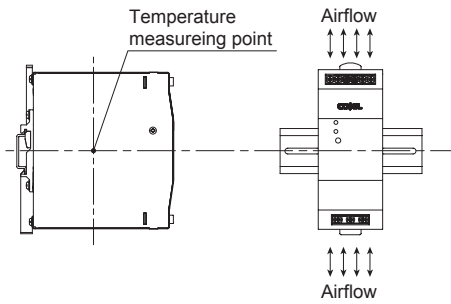


Fig.4.6 Temperature measurement point (Forced air)

Table 4.2 Specified temperature of the measurement point

| No. | Model              | temperature measurement point |
|-----|--------------------|-------------------------------|
| 1   | KHEA120F, KHNA120F | 75°C                          |
| 2   | KHEA240F, KHNA240F | 80°C                          |
| 3   | KHEA480F, KHNA480F | 85°C                          |

## 5 Life Expectancy and warranty

Please note derating curve depend on input voltage is required.

■ Life Expectancy

Table 5.1 Life Expectancy (KHEA30F, KHNA30F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Life Expectancy             |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 50°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 60°C                          | 6years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less                  | 10years or more             | 9years                              |
|                 |                |               | Ta = 60°C                          | 6years                      | 4years                              |
| B               | Convection     | AC85 - 170V   | Ta = 40°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 50°C                          | 10years or more             | 6years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less                  | 10years or more             | 9years                              |
|                 |                |               | Ta = 60°C                          | 6years                      | 4years                              |
| C               | Convection     | AC85 - 170V   | Ta = 35°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 45°C                          | 10years or more             | 7years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less                  | 10years or more             | 6years                              |
|                 |                |               | Ta = 60°C                          | 5years                      | 3years                              |
| D               | Convection     | AC85 - 170V   | Ta = 35°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 45°C                          | 10years or more             | 6years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 60°C                          | 5years                      | 3years                              |
| E               | Convection     | AC85 - 170V   | Ta = 35°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 45°C                          | 10years or more             | 6years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 60°C                          | 5years                      | 3years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.2 Life Expectancy (KHEA60F, KHNA60F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Life Expectancy             |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 45°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 55°C                          | 6years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 45°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 55°C                          | 9years                      | 6years                              |
| B               | Convection     | AC85 - 170V   | Ta = 30°C or less                  | 10years or more             | 8years                              |
|                 |                |               | Ta = 40°C                          | 10years or more             | 3years                              |
|                 |                | AC170 - 264V  | Ta = 45°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 55°C                          | 5years                      | 3years                              |
| C               | Convection     | AC85 - 170V   | Ta = 40°C or less                  | 10years or more             | 6years                              |
|                 |                |               | Ta = 50°C                          | 7years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 50°C                          | 8years                      | 5years                              |
| D               | Convection     | AC85 - 170V   | Ta = 30°C or less                  | 10years or more             | 5years                              |
|                 |                |               | Ta = 40°C                          | 8years                      | 2years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 50°C                          | 7years                      | 4years                              |
| E               | Convection     | AC85 - 170V   | Ta = 30°C or less                  | 10years or more             | 7years                              |
|                 |                |               | Ta = 40°C                          | 9years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 35°C or less                  | 10years or more             | 10years or more                     |
|                 |                |               | Ta = 45°C                          | 10years or more             | 9years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.3 Life Expectancy (KHEA90F, KHNA90F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Life Expectancy             |                                     |                   |                 |                 |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|-------------------|-----------------|-----------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |                   |                 |                 |
| A               | Convection     | AC85 - 170V   | Ta = 45°C or less                  | 10years or more             | 8years                              |                   |                 |                 |
|                 |                |               | Ta = 55°C                          | 7years                      | 4years                              |                   |                 |                 |
|                 |                | AC170 - 264V  | Ta = 45°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                | AC170 - 264V  | Ta = 55°C                          | 10years or more             | 7years                              |                   |                 |                 |
|                 |                |               | B                                  | Convection                  | AC85 - 170V                         | Ta = 35°C or less | 10years or more | 10years or more |
|                 |                |               |                                    |                             |                                     | Ta = 45°C         | 10years or more | 7years          |
|                 |                | AC170 - 264V  | Ta = 30°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 40°C                          | 10years or more             | 10years or more                     |                   |                 |                 |
| C               | Convection     | AC85 - 170V   | Ta = 30°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 40°C                          | 10years or more             | 8years                              |                   |                 |                 |
|                 |                | AC170 - 264V  | Ta = 30°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 40°C                          | 10years or more             | 10years or more                     |                   |                 |                 |
| D               | Convection     | AC85 - 170V   | Ta = 35°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 45°C                          | 10years or more             | 5years                              |                   |                 |                 |
|                 |                | AC170 - 264V  | Ta = 30°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 40°C                          | 10years or more             | 10years or more                     |                   |                 |                 |
| E               | Convection     | AC85 - 170V   | Ta = 35°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 45°C                          | 10years or more             | 6years                              |                   |                 |                 |
|                 |                | AC170 - 264V  | Ta = 30°C or less                  | 10years or more             | 10years or more                     |                   |                 |                 |
|                 |                |               | Ta = 40°C                          | 10years or more             | 10years or more                     |                   |                 |                 |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |                   |                 |                 |

Table 5.4 Life Expectancy (KHEA120F, KHNA120F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Life Expectancy                    |                                    |
|-----------------|----------------|---------------|------------------------------------|------------------------------------|------------------------------------|
|                 |                |               |                                    | Load factor $Io \leq 75\%$         | Load factor $75% < Io \leq 100\%$  |
| A               | Convection     | AC85 - 170V   | Ta = 50°C or less<br>Ta = 60°C     | 10years or more<br>8years          | 8years<br>3years                   |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 10years or more<br>6years          | 10years or more<br>4years          |
| B               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>10years or more | 10years or more<br>6years          |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>10years or more | 10years or more<br>9years          |
| C               | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>8years          | 10years or more<br>6years          |
| D               | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>9years          | 10years or more<br>7years          |
| E               | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>9years          | 10years or more<br>7years          |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                             | 3years                             |

Table 5.5 Life Expectancy (KHEA240F, KHNA240F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Life Expectancy                    |                                    |
|-----------------|----------------|---------------|------------------------------------|------------------------------------|------------------------------------|
|                 |                |               |                                    | Load factor $Io \leq 75\%$         | Load factor $75% < Io \leq 100\%$  |
| A               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>8years          | 9years<br>4years                   |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 10years or more<br>6years          | 10years or more<br>4years          |
| B               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
| C               | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 10years or more<br>10years or more | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>9years          | 10years or more<br>5years          |
| D and E         | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 10years or more<br>10years or more | 10years or more<br>8years          |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 10years or more<br>8years          | 9years<br>4years                   |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                             | 3years                             |

Table 5.6 Life Expectancy (KHEA480F, KHNA480F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year)          | Life Expectancy                     |                                    |
|-----------------|----------------|---------------|---|-------------------------------------|------------------------------------|
|                 |                |               |   | Load factor $Io \leq 75\%$          | Load factor $75% < Io \leq 100\%$  |
| A               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 45°C<br>Ta = 50°C | 10years or more<br>7years<br>5years | 4years<br>3years<br>2years         |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 55°C<br>Ta = 60°C | 8years<br>5years<br>4years          | 4years<br>3years<br>2years         |
| B               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 10years or more<br>10years or more  | 10years or more<br>10years or more |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 10years or more<br>10years or more  | 10years or more<br>10years or more |
| C               | Convection     | AC85 - 170V   | Ta = 15°C or less<br>Ta = 25°C              | 10years or more<br>10years or more  | 10years or more<br>5years          |
|                 |                | AC170 - 264V  | Ta = 30°C or less<br>Ta = 40°C              | 10years or more<br>8years           | 7years<br>3years                   |
| D               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 10years or more<br>10years or more  | 10years or more<br>5years          |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 10years or more<br>10years or more  | 10years or more<br>5years          |
| E               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 10years or more<br>8years           | 7years<br>3years                   |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 10years or more<br>10years or more  | 7years<br>3years                   |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                                   | 5years                              | 3years                             |

■ Warranty

Table 5.7 Warranty (KHEA30F, KHNA30F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Warranty term              |                                   |
|-----------------|----------------|---------------|------------------------------------|----------------------------|-----------------------------------|
|                 |                |               |                                    | Load factor $Io \leq 75\%$ | Load factor $75% < Io \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 50°C or less<br>Ta = 60°C     | 5years<br>5years           | 5years<br>3years                  |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years<br>5years           | 5years<br>3years                  |
| B               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 5years<br>5years           | 5years<br>3years                  |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years<br>5years           | 5years<br>3years                  |
| C               | Convection     | AC85 - 170V   | Ta = 35°C or less<br>Ta = 45°C     | 5years<br>5years           | 5years<br>5years                  |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years<br>5years           | 5years<br>3years                  |
| D and E         | Convection     | AC85 - 170V   | Ta = 35°C or less<br>Ta = 45°C     | 5years<br>5years           | 5years<br>3years                  |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years<br>5years           | 5years<br>3years                  |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                     | 3years                            |

Table 5.8 Warranty (KHEA60F, KHNA60F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Warranty term               |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 45°C or less<br>Ta = 55°C     | 5years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 45°C or less<br>Ta = 55°C     | 5years                      | 3years                              |
| B               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 45°C or less<br>Ta = 55°C     | 5years                      | 3years                              |
| C               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| D               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| E               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 3years                              |
|                 |                | AC170 - 264V  | Ta = 35°C or less<br>Ta = 45°C     | 5years                      | 5years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.9 Warranty (KHEA90F, KHNA90F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Warranty term               |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 45°C or less<br>Ta = 55°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 45°C or less<br>Ta = 55°C     | 5years                      | 5years                              |
| B               | Convection     | AC85 - 170V   | Ta = 35°C or less<br>Ta = 45°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
| C               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
| D and E         | Convection     | AC85 - 170V   | Ta = 35°C or less<br>Ta = 45°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.10 Warranty (KHEA120F, KHNA120F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Warranty term               |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 50°C or less<br>Ta = 60°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years                      | 3years                              |
| B               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| C,D and E       | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.11 Warranty (KHEA240F, KHNA240F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year) | Warranty term               |                                     |
|-----------------|----------------|---------------|------------------------------------|-----------------------------|-------------------------------------|
|                 |                |               |                                    | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 60°C     | 5years                      | 3years                              |
| B               | Convection     | AC85 - 170V   | Ta = 30°C or less<br>Ta = 40°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| C,D and E       | Convection     | AC85 - 170V   | Ta = 20°C or less<br>Ta = 30°C     | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 40°C or less<br>Ta = 50°C     | 5years                      | 5years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                          | 5years                      | 3years                              |

Table 5.12 Warranty (KHEA480F, KHNA480F)

| Mounting method | Cooling method | Input voltage | Average ambient temperature (year)          | Warranty term               |                                     |
|-----------------|----------------|---------------|---|-----------------------------|-------------------------------------|
|                 |                |               |   | Load factor $I_o \leq 75\%$ | Load factor $75\% < I_o \leq 100\%$ |
| A               | Convection     | AC85 - 170V   | Ta = 40°C or less<br>Ta = 45°C<br>Ta = 50°C | 5years                      | 4years                              |
|                 |                | AC170 - 264V  | Ta = 50°C or less<br>Ta = 55°C<br>Ta = 60°C | 5years                      | 3years                              |
| B               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 5years                      | 5years                              |
| C               | Convection     | AC85 - 170V   | Ta = 15°C or less<br>Ta = 25°C              | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 30°C or less<br>Ta = 40°C              | 5years                      | 5years                              |
| D               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 5years                      | 5years                              |
| E               | Convection     | AC85 - 170V   | Ta = 10°C or less<br>Ta = 20°C              | 5years                      | 5years                              |
|                 |                | AC170 - 264V  | Ta = 20°C or less<br>Ta = 30°C              | 5years                      | 3years                              |
| A,B,C,D and E   | Forced air     | AC85 - 264V   | Ta = 70°C                                   | 5years                      | 3years                              |



## 6 Applicable Electric Cable

■ Input terminals, Output terminals

### ● KHEA30F/60F/90F/120F/240F

Table 6.1 Applicable Wire

|                     | Input terminals  | Output terminals |
|---------------------|--|------------------|
| Solid wire          | Diameter 0.5 mm to 2.6 mm (AWG.24 to AWG.10)   |                  |
| Stranded wire       | 0.2mm <sup>2</sup> to 5.2mm <sup>2</sup> (AWG.24 to AWG.10)<br>Conductor diameter more than 0.18mm |                  |
| Sheath strip length | 8mm  |                  |

### ● KHEA480F

Table 6.2 Applicable Wire

|                     | Input terminals  | Output terminals |
|---------------------|--|------------------|
| Solid wire          | Diameter 0.8 mm to 2.6 mm (AWG.20 to AWG.10)   |                  |
| Stranded wire       | 0.5mm <sup>2</sup> to 5.2mm <sup>2</sup> (AWG.20 to AWG.10)<br>Conductor diameter more than 0.18mm |                  |
| Sheath strip length | 8mm  |                  |

■ RC terminals

### ● KHEA120F/240F/480F, KHNA120F/240F/480F

Table 6.3 Applicable Wire

|                     | RC terminals  |
|---------------------|---|
| Solid wire          | Diameter 0.5 mm to 1.3 mm (AWG.24 to AWG.16)                  |
| Stranded wire       | 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup> (AWG.24 to AWG.16) |
| Sheath strip length | 8mm   |

## 7 Option

### 7.1 Outline of option

#### ● -C

- Option -C models have coated internal PCB for better moisture resistance.

#### ● -E

(KHEA90F, KHNA90F)

- Option -E models acquires NEC Class2.

#### ● -N2

(KHEA120F/240F/480F, KHNA120F/240F/480F)

- Option -N2 models have attachment with screw mounting instead of DIN rail mounting.  
Mounting holes pitch are shown in Table 7.1.

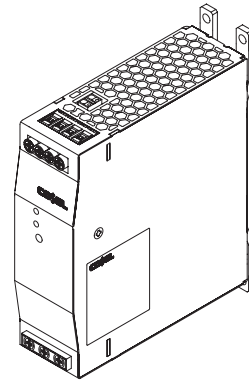


Fig.7.1 Image of option -N2

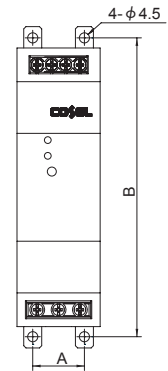


Fig.7.2 Mounting place (screw holes)

Table 7.1 Mounting holes pitch

| No. | Model              | A    | B     |
|-----|--------------------|------|-------|
| 1   | KHEA120F, KHNA120F | 23mm | 133mm |
| 2   | KHEA240F, KHNA240F | 34mm | 133mm |
| 3   | KHEA480F, KHNA480F | 54mm | 133mm |

### 7.2 Others

- While turning on the electricity, and for a while after turning off, please don't touch the inside of a power supply because there are some hot parts in that.
- When a mass capacitor is connected with the output terminal (load side), the output might become the stop or an unstable operation. Please contact us for details when you connect the capacitor.