

1	Connection for Standard Use	TUHS-16
2	Wiring Input/Output Pin	TUHS-16
2.1	Wiring input pin	TUHS-16
2.2	Wiring output pin	TUHS-17
3	Function	TUHS-18
3.1	Input voltage range	TUHS-18
3.2	Overcurrent protection	TUHS-18
3.3	Overvoltage protection	TUHS-18
3.4	Isolation	TUHS-18
3.5	Reducing standby power	TUHS-18
4	Series and Parallel Operation	TUHS-19
4.1	Series operation	TUHS-19
4.2	Parallel operation	TUHS-19
4.3	Various connection methods	TUHS-19
4.4	Long hold-up time connection	TUHS-19
5	Cleaning	TUHS-20
6	Temperature Measuring Point	TUHS-20

1 Connection for Standard Use

■ To use TUHS series, connection shown in Fig.1.1 (a) or (b) and external components are required.

● AC input or DC input

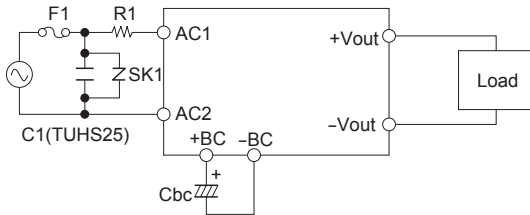


Fig.1.1(a) Connection for standard use (AC input or DC input)

Table 1.1 External components

No.	Symbol	Components	Reference
1	F1	Input fuse	2.1 "Wiring input pin (1)"
2	C1	Input Capacitor	2.1 "Wiring input pin (2)"
3	Cbc	Smoothing Capacitor	2.1 "Wiring input pin (3)"
4	R1	Inrush current limiting resistor	2.1 "Wiring input pin (4)"
5	SK1	Surge Protective Device	2.1 "Wiring input pin (5)"

● DC input

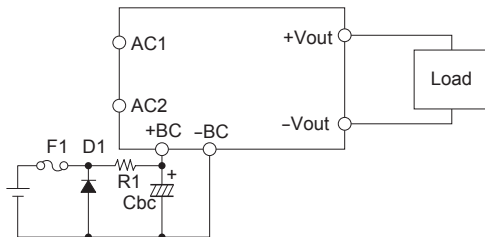


Fig.1.1(b) Connection for standard use (DC input)

2 Wiring Input/Output Pin

2.1 Wiring input pin

(1) F1: External fuse

■ Fuse is not built-in on input side. In order to protect the unit, install the slow-blow type fuse on input side (as shown in Table 2.1). In the case of using DC input, please use a DC fuse.

Table 2.1(a) Recommended fuse (AC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	3.15A

Table 2.1(b) Recommended fuse (DC input)

Model	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
Rated current	2A	2A	2A	2A	2A

(2) C1: Input Capacitor(TUHS25)

To comply with conducted noise CISPR22-B, EN55022-B, connect capacitor C1 which is 0.1 μ F or more at AC input terminal.

(3) Cbc: Smoothing capacitor

■ In order to smooth voltage, connect Cbc between +BC and -BC. Recommended capacitance of Cbc is shown in Table 2.2. Hold-up time and load factor is shown in figure 2.1-figure 2.10.

■ Keep the capacitance within the allowable external capacitance.

■ Select a capacitor of which the ripple voltage does not exceed 25Vp-p.

■ When the power supply is operated under -20degC, it may cause the smoothing voltage unstable due to the characteristic of equivalent series resistor. Please choose the capacitor which has more than recommended capacitance.

Table 2.2 Input Capacitor Cbc

No.	Model	Rated Input Voltage	Cbc	Allowable capacitance range
1	TUHS3	DC400V or more (AC200V _{in})	18 μ F	4.7 μ F to 68 μ F
2	TUHS5		22 μ F	10 μ F to 68 μ F
3	TUHS10	DC200V or more (AC100V _{in})	47 μ F	22 μ F to 150 μ F
4	TUHS15		68 μ F	33 μ F to 220 μ F
5	TUHS25		120 μ F	47 μ F to 390 μ F

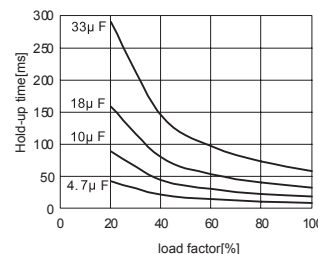


Fig.2.1 TUHS3 hold-up time(AC100V)

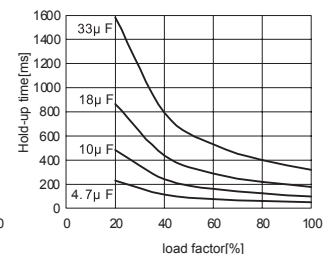


Fig.2.2 TUHS3 hold-up time(AC200V)

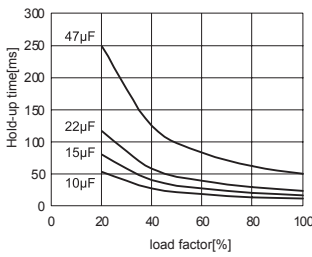


Fig.2.3 TUHS5 hold-up time(AC100V)

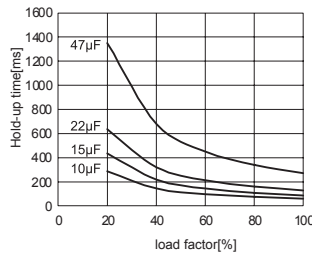


Fig.2.4 TUHS5 hold-up time(AC200V)

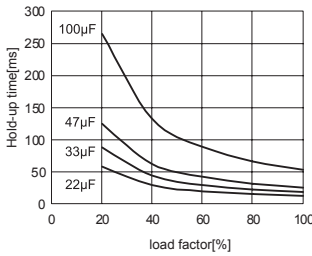


Fig.2.5 TUHS10 hold-up time(AC100V)

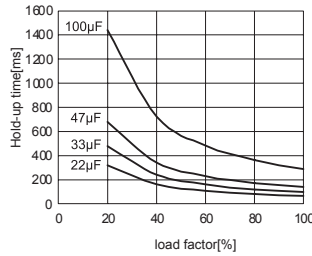


Fig.2.6 TUHS10 hold-up time(AC200V)

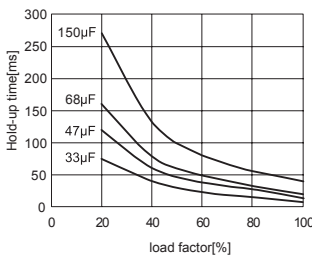


Fig.2.7 TUHS15 hold-up time(AC100V)

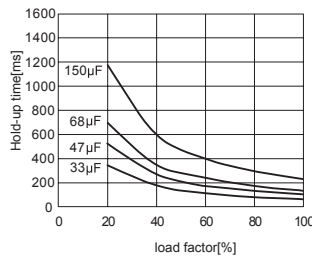


Fig.2.8 TUHS15 hold-up time(AC200V)

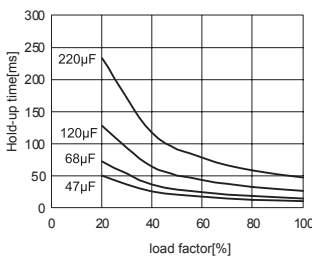


Fig.2.9 TUHS25 hold-up time(AC100V)

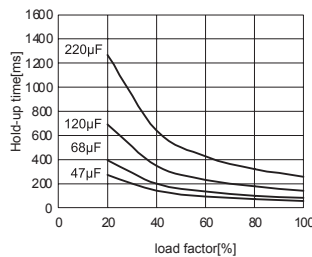


Fig.2.10 TUHS25 hold-up time(AC200V)

(4) R1: Inrush current limiting resistor

- Connect resistor R1 between AC input and power supply to limit inrush current to 50A(TUHS3/5/10/15) and 60A(TUHS25). Select a resistor which has enough permissible current capability.
- The power thermistors are heat-generating components. Pay attention to the rated operating temperature when using the power thermistors.
- When the power turns ON/OFF repeatedly within a short term, please keep enough interval to cool down the power supply before turning it on again.
- In this case, recommend using thermistor with thermal resistor in parallel or inrush current limiting circuit by triac.

(5) SK1: Surge Protective Device

- Connect a surge protective device to improve Surge immunity.

(6) D1: Reverse Input Voltage Protection(DC input)

- Avoid the reverse polarity input voltage. It cause the power supply failure. It is possible to protect the unit from the reverse input voltage by installing an external diode.

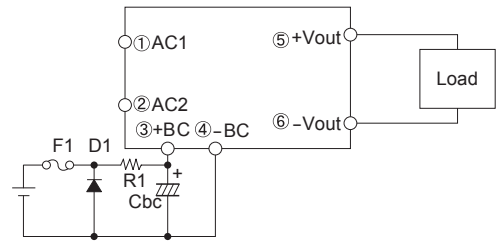


Fig.2.11 Reverse input voltage protection

2.2 Wiring output pin

(1) Co:Output capacitor

- In the TUHS series, the output capacitor is basically unnecessary. Reduce the ripple voltage by connecting the output capacitor.

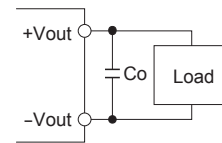


Fig.2.12 Connecting Example of an External Capacitor to the Output Side

- Install an external capacitor Co between +VOUT and -VOUT pins for stable operation of the power supply. Recommended capacitance of Co is shown in Table 2.3.
- If output current decreases rapidly, output voltage rises transiently and the overvoltage protection circuit may operate. In this case, please install a capacitor Co.

Table 2.3 Recommended capacitance Co

No.	output voltage	TUHS3	TUHS5	TUHS10	TUHS15	TUHS25
1	5V	0 - 100µF	0 - 100µF	0 - 330µF	-	0 - 1000µF
2	12V	0 - 47µF	0 - 47µF	0 - 150µF	0 - 150µF	0 - 470µF
3	15V	0 - 47µF	0 - 47µF	0 - 120µF	0 - 120µF	0 - 390µF
4	24V	0 - 22µF	0 - 22µF	0 - 68µF	0 - 68µF	0 - 220µF

■The specified ripple and ripple noise are measured by the method introduced in Fig.2.13.

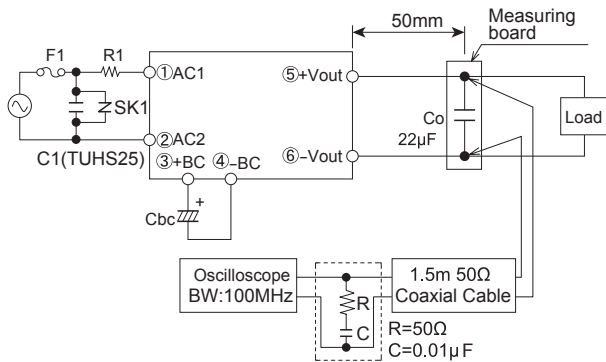


Fig.2.13 Method of Measuring Output Ripple and Ripple noise

■When connect the output to FG of an equipment, a noise may become big. The noise can be reduced by connecting external filter and grounding capacitor on the input side.

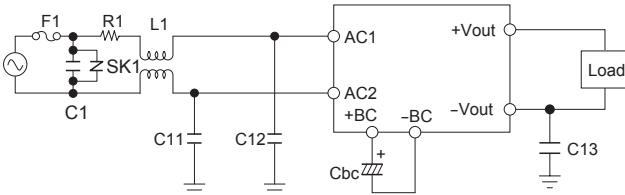


Fig.2.14 Recommended circuit of connect output to FG

3 Function

3.1 Input voltage range

- The range is from AC85V to AC264V or DC120V to DC370V (please see SPECIFICATIONS for details).
- In case of less than AC85V or DC120V, it is possible to operate continuously by input voltage derating as shown in "Derating".
- In cases that conform with safety standard, input voltage range is AC100-AC240V (50/60Hz) and DC120-DC370V.

3.2 Overcurrent protection

- Overcurrent protection is built-in and comes into effect over 105% of the rated current.
- Overcurrent protection prevents the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is cleared.
- When the output voltage drops at overcurrent, the average output current is reduced by hiccup operation of power supply.

3.3 Overvoltage protection

- The overvoltage protection circuit is built-in and comes into effect at 110% to 160% of the rated output voltage. When the load factor is less than 30%, output voltage may be increased more than maximum voltage depending on the failure mode.
- Please note that devices inside the power supply might fail when voltage more than rated output voltage is applied to output pin of the power supply. This could happen when the customer tests the overvoltage performance of the unit.

3.4 Isolation

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

3.5 Reducing standby power

- A circuit reducing standby power is built in TUHS. (standby power of AC100V input : 0.5W max)
- The load factor: $I_o=0-30\%$, the internal switch element is intermittent operated, and the switching loss is decreased. The specification of the Ripple/Ripple Noise changes by this intermittent operation. The value of the ripple/ripple Noise when intermittent operates changes in the input voltage and the output current. Please contact us for details.

4 Series and Parallel Operation

4.1 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.

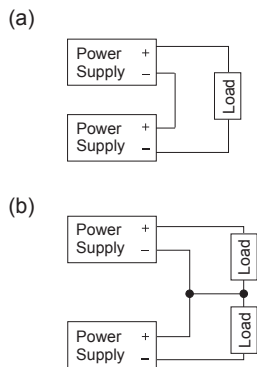


Fig.4.1 Examples of series operation

4.2 Parallel operation

■ Parallel operation is not possible.
 ■ Redundancy operation is available by wiring as shown below.

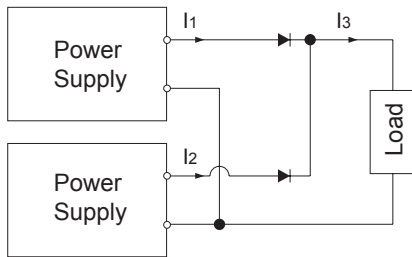


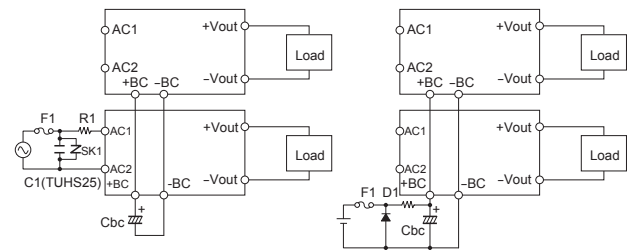
Fig.4.2 Example of Redundancy Operation

■ 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.

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

4.3 Various connection methods

- Using one smoothing capacitor, up to two TUHS can be operated. Shown an example in Fig.4.3.
- Total output wattage must be less than the maximum wattage of TUHS which AC is supplied.
- When connect different wattage of TUHS, please input AC into the power supply which the wattage is higher.
- When smoothing capacitor is commonly used, noise may become big because of the length of the power line. The noise can be attenuate by connecting Line Filter between TUHS and R1.
- Avoid connecting AC input and DC input at the same time because it may damage the TUHS or an equipment(Fig.4.4).



(a) AC input , Cbc common (b) DC input , Cbc common

Fig.4.3 TUHS connect method

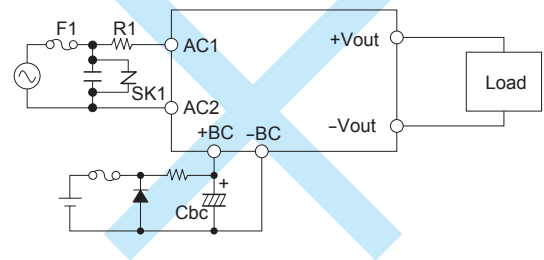


Fig.4.4 TUHS Connection prohibition

4.4 Long hold-up time connection

■ It is possible that setting the hold-up time of the power supply for a long time by connecting like Fig.5.5. Please set the charge current of the CL to become less than 1A. Please use the diode which reverse voltage is 600V or more. Please contact us for detail.

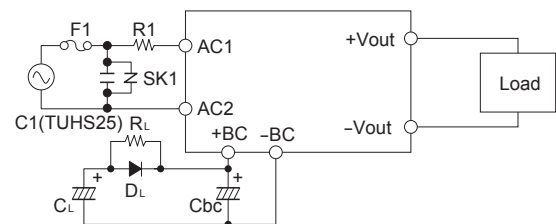


Fig.4.5 Long hold-up time connection

5 Cleaning

- If you need to clean the unit, please clean it under the following conditions. Cleaning Method: Immersion, Ultrasonic or Vapor Cleaning
Cleaning agent: IPA (Solvent type)
Cleaning Time: Within total 2 minutes for Immersion, ultrasonic and vapor cleaning
- Please dry the unit sufficiently after cleaning.
- If you do ultrasonic cleaning, please keep the ultrasonic output at 15W/ℓ or below.

6 Temperature Measuring Point

- It is necessary to note thermal fatigue life by power cycle.
Please reduce the temperature fluctuation range as much as possible when the up and down of temperature are frequently generated.
- Please have sufficient ventilation to keep the temperature of point A in Fig.6.1 at Table 6.1 or below. Please also make sure that the ambient temperature does not exceed 85°C.

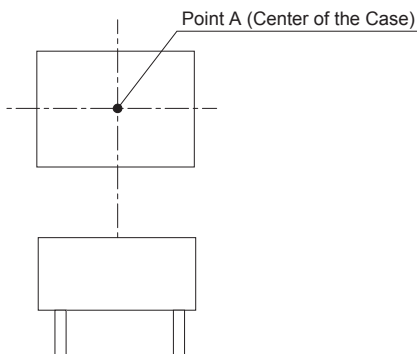


Fig.6.1 Temperature Measuring Point on the case (Top View)

Table 6.1 Point A Temperature

Model	TUHS3	TUHS5	TUHS10	TUHS15		TUHS25
Output Voltage	ALL	ALL	ALL	12V, 24V	15V	ALL
Point A	105°C	105°C	105°C	100°C	95°C	100°C

Application manuals available at our website.
Recommended external components are also introduced for your reference.