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# 1 Function

## 1.1 Input Voltage Range

■ If Input voltage value doesn't fall within specifications, a unit may not operate in accordance with specifications and/or fail.

## 1.2 Overcurrent Protection

■ 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. The unit automatically recovers when the fault condition is cleared.

## 1.3 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.

■ In the case of use in locations exposed to constant voltage between primary and secondary is applied, please contact us.

## 1.4 Remote ON/OFF

■ You can turn the power supply ON or OFF without turning input power ON or OFF through the pin terminal RC.

■ Please keep the voltage level of the pin terminal RC ( $V_{RC}$ ) at 9.0V or below.

Table 1.1 Pin Specification of Remote ON/OFF

Voltage Level of the pin terminal RC ( $V_{RC}$ )	Output
Open or Short or $0V \leq V_{RC} \leq 0.3V$	ON
$2.0V \leq V_{RC} \leq 9.0V$	OFF

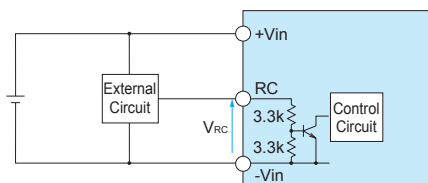


Fig. 1.1 Internal Circuits of Remote ON/OFF

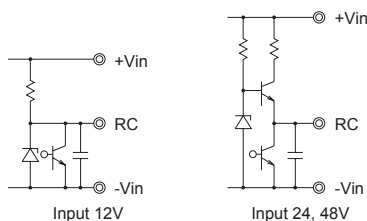


Fig. 1.2 Examples of Using an External Remote ON/OFF Circuit

## 1.5 Output Voltage Adjustment Range (MHFS3/MHFS6)

■ The output voltage is adjustable through an external potentiometer.

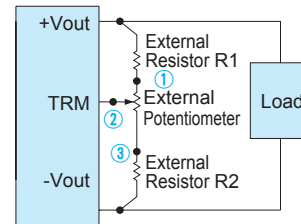
■ To increase the output voltage, turn the potentiometer so that the resistance value between 2 and 3 becomes small.

■ Please use a wire as short as possible to connect to the potentiometer and connect it from the pin on the power supply side. Temperature coefficient deteriorates when some types of resistors and potentiometers are used. Please use the following types.

Resistor Metal Film Type, Temperature Coefficient of  $\pm 100\text{ppm}/^\circ\text{C}$  or below

Potentiometer Cermet Type, Temperature Coefficient of  $\pm 300\text{ppm}/^\circ\text{C}$  or below

■ When the output voltage adjustment is used, note that the output may be stopped when output voltage is set too high.



(a) Single Output

Fig. 1.3 Connecting External Devices

Table 1.2 List of External Devices (MHFS3)

Output Voltage	Constant of External Device [ $\Omega$ ]		
	Potentiometer	R1	R2
3.3V (-5%, +10%)	1k	680	150
5V (-5%, +20%)	1k	330	33
9V (-5%, +20%)	5k	6.8k	680
12V (-5%, +20%)	5k	12k	1.2k
15V (-5%, +20%)	5k	12k	220

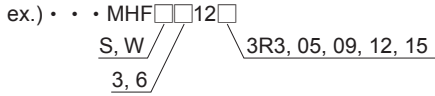
Table 1.3 List of External Devices (MHFS6)

Output Voltage	Constant of External Device [ $\Omega$ ]		
	Potentiometer	R1	R2
3.3V (-5%, +10%)	1k	680	150
5V (-5%, +20%)	1k	2.2k	220
9V (-5%, +20%)	5k	6.8k	680
12V (-5%, +20%)	5k	12k	1.2k
15V (-5%, +20%)	5k	12k	220

## 2 Wiring to Input/Output Pin

### Model name

The following letters / numbers are entered in □.



### 2.1 Wiring Input Pin

#### (1) External fuse

- Fuse is not built-in on input side. In order to protect the unit, install the normal-blow type fuse on input side.
- When the input voltage from a front end unit is supplied to multiple units, install the normal-blow type fuse in each unit.

Table 2.1 Recommended fuse (Normal-blow type) [A]

Model Model name	MH3	MH6
MHF□□12□	3.15	5.0
MHF□□24□	2.0	2.5
MHF□□48□	1.6	2.0

#### (2) External capacitor on the input side

- Adding a capacitor  $C_i$  near the input pin terminal and reduce reflected input noise from a converter. Please connect the capacitor as needed.
- When you use a capacitor  $C_i$ , please use the one with high frequency and good temperature characteristics.
- If the power supply is to be turned ON/OFF directly with a switch, inductance from the input line will induce a surge voltage several times that of the input voltage and it may damage the power supply. Make sure that the surge is absorbed, for example, by connecting an electrolytic capacitor between the input pins.
- If an external filter containing L (inductance) is added to the input line, or a wire from the input source to the DC-DC converter is long, not only the reflected input noise becomes large, but also the output of the converter may become unstable. In such case, connecting  $C_i$  to the input pin terminal is recommended.
- If you use an aluminum electrolytic capacitor, please pay attention to its ripple current rating.

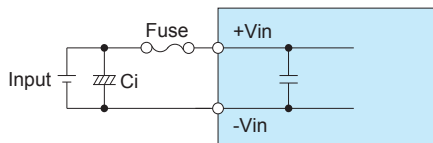


Fig.2.1 Connecting Example of an External Capacitor to the Input Side

Table 2.2 Recommended Capacitance of an External Capacitor on the Input Side [ $\mu$ F]

Model Model name	MH3	MH6
MHF□□12□	10-220	10-220
MHF□□24□	10-100	10-100
MHF□□48□	10-47	10-47

\* Please adjust the capacitance in accordance with a degree of the effect you want to achieve.

#### (3) Reverse input voltage protection

- If a reverse polarity voltage is applied to the input pin terminal, the power supply will fail. If there is a possibility that a reverse polarity voltage is applied, connect a protection circuit externally as described below.

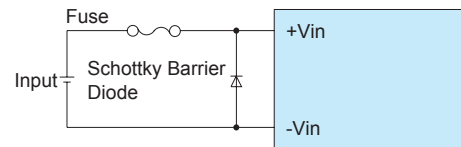


Fig.2.2 Reverse Input Voltage Protection

### 2.2 Wiring Output Pin

- If you want to further reduce the output ripple noise, connect an electrolytic capacitor or a ceramic capacitor  $C_o$  to the output pin terminal as shown below.

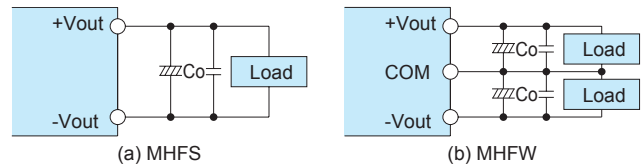


Fig.2.3 Connecting Example of an External Capacitor to the Output Side

Table 2.3 Recommended Capacitance of External Capacitor on the Output Side [ $\mu$ F]

Model Output Voltage	MH3	MH6
3.3	0 - 220	0 - 220
5	0 - 220	0 - 220
9	0 - 100	0 - 100
12	0 - 100	0 - 100
15	0 - 100	0 - 100
±12	0 - 100	0 - 100
±15	0 - 100	0 - 100

- \* If you use a ceramic capacitor, keep the capacitance within the range between about 0.1 to 22 $\mu$ F.
- \* Please adjust the capacitance in light of the effect you want to achieve.
- \* If you need to use an external capacitor whose capacitance exceeds the range provided in Table 2.3, please contact us.

■ If the distance between the output and the load is long and therefore noise is created on the load side, connect a capacitor externally to the load as shown below.

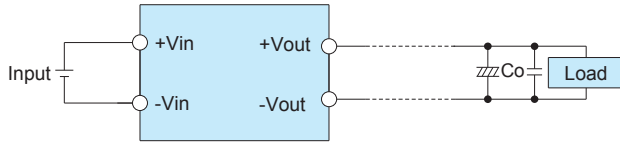


Fig.2.4 Connecting Example

## 3 Series/Redundancy 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.

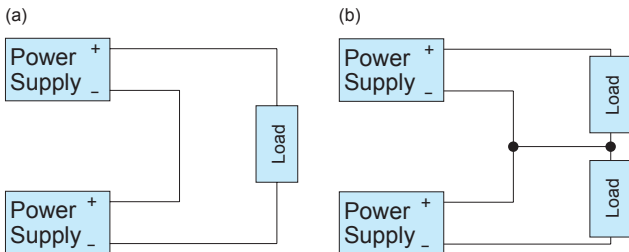


Fig.3.1 Examples of series operation

### 3.2 Redundancy Operation

■ Parallel operation is not possible.

■ Redundancy operation is available by wiring as shown below.

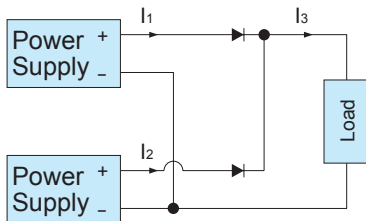


Fig.3.2 Redundancy operation

■ 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 for each power supply.

$$I_3 \leq \text{Rated Current Value}$$

## 4 Input Voltage/Current Range

■ If you use a non-regulated power source for input, please check and make sure that its voltage fluctuation range and ripple voltage do not exceed the input voltage range shown in specifications.

■ Please select an input power source with enough capacity, taking into consideration of the start-up current ( $I_p$ ), which flows when a DC-DC converter starts up.

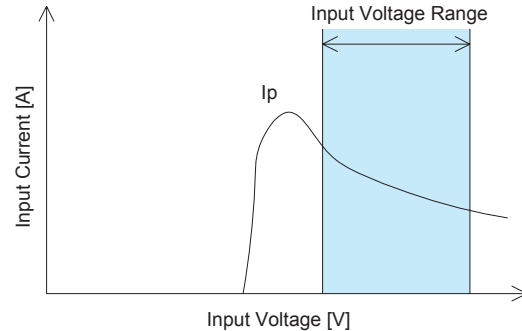


Fig.4.1 Input Current Characteristics

## 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 Safety Standards

■ To apply for a safety standard approval using the power supply, please meet the following conditions. Please contact us for details.

● Please use the unit as a component of an end device.

● Reinforced insulation (250 VAC or less) is provided between the input and output of this power supply. Limited to use when the input voltage of the device is 250 VAC or less.

● Safety approved fuse must be externally installed on input side.

● MH series has 2MOOP medical isolation grade.

# 7 Temperature of measurement points

■ Please have sufficient ventilation to keep the temperature of point A in Fig.7.1 at Table7.1 or below. Please also make sure that the ambient temperature does not exceed 85°C.

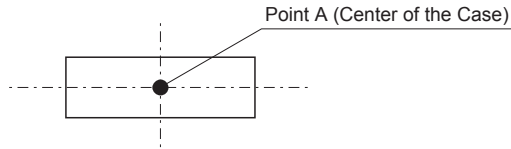


Fig.7.1 Temperature Measuring Point on the case (Top View)

Table 7.1 Point A Temperature

Model	MH3	MH6
Point A	105°C	105°C