

# Instruction Manual

MODEL DOC series



## For Safe Use

### ◆ Introduction














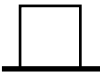


This product generates high voltage and energy.

In order to use the product safely and prior to using the product, please read the instruction manual to the end before use in order to use the product safely, because there is a danger of death or serious injury due to electric shock. Please use the product after fully understanding how to use the product properly. We are not responsible for any damages incurred by not observing the warnings and procedures stated in the instructions, so be forewarned.

Keep the instruction manual carefully so that you can view it whenever you need.

### ◆ Symbols

In order to use the product safely, the following symbols are displayed in the instruction manual and on the product. Understand the meaning of the symbols and observe each item. Depending on the product, some symbols may not be used.

 <b>WARNING</b> Indicates content that could cause death or serious injury.	 Frame or chassis terminal
 <b>CAUTION</b> Indicates content that could cause injury or damage to property.	 High temperature attention Touching it carelessly may cause burns.
 Indicates danger / warning / caution. Refer to the instruction manual when using the part with this symbol.	 Power On
 Indicates where high voltage is handled. Touching it may cause electric shock and result in death or serious injury.	 Power Off
 This symbol means "Prohibited".	 Power standby The product will not be completely disconnected from the power supply even if it is set to standby.
 Indicates that it must be performed in order to demonstrate the performance of the product.	 Bistable push button switch on
 Protective earth terminal (ground terminal for electric shock prevention)	 Bistable push button switch off
 Ground terminal	 Alternative Current



◆ **Understand the risk.**

Products generate high voltage and energy.

An electrician or equivalent knowledge must read the instruction manual to the end and familiarize yourself with the proper use and danger of the product.

If you want the product to be handled by another person, limit it to those with knowledge of electricity, and have people who are familiar with correct use and danger of the product conduct education and training before handling it, or handle the product under the supervision of those who are familiar with the proper use and danger of the product. Persons, with the exception of the above, must not handle the product.

◆ **Do not open the product case and panel.**

Do not disassemble, remodel, or repair by opening the product case and panel yourself. There is a high voltage area inside, which may possibly cause electric shock and fire.

Never remove the case and panel of the product, since the safety and function of the product will not be guaranteed.

◆ **It is not suitable for use in places where there is a possibility of a child being present.**

The product is designed assuming that it will be used in places where there are only adults, such as factories and laboratories. Do not use it where there is a possibility of a child being present.

◆ **Ensure that the product is handled only by a limited number of people.**

Only those who are familiar with the proper use and danger of the product, or those who are educated and trained by them should install the product. Any other person handling the product may cause electric shock, burns and injuries.

◆ **Ground it.**

When the product has a protective ground terminal or GND terminal, connect it to the ground.

If the input terminal of the product is an inlet type, connect to the power outlet with the ground using the supplied power cable or a power cable suitable for the area to be used. If it is not connected to the ground, there is a risk of electric shock and fire, which is extremely dangerous.

◆ **About power supply cable**

If there is a power supply cable attached to the package or product, it cannot be used for other products. In the case of a product that does not include a power supply cable, you must purchase an optional power supply cable suitable for the operating environment and the area, or you must prepare it yourself.

◆ **About the connection of the power supply cable**

Connection of the power cable should be done by an electrician or someone who has equivalent knowledge and is familiar with the correct usage and danger of the product. Refer to the page about connection of the input cable in the instruction manual and carry out work. For products that have acquired safety standards, also refer to the page that describing overvoltage categories.

◆ **About input voltage**

For the input voltage of the product, refer to the page describing the input terminal of the product and the input voltage in the instruction manual. Do not supply input exceeding the specifications of the product.

◆ **About the fuse**

The product contains a protective fuse. In the case of a product in which a fuse holder is arranged externally, it is possible to replace the fuse. For the replacement method, refer to the instruction manual.

If the product does not have a fuse holder externally, the user cannot replace the fuse. If the fuse blows out, do not open the case or panel. Please contact our sales representative.

◆ **Do not modify or damage the cable.**

It may cause electric shock and fire.



◆ **Designed for indoor use**

Use the product indoors. Do not use it outdoors or indoors where there is a possibility of water leakage, flooding, or crown.

◆ **About operating temperature and humidity**

Use within the range of operating temperature and humidity stated in the instruction manual.

Do not use it in a place where the ambient temperature becomes higher than the operation temperature of the product or in a narrow closed place.

◆ **Do not install in places that cause condensation.**

Do not install it in places that cause condensation, where it is exposed to steam or water vapor.

Insulation deteriorates, causing breakdown, electric shock, or fire.

◆ **Do not place anything on top of the product.**

Falling or collapsing is dangerous.

◆ **Do not put any objects on or in the product.**

Do not put any objects such as metal or liquid in the product through the inlet etc. Failure, electric shock, fire may result.

◆ **Operate the product with your right hand.**

In case of electric shock when manipulating the product, in order to reduce the risk of current flowing through important organs of the body. Keep your left hand off from the product and operate with your right hand.

◆ **Do not touch the wiring or load connected to the output terminal or output terminal during operation or immediately after output stop.**

Very high voltage is applied to the terminals during normal operation and trial operation.

Touching it will result in electric shock.

In addition, since a capacitor is connected to the terminal, high voltage remains on the terminal even immediately after stopping the output. To avoid electric shock, do not touch the terminals.

◆ **Turn off the power when touching the terminal.**

Before touching the terminals of the product, turn off the power and check that the power has actually turned off.

There is a capacitor at the terminal, and it is particularly dangerous to touch it immediately after turning off the power supply. Be careful of the electric charge of these capacitors and connect it to earth to discharge it completely. Remove input line (AC line) during work.



◆ **Install horizontally.**

Do not install the product in the reverse direction and the lateral direction. Internal heat dissipation becomes insufficient, parts deteriorate, there is a risk of smoke and fire.

◆ **Do not install in the place where cool air blows directly.**

There is a danger of condensation, leakage current and burnout.

◆ **Do not install the product in places around corrosive gas or liquid and places where chemicals handled.**

There is a danger of parts being deteriorated, smoking and burning.

◆ **Avoid using it in a place with much dust.**

If dust accumulates in the air inlet, remove it promptly.

If dust accumulates in the air inlet, cooling of the product is hindered and it may cause malfunction.

◆ **Do not block intake port and exhaust port.**

Secure more than 30cm space on the front and back of the product.

If the intake port and exhaust port are blocked, the specified performance of the product cannot be demonstrated and parts are deteriorate, which may cause smoke and fire.

◆ **When work such as welding is conducted near the product, disconnect all the wires from the product.**

◆ **Do not wipe with chemicals (thinner etc.) or wet cloth.**

There is a danger of electric shock, electric leakage, burnout from chemicals or water entering the inside of the product.

◆ **About fan replacement**

In the case of products with air-cooling fans, the fan has a lifetime part. As wear, deterioration, etc. progress with the lapse of use time, operation may become unstable. Also note that the lifetime of fan varies greatly depending on the environment where it is used (temperature, humidity, dust, etc.). In order to use the product for a longer time, it is necessary to replace the fan periodically. For replacement, please contact our sales office (replacement require separate repair charges). Do not exchange fans with other users because there is a danger of electric shock, etc.

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# 1 Introduction

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## 1 – 1 Introduction

Thank you very much for your purchase of our product.

DOC series is a rack-mount four-quadrant fast response bi-polar power supply.

We have done our best for the quality control of our products. Please handle this unit properly according to this instruction manual so that you can use the full performance of this unit safely for long.

We have carefully prepared this instruction manual, but if you find any doubtful or unclear point or any omission, please kindly contact us shortly.

## 1 – 2 Unpacking the bi-polar amplifier

When unpacked the unit, you will please check the following accessories are enclosed with the power supply main body.

〈Accessories〉

- AC input cable (1 pc.)
- Instruction manual

## 1 – 3 Environmental requirements

- Place and use the power supply horizontally.
- Never place any object on the power supply.
- There are air suction and exhaust holes for cooling at upper part and sides of the power supply. Provide an ample space to the power supply, and use it at the place where the ventilating condition is good.
- Avoid using the unit at such places where it is very dusty or there is corrosive gas.

## 1—4 Points to be careful about in handling and care

### WHEN TOUCHING LOAD AFTER TURNING OFF THE OUTPUT

1. Make the setting of an output voltage to zero (0). Turn off the OUTPUT ON/OFF switch.
2. Check and confirm that the voltage is zero at an output voltmeter of this unit.
3. Turn off the POWER ON/OFF switch.
4. Earthling an output for more than 10 seconds, check and confirm that the voltage is zero with another high voltage meter. It is especially dangerous that the load is capacitive or a long cable is used.
5. Make it a rule to touch load with right hand.

### FOR SAFER OPERATEION

1. Laying an insulation plate which can withstand the voltage to be used on the floor on which an operator stands, carry out the operation. If done so, it will be comparatively safe.
2. When operating a power supply and load, do it with right hand while putting left hand in the pocket, taking care not to touch other objects.
3. After turning off the voltage (even if a long period of time has lapsed after turning off), be sure to earth the output longer than 10 seconds when you touch load.

## 1—5 What to do before calling service

### In case no output

1. Check whether or not a specified voltage has been inputted.  
100–240V AC  $\pm 10\%$  50/60Hz single phase of input voltage.
2. Check whether or not a connection is correct.



## 1 – 6 Characteristics of bi-polar amplifier

### Capacitive load

Capacitive load may cause oscillation when it is more than 100pF. In such case, insert  $1\ \Omega$  ( $10\ \mu\text{F}$ )  $\sim 1\text{k}\ \Omega$  (1000pF) power resistance in series with the output. Be careful that the frequency bandwidth is limited depending on the resistance inserted in series and the capacity under capacitive load.

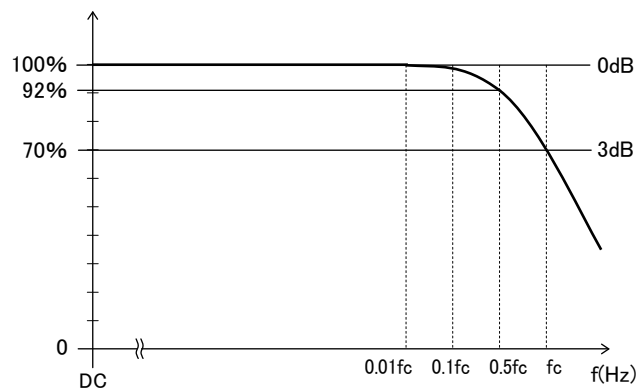
### Inductive load

Some inductance of inductive load may cause resonance in CC mode.

In such cases, connect a C-R series circuit between output terminals to prevent resonance.

### Response speed

When accurate output waveforms are required, select a bi-polar amplifier with a frequency bandwidth adequately higher than the used frequency. In case of using in sine waves, 3 to 5 times quick frequency bandwidth is required, and around 10 times quick one is required in case of using in square waves in general. Inadequate bandwidth causes not only decrease in the output amplitude but much difference between the input and output phases. Therefore attention must be paid by using the product while monitoring the output waveforms.

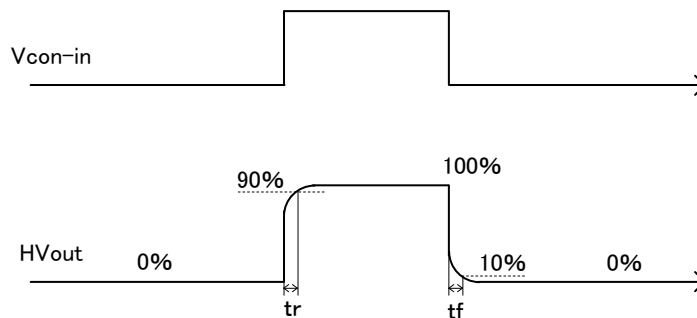


**Rising time**

(Stepping time):The responsivity is sometimes expressed by the rising time(as shown in the drawing below). The rising time of a bi-polar amplifier at a response speed of (=frequency bandwidth)

$f_c(\text{Hz})$  is generally acquired by “trap proximately  $0.35/f_c$ ”

Falling time  $t_f$  is the same as  $t_r$ .

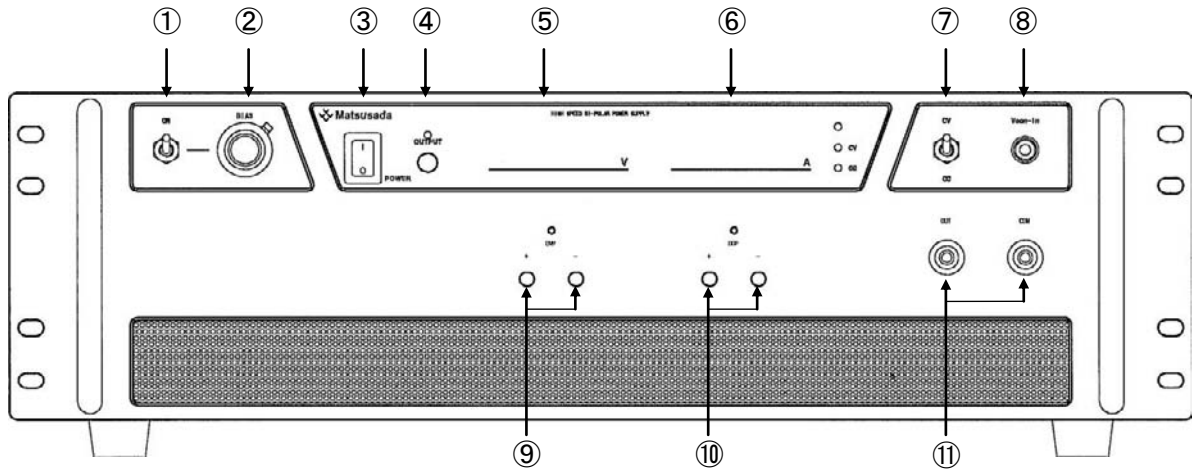


## 1-7 Connection Precaution

- Since minus on secondary side and common are internally connected, please use minus common. Plus common cannot be used.

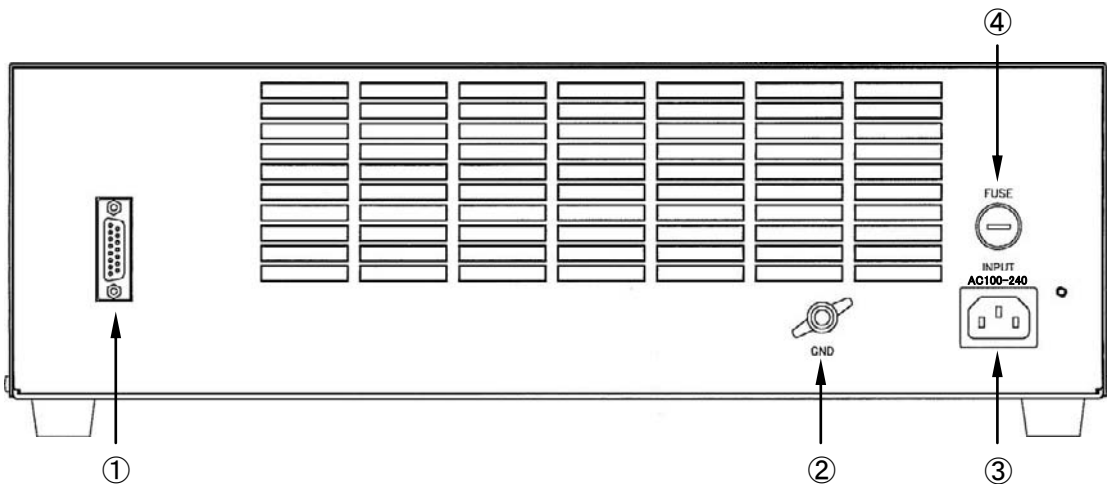
## 2 Exterior view diagram

### 2-1 Front panel



- |                        |                       |
|------------------------|-----------------------|
| ① Bias ON/OFF switch   | ⑦ CV/CC select switch |
| ② Bias setting dial    | ⑧ Vcon-in terminal    |
| ③ POWER ON/OFF switch  | ⑨ OVP setting volume  |
| ④ OUTPUT ON/OFF switch | ⑩ OCP setting volume  |
| ⑤ Voltage meter        | ⑪ Output terminal     |
| ⑥ Current meter        |                       |

### 2-2 Rear panel



- |                     |
|---------------------|
| ① Control connector |
| ② Ground terminal   |
| ③ AC input terminal |
| ④ FUZE (5A)         |

## 3 Instruction for handling

### 3-1 Overview

This product is a bi-polar amplifier that operates on constant voltage mode when set as constant voltage control, and operate constant current mode when set as constant current control, following input control voltage waveform.

### 3-2 Operations

1. To ensure your safety during installation, always be sure to connect the chassis of the unit to a ground.
2. Turn the power switch to the ON position. Digital display lights up.
3. Turn the OUTPUT ON/OFF switch to the ON position. The red indicator will light up to indicate that the bipolar amplifier is ready for operation. In this case, the voltage and current that set by Vcon-in and bias setting dial will output. Be careful with setting output.
4. When inputting voltage into Vcon-in, output voltage can be controlled on CV mode, and output current can be controlled on CC mode.
5. Voltage monitor  
Output 0 to  $\pm 10V$  against rated output voltage. Output impedance is  $1k\Omega$ .
6. Current monitor  
Output 0 to  $\pm 10V$  against rated output current. Output impedance is  $1k\Omega$ .

### 3-3 Select CV/CC setting

By inputting voltage into Vcon-in, output voltage can be controlled on CV mode, and output current can be controlled on CC mode.

Vcon	CC mode Output current	CV mode Output Voltage
-10V	- rating	- rating
0V	0A	0V
+10V	+ rating	+ rating

### 3-4 Using bias

Switching the bias voltage ON/OFF switch to the ON position makes it possible to vary bias voltage using the BIAS dial. The bias of voltage can be controlled on CV mode, and bias of current can be controlled on CC mode.

	CC mode	CV mode
Reading	Output current	Output voltage
000(ccw)	- rating	- rating
500	0A	0V
1000(cw)	+ rating	+ rating

### 3—5 Over Voltage Protection (O.V.P)

Variable from 0 to approx 110% with Output voltage limiter in front panel.

Set the following procedure.

1. Turn off the power, wait one minute, and open the load.
2. Turn off the bias switch, turn off the output switch, and set to the CV mode.
3. Input the power, turn on the output switch, and input DC12V to the Vcon-in terminal.  
Present limit voltage is output.  
(Factory: about 110% of the rated output voltage)
4. Set to the desired value by turning the limiter.

### 3—6 Over Current Protection (O.C.P)

Variable from 0 to approx 110% with Output current limiter in front panel.

Set the following procedure.

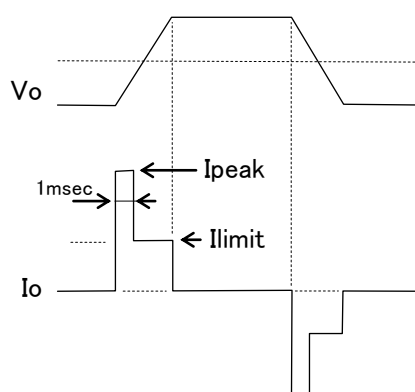
1. Turn off the power, wait one minute, open the load, and short the output terminal + and -.  
Prepare the wire of sufficient thickness to flow 110% of rated output current.
2. Turn off the bias switch, set the bias setting dial to "5.0", turn off the output switch, and set to the CV mode.
3. Input the power, turn on the output switch, and turn the bias setting dial clockwise little by little until the current limiter is activated.  
(Factory: about 110% of the rated output current)
4. Set to the desired value by turning the limiter.

### 3—7 Regarding Over Current Protection

There are two circuits installed in this power supply; a circuit is to limit pulse current, and another is to limit normal current. The normal current is limited within 1msec.

Apart from the above, another circuit is to limit pulse current at 2 times of the rated in case of swinging rectangle wave or charging capacitive in order to protect amp devices. Repeating high frequency, for instance, damages power supply since 2 times of the rated output current is expected at all time.

Therefore, it is strongly recommended that you connect resistance in series to a load, or using power supply in lower frequency in this case.

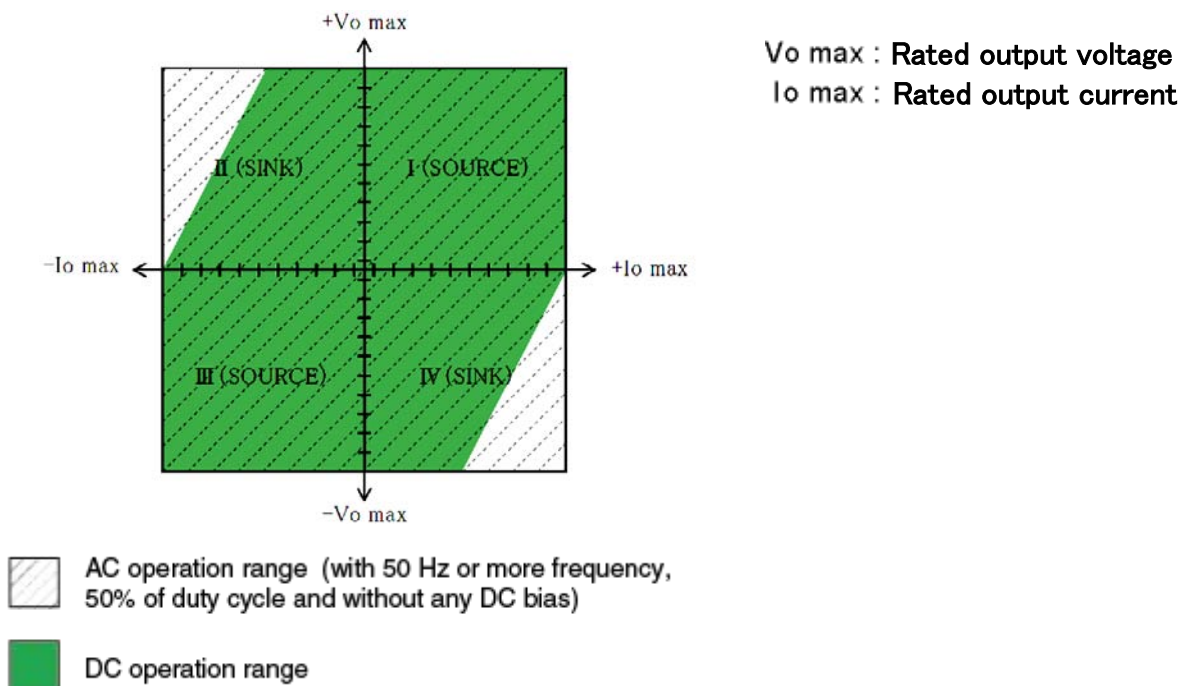


### 3-8 Power outage protection

There is a circuit installed that makes power supply not to output after recovery from power outage. Voltage is not outputted after recovery from power outage. Output ON/OFF switch needs to be turned off and on to reset.

### 3-9 Output Range

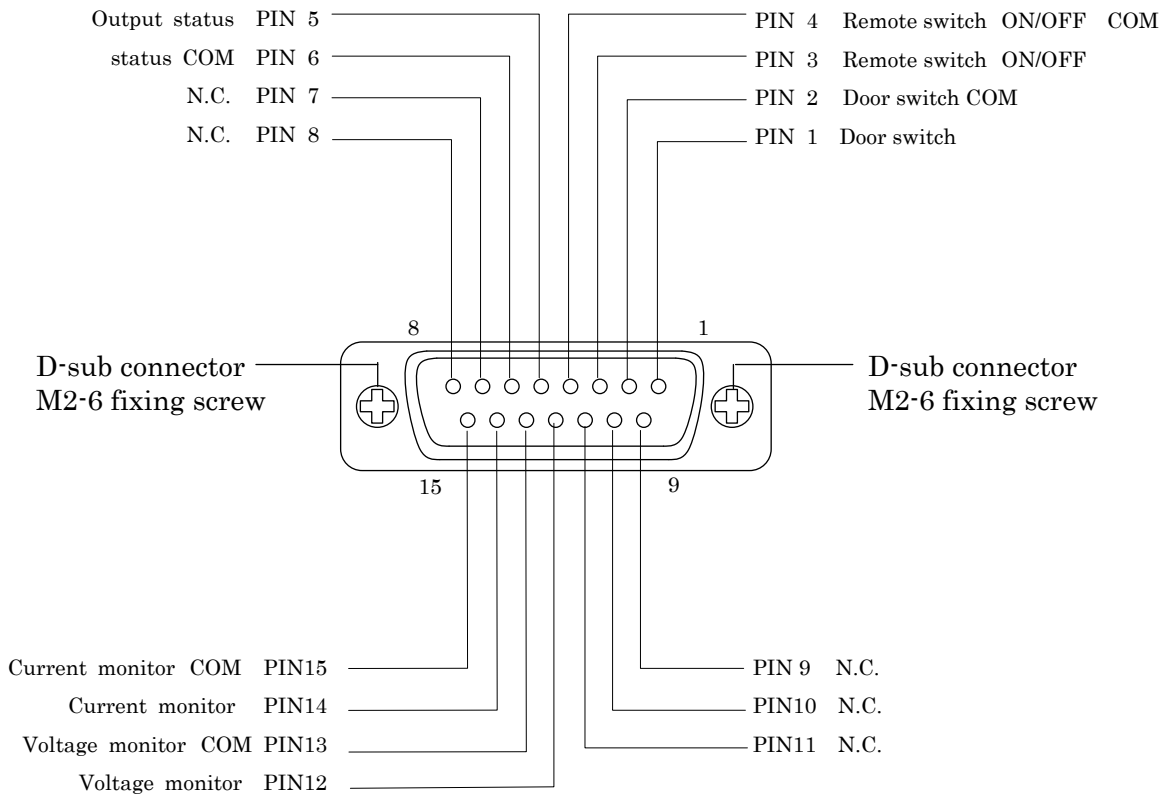
This amplifier is operatable in four-quadrant output range (unipolar type is operated in two-quadrant range), but when operated in DC mode or in low frequency operated please derate the output as per the following diagram.



Please avoid continuous use in high frequency.  
 It increases internal loss causing failures.

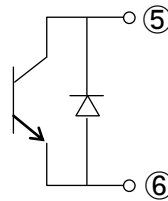
## 4 Standard functions

### 4-1 Control connector (D-sub 15S type)



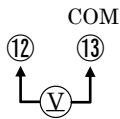
### 4-2 Output status

While output switch is turned ON,  
Between ⑤—⑥ should short-circuit.



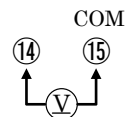
### 4-3 Voltage monitor

Output 0 to  $\pm 10V$  against rated output voltage. The output impedance is  $1k\Omega$ .



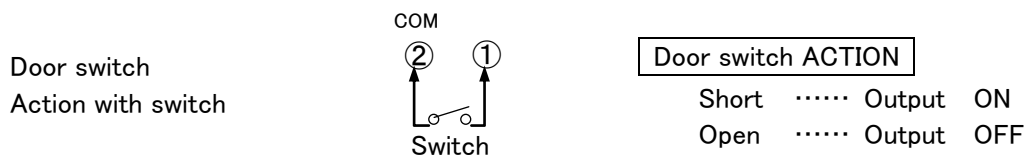
### 4-4 Current monitor

Output 0 to  $\pm 10V$  against rated output current. The output impedance is  $1k\Omega$ .



### 4-5 Door switch

The output can be turned off with Door switch.  
For safety reason, once cut off, Door switch cannot be used to resume the operation.  
Turn off the OUTPUT ON/OFF switch to reset the condition.



#### Door switch action by open collector

Note 1

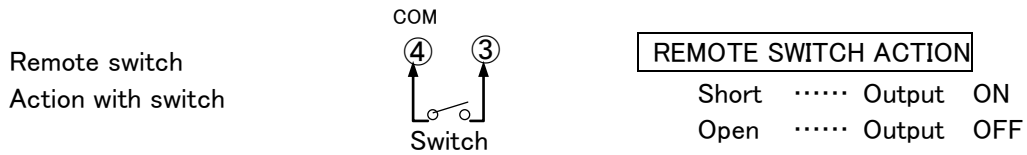


In place of switch, an open collector will suffice for it.



### 4-6 Remote ON/OFF switch

The output can be turned on and off with remote switch.



Remote switch action by open collector

Note 1



In place of switch, an open collector will suffice for it.

\* 1 Cautions for use of open collector.

When an open collector is used with Remote ON/OFF function, use them according to the following rule.

DEFINITION OF OPEN COLLECTOR

OUTPUT	SWITCH	OPEN COLLECTOR
ON	<p>Short</p>	<p>VCE 0.4V or less (10mA)</p>
OFF	<p>Open</p>	<p>VCE 2V or more (Open 5V)</p>



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