

Instruction Manual

MODEL EPR SERIES



SAFETY

**This power supply unit generates high voltage and energy.
Electric shock may lead to death or serious injury.
Be sure to follow the instructions below and handle the unit with caution.**

1. BE SURE TO GROUND!!

Be sure to ground the power supply unit before use.

2. DO NOT TOUCH ANY HIGH VOLTAGE TERMINALS!!

Do not operate the power supply unless someone who is familiar with the operation precede, the hazards of high voltage, and the treatment for the electrical shock is present.

3. UNDERSTAND THE HAZARDS OF HIGH VOLTAGE!!

In case you let somebody operate the power supply for you, must be sure that he/she fully understands the hazards of high voltage and the areas where never can be touched.

4. CUT OFF THE POWER BEFORE TOUCH THE UNIT!!

Cut off the power, and check that the power is OFF, before you touch the power supply. Capacitors in the output circuit are still charged and dangerous even after the power has been cut off. Discharge all remaining high voltage by grounding them.

5. DISCONNECT THE INPUT LINES(AC LINES) !!

In case you need to touch the inside of the power supply following instruction manual, cut off the power and disconnect the input lines(AC lines), and ground all the capacitors and high voltage section.

Don't remove the case or touch the inside of power supply unless so instructed in the instruction manual.


6. OPERATE THE POWER SUPPLY WITH YOUR RIGHT HAND!!


In order to avoid the electric shock to your important organs, operate the power supply with your right hand and keep your left hand off from the power supply.

For Safe Use

Symbols

Various symbols are used in this instruction manual and on the product for ensuring safety. What will be caused by ignoring the instructions given with the symbols or by improper handling are classified as shown below. Read carefully and understand the descriptions before proceeding to the main body of this manual.


 **Warning:** failure to follow the instructions with this indication may lead to death or serious injury.


 **Caution:** failure to follow the instructions with this indication may lead to injury or damage in property.

Meanings of the Symbols

Some of the symbols used are shown on the right.

 Indicates that which requires caution.

 Indicates that which forbidden.

 Indicates that which must be done.

 Indicates electric shock hazard.

Warning



NO

- Do not touch the output terminal or the leads or load connected to it while the unit is in operation or immediately after it is stopped. Otherwise it may cause electric shock or injury.



NO

- Do not install the unit in a place subject to steam or water vapor. Otherwise it may cause poor insulation and lead to fire or electric shock.



NO

- Do not install the unit in a place subject to dew condensation. Otherwise it may cause electric shock.



NO

- Do not modify or damage the cables. Otherwise it may cause electric shock.



NO

- Do not place any object on the unit. Dangerous situations may occur if the object drops or falls.
- Do not put any object in the unit. It may cause damage.



GROUND

- Be sure to ground the unit to avoid a rare possibility of electric shock. Otherwise it may lead to fire, electric shock or injury.



NO
DISASSEMBLY

- Do not disassemble, remodel or repair the unit. High voltage may be built up inside, which may cause electric shock.
- Disassembly, remodeling or repair hamper ensuring of safety and may lead to dangerous situations.



NO

- Do not install the unit outdoors or in a place subject to leaking of water, flood or snow. Otherwise it may cause electric shock.

Caution



NO

- Do not install the unit upside down or on a wrong side. Insufficient heat release may cause deterioration of parts, which may generate smoke or set fire.



NO

- Do not use the unit in a place subject to high temperature or in an enclosed, limited area. It not only hampers the unit from achieving its performance but also causes deterioration of parts leading to smoking or burning.



NO

- Do not cover the vent holes of the unit. Vent holes are provided to prevent elevation of temperature inside. Covering them not only hampers the unit from achieving its performance but also causes deterioration of parts, which may generate smoke or set fire.



NO

- Do not install the unit and the remote controller in a place subject to direct cold air. Condensation may lead to electrical leak/burning.



NO

- Do not wipe the unit with chemicals (such as thinner) or wet cloth. It may allow water inside leading to electric shock, electrical leak or burning.



NO

- Do not install the unit in a place subject to corrosive gas or liquid (such as a place where chemicals are handled). Deterioration of parts may cause generation of smoke or burning.

- After reading this manual, be sure to store it in a place convenient for the users so that it can be referred to at anytime.

First-aid procedures to be implemented in case of electrical shock

RESCUE

1. Free victim from contact with live conductor quickly.
Avoid contact with neither live conductor nor victim's body.
2. Shut off high voltage at once and ground the circuit. If high voltage cannot be turned off quickly, ground the circuit to discharge, or cut high voltage line by an ax with dry wooden handle. Be careful of electric flash.
3. If circuit cannot be broken or grounded, use a dry board, dry clothing, or other nonconductor to free victim.
4. Call an ambulance immediately.

SYMPTOMS

NEVER TAKE ELECTRICALLY SHOCKED CONDITION AS DEATH.

Symptoms of electric shock may include unconsciousness, failure to breathe, absence of pulse, pallor, and stiffness, as well as severe burns.

Whenever victim is not breathing properly, give artificial respiration(see next page).

TREATMENT

1. Start artificial respiration at scene of accident. Only in case victim's or operator's life is endangered, remove victim to safe location nearby.
2. After starting artificial respiration, continue without loss of rhythm until victim start breathing without help, or being passed to medical aid.
3. When operator change while giving artificial respiration, do so without losing the rhythm of respiration.
4. After giving first aid, try to get a diagnosis by a doctor as soon as possible because shock can cause internal burn, which can be lethal if left untreated.

AFTER VICTIM REVIVES

Be prepared to resume artificial respiration, as he may stop breathing again.

Keep victim warm and lying down until he or she has been conscious for at least thirty minutes.

Artificial respiration

1. PLACE VICTIM

Place victim in face-upward position horizontally.

2. CLEAR THROAT

Turn head to one side quickly wipe out any fluid, mucus, or foreign body from mouth and throat with fingers.

2. Clear throat



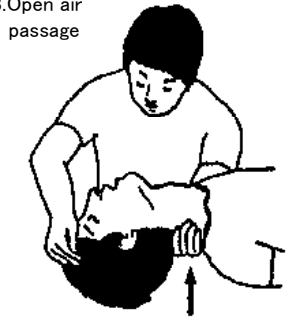
3. OPEN AIR PASSAGE

Tilt head back and extend neck to open air passage.

4. LIFT JAW FORWARD

Put thumb in victim's mouth and grasp jaw firmly. Lift jaw forward to pull tongue out of air passage. Do not hold or depress tongue.

3. Open air passage



5. PINCH NOSTRILS CLOSED

With other hand pinch nostrils closed to prevent air leak.

6. BLOW AIR IN

Take a deep breath, seal victim's open mouth and exhale firmly into victim's mouth until chest is seen to lift.

Make sure to open mouth widely to avoid air leakage.

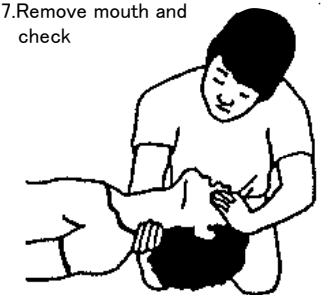
6. Blow air in



7. REMOVE MOUTH AND CHECK

Check the sound of breathing out air and see normal breathing when releasing mouth. If no sound, repeat from OPEN AIR PASSAGE. Continue at a rate of 12 to 20 times per minute.

7. Remove mouth and check



Quantity of air have to be increased gradually. Especially when victim is infant, be carefully not to be too strong, not to blow in too much air.

Keep giving artificial respiration until victim start breathing without help, or being passed to medical aid.

WARRANTY

1. WARRANTY POLICY

Matsusada Precision Inc. ("Matsusada") warrants that the products supplied by it will be free from defects in materials and workmanship for a period of twelve (12) months from the date of original shipment to buyer. This warranty shall not apply to any product which has been repaired, modified or worked on by persons unauthorized by Matsusada, used other than in accordance with the instruction manuals, used in inappropriate environment (with corrosive gas, high humidity, etc) or damaged by any event beyond Matsusada's control such as force majeure. Matsusada shall in no way be liable for any incidental, special or consequential damages relating to this warranty.

Matsusada's sole liabilities and the buyer's sole remedies shall be limited, at Matsusada's discretion, to a repair or replacement of the products.

The foregoing warranty is in lieu of all other warranties, express or implied, including those of merchantability or fitness for a particular purpose.

As the products are not designed and manufactured for applications which require extraordinary reliability or safety, or affecting people's life (nuclear energy, aerospace, socially fundamental facility, medical equipment, etc), this warranty shall not be applied for such applications. The specific design and manufacturing might be required for such applications.

No modification or supplement of this warranty shall be binding unless in writing and signed by a duly authorized officer of Matsusada.

2. INSTRUCTION MANUAL AND TEST DATA

- Each rack mount and bench top power supply have 1 instruction manual. Extra instruction manuals available with charge.
- Schematics of products shall not be submitted to users. Test result or test data for the products shall be available upon request with charge.

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1 Introduction

1 – 1 Introduction

Thank you very much for your purchase of our product HIGH VOLTAGE POWER SUPPLY.

We have done our best for the quality control of the unit.

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 POWER SUPPLY

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

〈Accessories〉

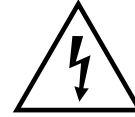
- AC input cord (1 pc)
- Instruction manual (1 pc)
- Output Cable (1 pc)

1 – 3 Installation conditions

- Install the power supply unit horizontally when use.
- Never put any object on the power supply unit.
- The top and side surfaces are the cooling air supply and exhaust openings. The power supply must be provided with adequate space and good ventilation.
- Do not operate the power supply in a dusty area or in corrosive gas environment

1-4 Caution for handling

WHEN TOUCHING LOAD AFTER TURNING OFF A HIGH VOLTAGE

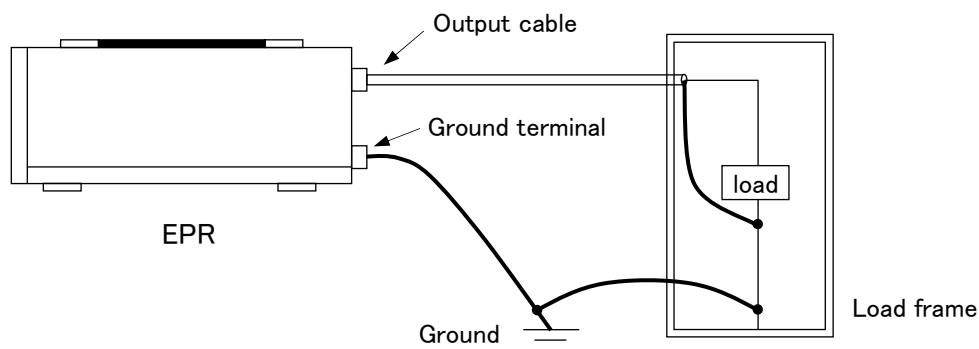


1. Make the setting of an output voltage to zero (0). Turn off the OUTPUT ON/OFF switch.
2. Make sure that the output voltage is zero with the output voltage meter of this unit.
3. Turn off the POWER ON/OFF switch.
4. Ground the output for more than 10 seconds, and make sure that the output voltage is zero at another HV voltmeter. It is especially dangerous when a capacitive load is connected or a long cable is attached there to.
5. Make it a rule to touch loads with right hand.

HOW TO GROUND



- For safer operation, be sure to ground the ground terminal of power supply at one point on the ground.



- Make sure to connect the GROUND terminal correctly as shown above. Improper grounding is dangerous and may cause an electric shock or damage the power supply.
- In case output short circuit or discharging is expected, use shorter and thicker grounding wire.

FOR SAFER OPERATION

1. It would be rather safe if the power supply is operated on an insulation board, which is withstand the voltage used.
2. Try to handle the power supply or load with your right hand, and try to keep the left hand, for example, putting it pocket.
3. Ground the output more than 10 seconds before touching the load after turning off the power supply even long time has past after turning off the power supply.

1—5 Troubleshooting

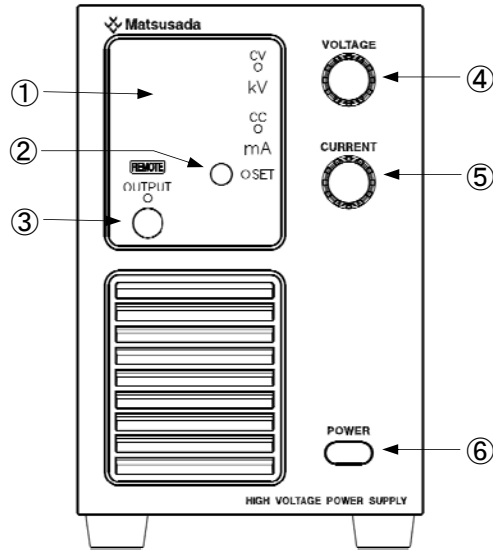
•In case there is no output voltage

1. Check if the proper input voltage is supplied to the power supply.
 - Power supply input voltage, AC100–240V \pm 10%, 50/60Hz single phase
 - Control voltage for external voltage control is 0 to +10V
2. Check if the connection of control on the rear panel is correct.
3. Check if the function of option is properly operated.

If “E01” is appears, firstly stop the power supply and contact our sales agent from where you purchased. Abnormality has occurred in this unit.

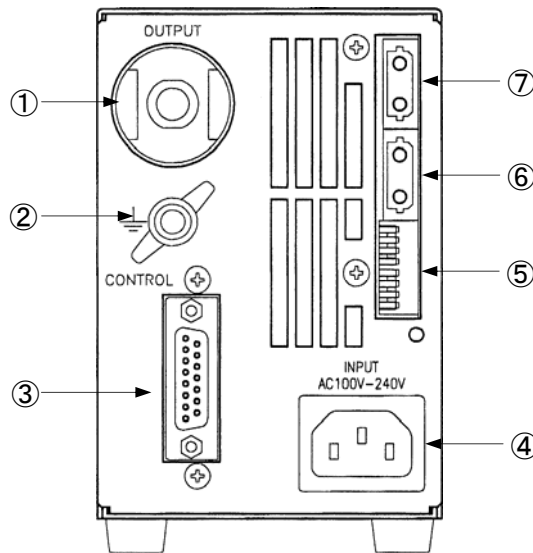
2 Exterior view diagram

Front panel



- ① Output voltage/current meter
- ② Output voltage/current preset switch
- ③ Output switch
- ④ Output voltage setting dial
- ⑤ Output current setting dial
- ⑥ POWER ON/OFF switch

Rear panel



- ① Output connector
- ② Ground terminal
- ③ Control connector (D-sub 15pin)
- ④ AC input connector
- ⑤ Upper connection switch
- ⑥ Optical fiber cable connector (IN)
- ⑦ Optical fiber cable connector (OUT)

Dimension 124H × 450D × 84W (mm)

3 Operation manual

3-1 Outline

This unit is a compact handy type high voltage power supply.

3-2 Operation method

1. Upon confirming the connection made with this unit as specified (Refer to 1-4[HOW TO GROUND]), operate it. Be sure to connect the earth with the ground terminal of the unit.
2. Connect the attached AC input cord with AC input connector on the rear panel (INPUT AC100V-240V) and plug socket.
3. Connect the interlock. (Refer to P12. 3-4-6 Door switch (Interlock))
4. Turn on the POWER Switch. The unit gets in stand-by mode.
No high voltage is generated on the output terminal when unit is in this mode.
5. Pressing the output voltage/current preset switch and keeping it pressed shows the voltage and current settings on the display. Turn the output voltage dial to adjust the voltage as desired. Then turn the output current setting dial to adjust the current as desired.
6. Press the OUTPUT switch to output the set value. The red lamp lights on.
7. For ending the operation of the power supply, be sure to return the output voltage setting dial to 0 (if the same voltage is to be used again, leave it as it is), turn off the switches in the order OUTPUT switch, POWER ON/OFF switch.

3-3 Description of Operation Modes

The EPR Series power supply units are provided with two operation modes (constant voltage and constant current modes) and two control modes (local and remote modes).

This section describes the constant voltage and constant current modes in the local modes.

The operation mode is determined by the following:

- Output voltage setting V_{set}
- Output current setting I_{set}
- Load resistance R_L

3-3-1 Constant Voltage Mode

The power supply unit operates in the constant voltage mode when the load current I_L is less than the current setting I_{set} ($I_L < I_{set}$; $I_L = V_{set}/R_L$).

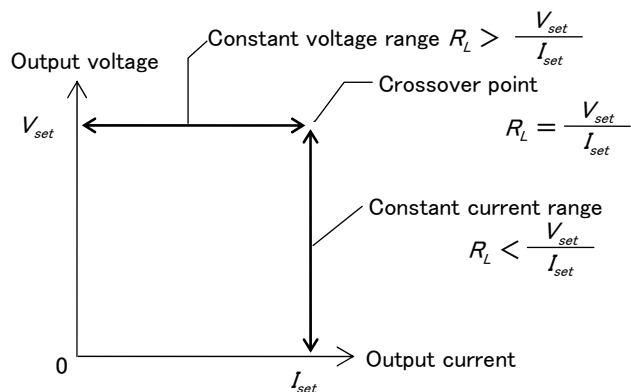
In the constant voltage mode, the voltage is constant at the set value (V_{set}) and the load current I_L changes according to the load.

When using the power supply unit in the constant voltage mode, turn the current setting knob clockwise all the way to the maximum or ensure that it is set to the required current, which allows setting to the desired voltage.

3-3-2 Constant Current Mode

The power supply unit operates in the constant current mode when the load resistance is low enough to make the load current I_L more than the current setting ($I_L > I_{set}$). In the constant current mode, the current is constant at the set value (I_{set}) and the load voltage changes according to the load.

- R_L = Load resistance
- V_{set} = Output voltage setting
- I_{set} = Output current setting



3-3-3 Crossover Mode

The automatic crossover system functions to automatically switch between the modes as the load response changes. For example, the mode is changed from the constant voltage to constant current when the load current exceeds the current setting. The mode is brought back to the constant voltage when the resistance becomes high enough.

3-4 Other function

3-4-1 Over voltage protection (O.V.P)

This unit has an over voltage protection. Even at the time of abnormality, it is limited at approx. 110% of the maximum rated voltage, protecting power supply and load from damage.

3-4-2 Over current protection (O.C.P)

This unit has an over current protection. When over current, the output current is limited by decreasing the output voltage.

3-4-3 Power failure protection

This unit integrates a circuit to stop the output when it is recovered from power failure.

During the operation, when recovered from power failure, unit does not resume the output.

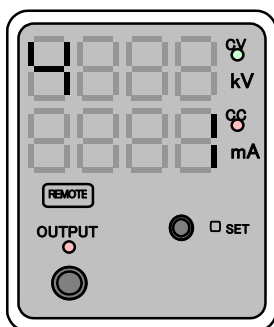
Resume the output by OUTPUT ON/OFF switch.

When power failure protection is not in use, set "0" (OFF) for "4" of starting menu.

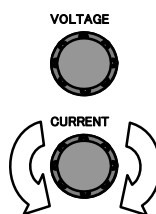
(Please refer to 4 for starting menu.)

Then, when recovered from power failure, or when turn on POWER ON/OFF switch, power supply shall get back to the status when power failure is happened.

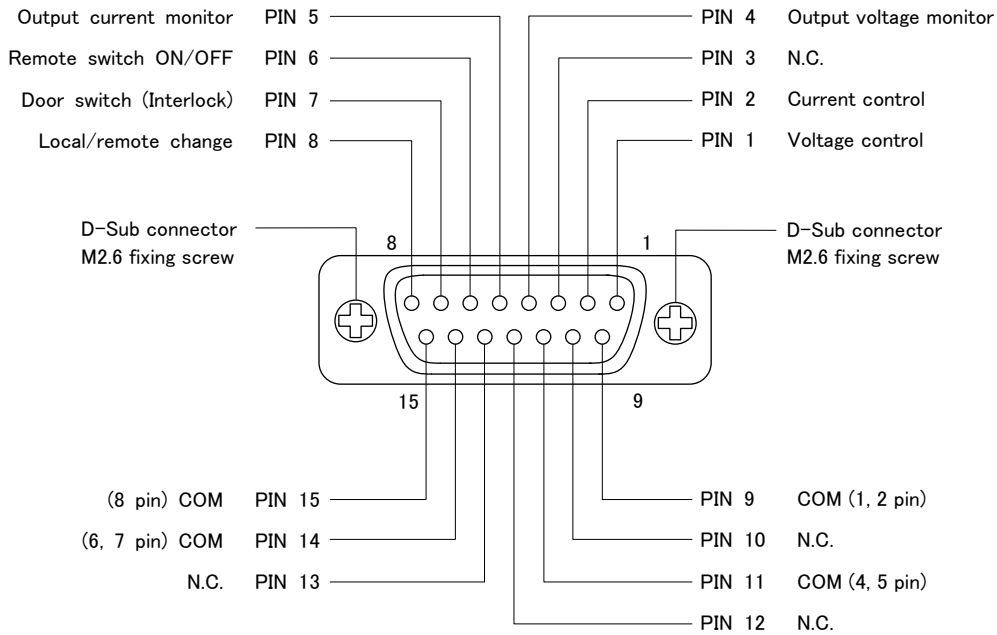
(If power is failure when OUTPUT ON/OFF is ON, then the unit resume the output automatically. When power is failure when OFF, power supply keep off.)



On/Off for power failure cancellation function is changed by current setting dial

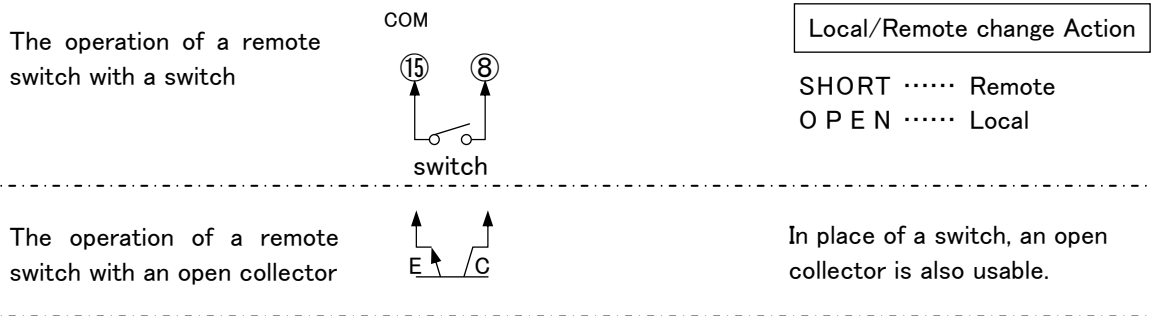


Control connector ··· D-sub 15S type



3-4-4 Local/Remote change

Use the external switch to select controlling the front panel setting dial (Local mode) or the rear panel control connector (Remote mode). Select to Remote mode, and the output voltage and the output current can be set with the external voltage source.



3-4-5 Way of changing ON and OFF of a remote switch

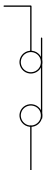
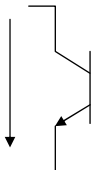
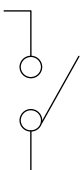
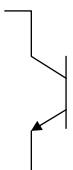
It is possible to change ON and OFF of output with a remote switch.



Precautions for use of an open collector *1

Use an open collector according to the following rules.

The rule of an open collector

Output	Switch	Open collector
ON	 <p>Short</p>	 <p>VCE Up to 0.4V (10mA)</p>
OFF	 <p>Open</p>	<p>5V</p>  <p>VCE More than 2V (open circuit voltage 5V)</p>

About the operation with the OUTPUT switch on the front panel or a remote switch, and the indication of OUTPUT LED

The procedure of operation for an output is different with whether the remote switch is set to ON or OFF at the time of POWER ON.

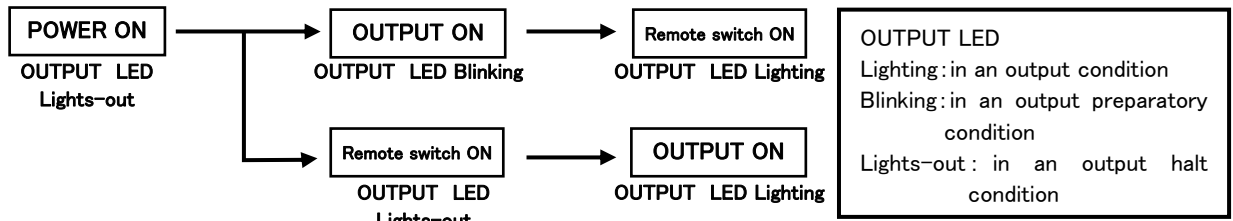
About the difference arising from the state of the remote switch at the time of POWER ON

When a blackout protection is ON

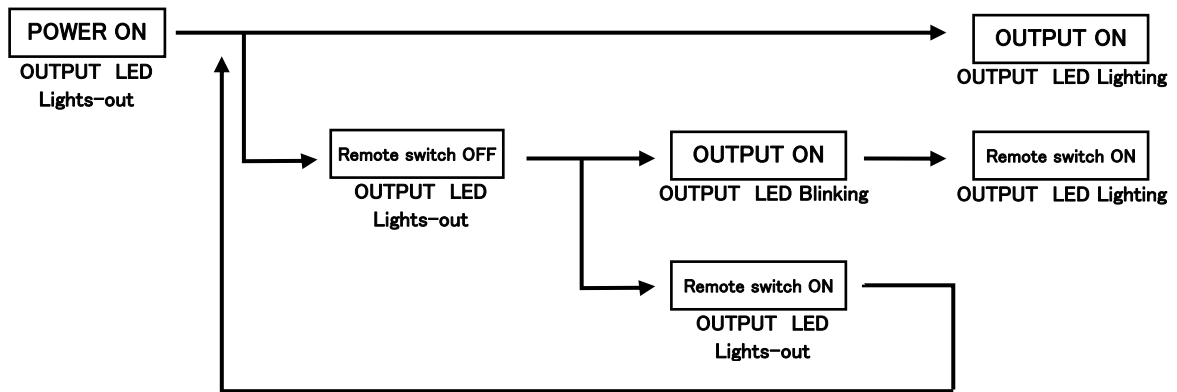
When the POWER switch is turned off during output preparation or an output, a blackout protection operates.

When the POWER switch is turned on again, it will be in an output halt condition.

- ① In the case of the remote switch OFF and the POWER switch ON



- ② In the case of the remote switch ON and the POWER switch ON



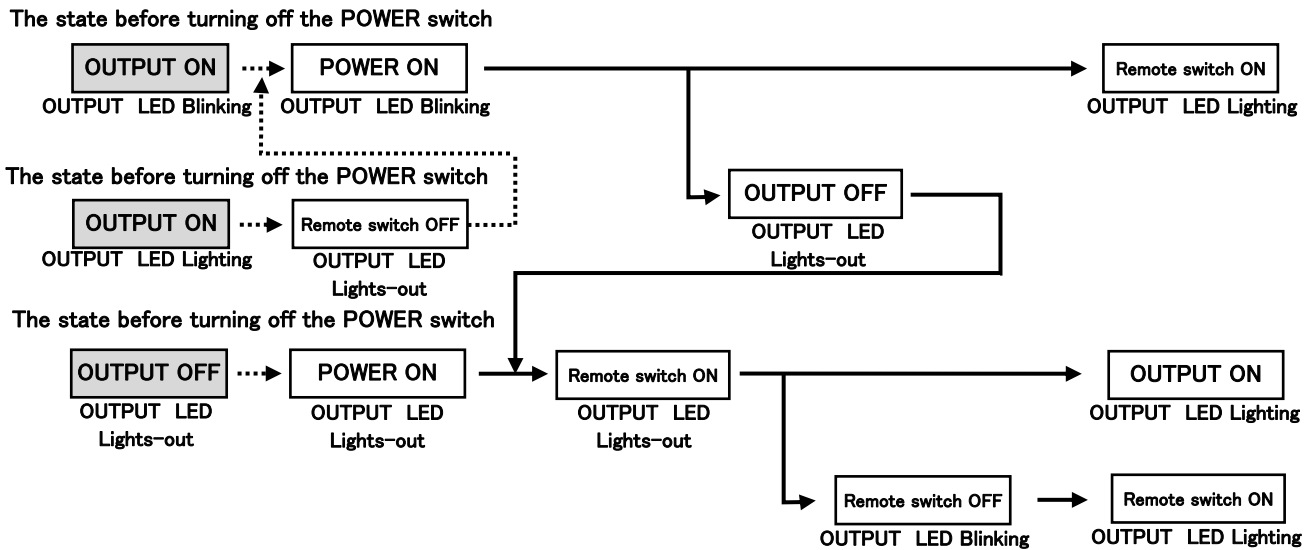
*EPR series is high voltage power supply. Therefore, for the safety of users, at the time of factory shipments, it is a setup switch is not outputted unless the OUTPUT switch is turned on. When a blackout protection is OFF, output can be done only with the operation of the remote switch even if the OUTPUT switch is not turned on.

When a blackout protection is OFF

When the POWER switch is turned on again after being turned off during output preparation or an output, EPR series starts in a state before turning off the POWER switch. An output is started by making the remote switch short-circuit in an output preparatory

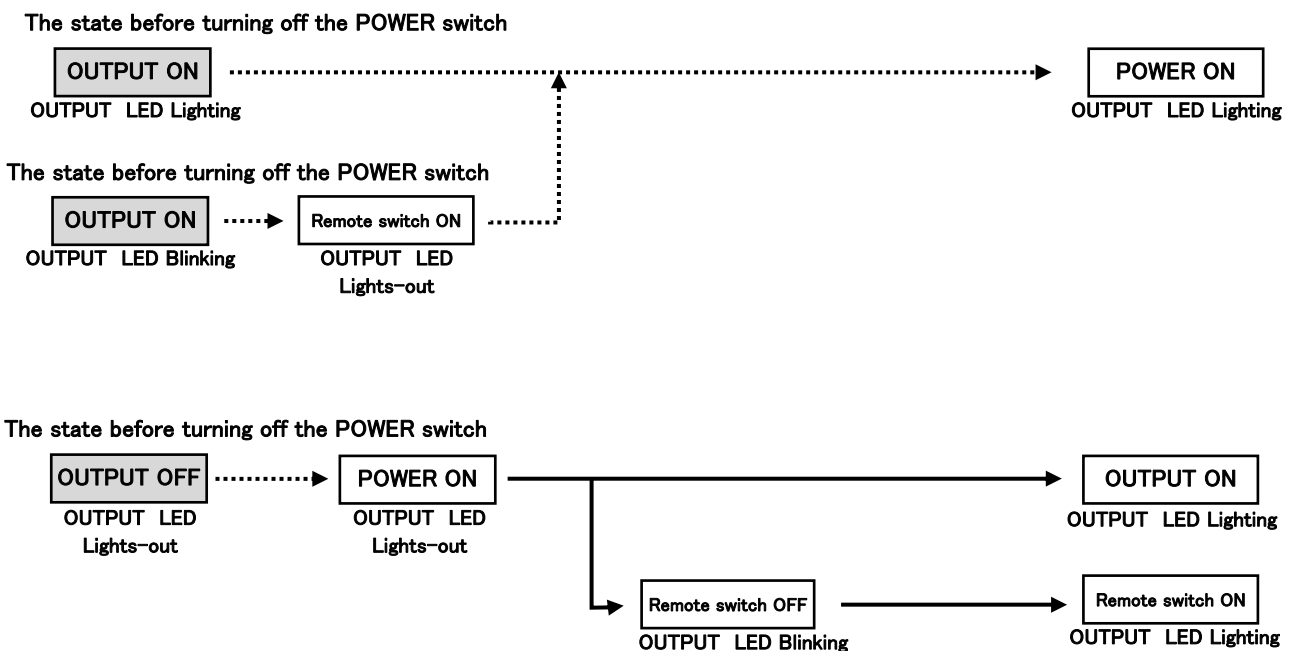
If the POWER switch was turned off during the output, please be careful that the output is reopened immediately when the POWER switch is turned on again.

① In the case of the remote switch OFF and the POWER switch ON



*An output can be done without turning on the OUTPUT switch.

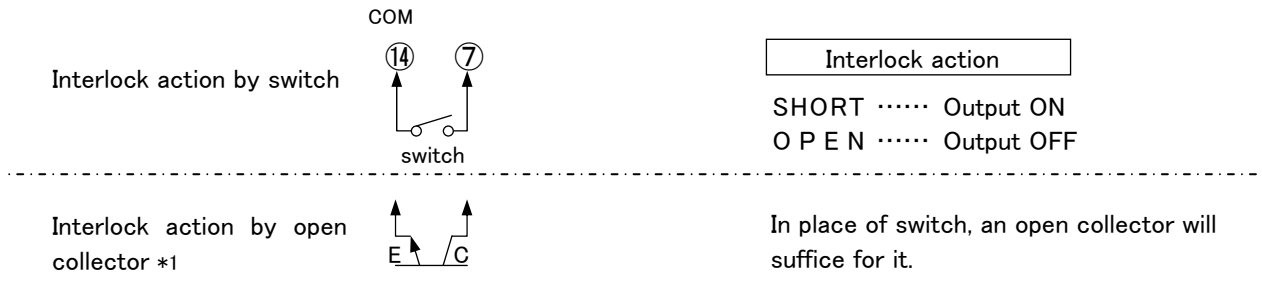
② In the case of the remote switch ON and the POWER switch ON



3-4-6 Door switch (Interlock)

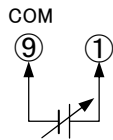
High voltage output can be cut off with external switch off. For safety reason, once the output is cut off, the unit shall not resume the output even turning the external switch back on.

To reset this status, turn the Power switch on after shorting the interlock terminal.

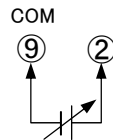


3-4-7 External voltage control

In the remote mode, 0-10Vdc external voltage can control the output voltage within the range of 0-100%.



Voltage control

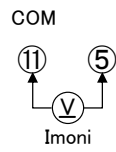


Current control

3-4-8 Output current monitor

10V output for the maximum rated output current. Output impedance is 1k ohm.

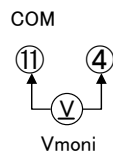
The monitor output polarity is positive regardless of the high voltage output polarity.



3-4-9 Output voltage monitor

10V output for the maximum rated output voltage. Output impedance is 1k ohm.

The monitor output polarity is positive regardless of the high voltage output polarity.



4 Start menu

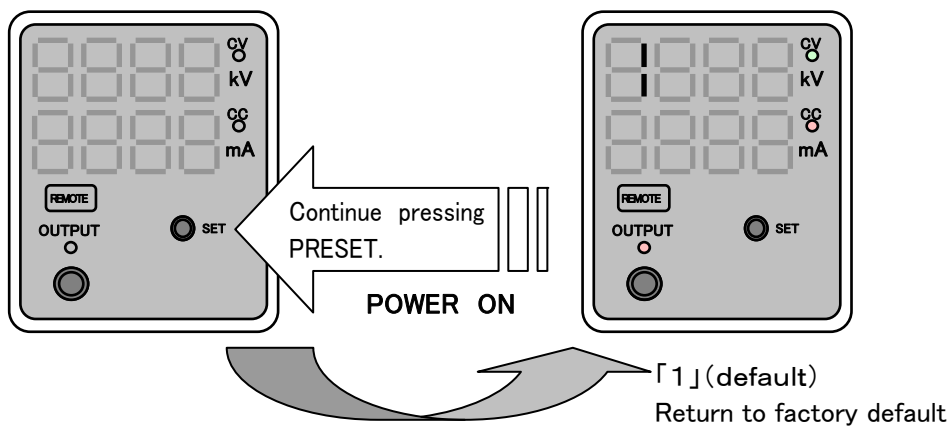
4-1 Start menu

In the start menu, settings of the following functions and initialization to the factory default are executed.

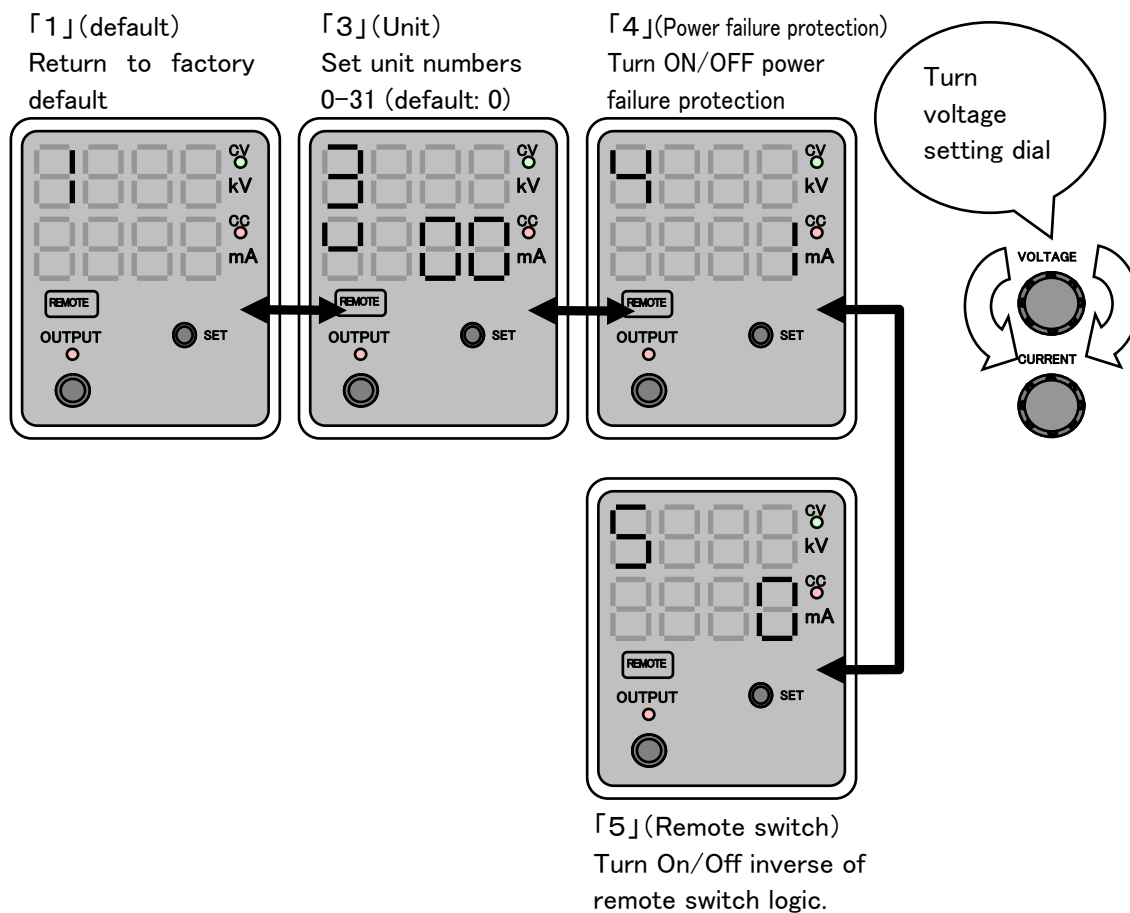
Menu number "1": default	initializes to the factory default.
Menu number "3": unit setting	sets unit numbers.
Menu number "4": power failure protection	sets power failure protection.
Menu number "5": inverse of remote switch logic	sets inverse of remote switch logic.

4-2 Setting start menu

Continue to press the preset switch when the power switch of the body is on, so that the display is changed to "1".

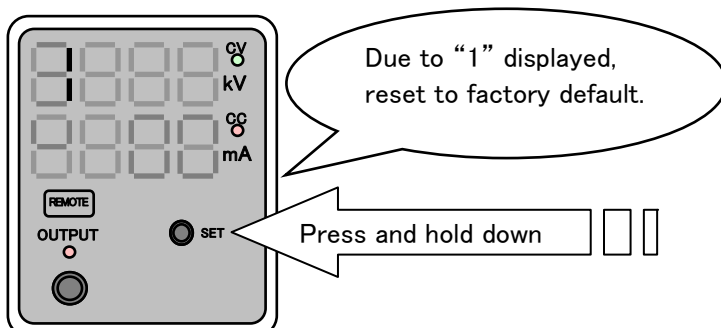


1. To change the menu display, turn the voltage setting dial so that the display is switched to menus.



2. To end (register) the menu, press and hold down the PRESET switch in the state of the menu to be registered.

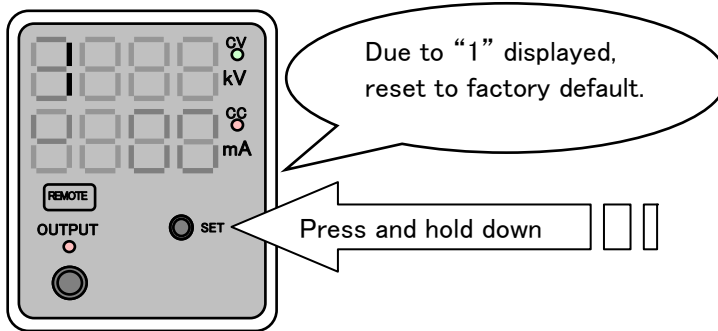
* “1”: when the default is displayed, all settings are initialised to the factory default.



4-3 Menu mode

1. Menu number "1": Menu to reset to factory default

a. PRESET switch (press and hold down): initialized to factory default

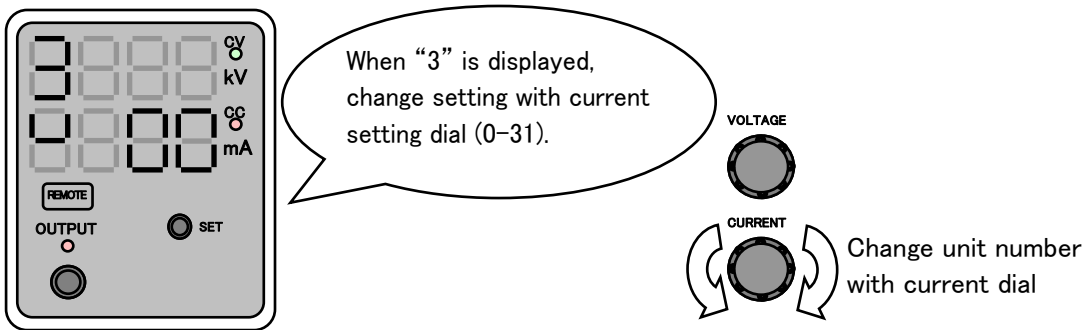


2. Menu number "3": Unit number setting menu

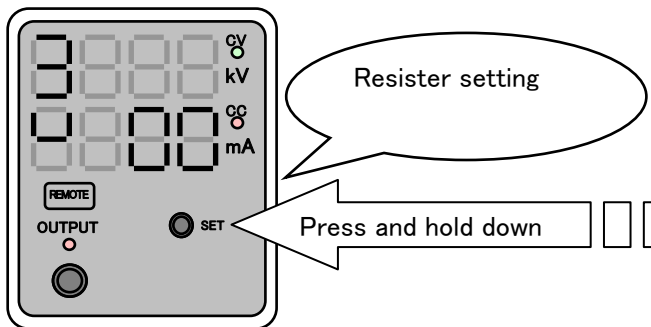
a. "3" displayed:

Unit numbers can be changed by turning the current setting dial. (0-31)

(* "0" is set by factory setting and default.)



b. PRESET switch (press and hold down): register settings

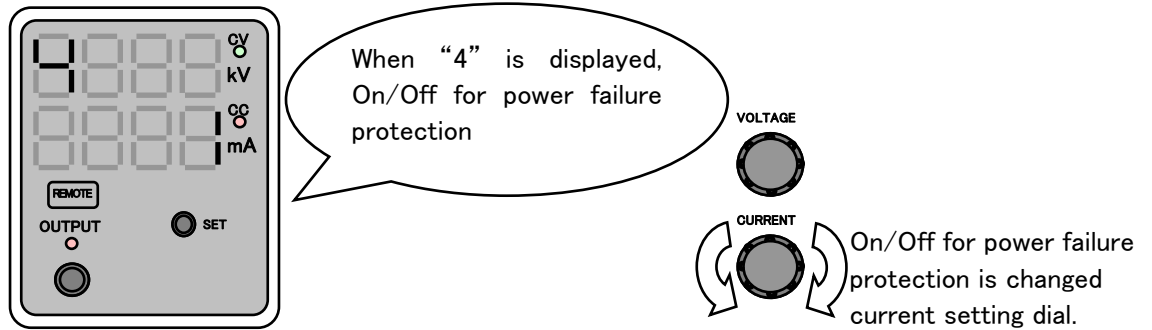


3. Menu number “4”: power failure protection setting menu

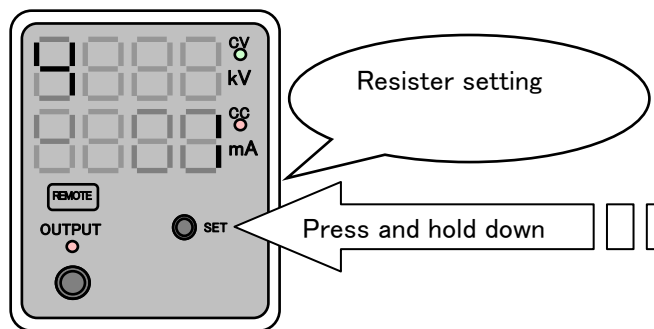
a. “4” displayed:

On/Off for power failure protection is changed by current setting dial.

(* “1” (On) is set by factory setting and default.)



b. PRESET switch (press and hold down): register settings

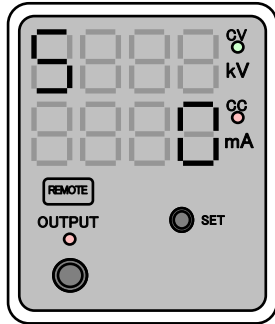


4. Menu number “5”: inverse of remote switch logic setting menu

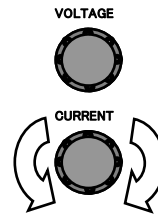
a. “5” displayed:

On (1)/Off (0) for inverse of remote switch logic is changed by current setting dial.

(* “0” (Off) is set by factory setting and default.)

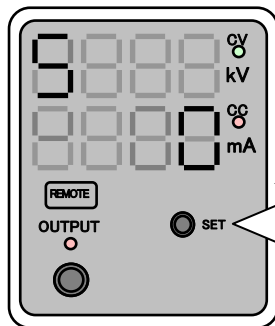


When “5” is displayed, On/Off for inverse of remote switch logic.



On/Off for inverse of remote switch logic is changed current setting dial.

b. PRESET switch (press and hold down): register settings



Register setting

Press and hold down



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