Instruction Manual

MODEL DOPF Series

Matsusada Precision

Rev. 0.9

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

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.

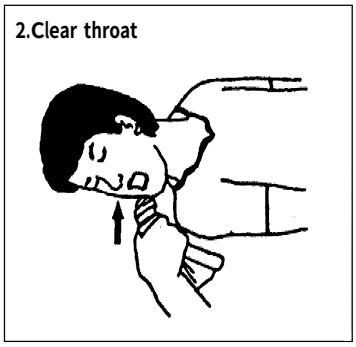
Artificial respiration

1. PLACE VICTIM

Place victim in face-upward position horizontally.

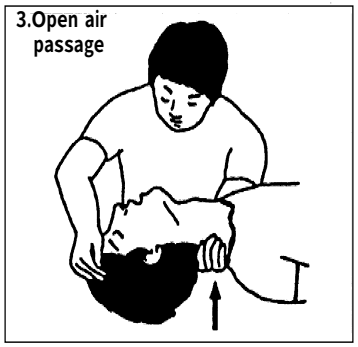
2. CLEAR THROAT

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



3. OPEN AIR PASSAGE

Tilt head back and extend neck to open air passage.

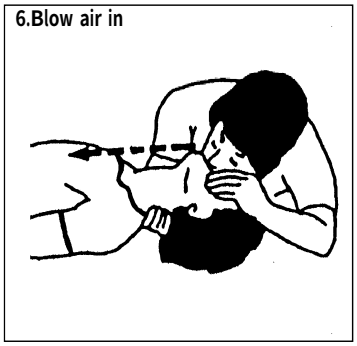


4. LIFT JAW FORWARD

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.

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.

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.

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.

Table of contents

Table of contents

1 Introduction

1-1 Introduction

Thank you very much for your purchase of our product, HIGH SPPED AMPRIFIER.
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 amplifier

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

〈Accessories〉

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

<Accessories for Option>

- Instruction manual
- GP－Cable (-LGob option)
- Install manual (-LUs1 option)
- USB driver (-LUs1 option)

1-3 Environmental requirements

- Place and use the high voltage amplifier horizontally.
- Never place any object on the high voltage amplifier.
- There are air suction and exhaust holes for cooling at upper part and sides of the high voltage power supply. Provide an ample space to the high voltage 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.

WHEN TOUCHING LOAD AFTER TURNING OFF HIGH VOLTAGE

1. Make the setting of an output voltage to zero (0).
2. Turn off the POWER ON/OFF switch.
3. Check and confirm that the voltage is zero at an output voltmeter of this unit.
   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.
4. Make it a rule to touch load with right hand.

How to GROUND

- For the safe operation, be sure to ground the ground terminal of power supply at one point.
- Make sure to ground properly as per the above sketch Insufficient ground can cause electrical shock or serious damage to the unit.
- In case output short circuit or arcing is expected, please make the ground wire shorter and thicker.

Ground terminal

AC input terminal

FOR SAFER OPEREATION

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 so with right hand with left hand put in the pocket, taking care not to touch other objects.
3. After turning off the voltage (even if a long time has lapsed after turning off), if you touch load, be sure to earth the output longer than 10 seconds.

1-5 What to do before calling for sarvice

In case no output

1. Check whether or not a specified voltage has been inputted.
   AC100～120V 50/60Hz single phase of input voltage.
   (For output power of 600W or higher, AC 200～240V 50/60Hz single phase)

2. Check whether or not a connection is correct.

1-6 Characteristics of bi-polar amplifier

Capacitive load

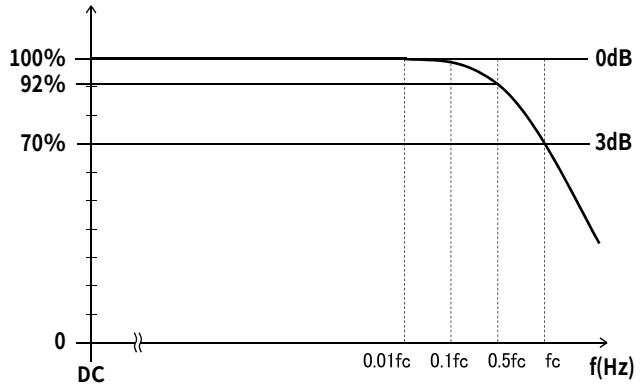
Capacitive load may cause oscillation when it is more than 100pF. In such case, insert 1Ω(10μF)～1kΩ (1000pF) power resistance in series with the output. Be careful that the frequency bandwidth is limited depending on the resistance inserted in series in series and the capacity under capacitive load.

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 phase. Therefore attention must be paid by using the product while monitoring the output waveforms.

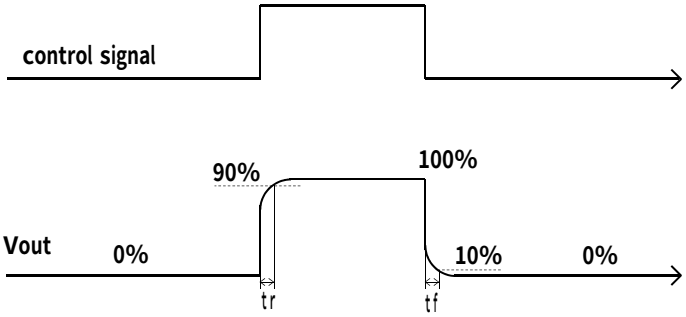


Rising time

(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)

Fc(Hz) is generally acquired by “trapproximately 0.35/fc”

Falling time tf is the same as tr.



2 Exterior view diagram

2-1. Exterior view diagram

Correspondence list of model and exterior/dimension

Model	Output power	Weight	Exterior/Dimension view			Dimensions ※1		Output terminal
			Number	Exterior page	Dimension page	Height	Depth	
DOPF5-30	150W	17kg	A	p.7,8	p.13	133mm	550mm	Terminal board
DOPF5-60	300W	23kg	B	p.9	p.15	177mm	610mm	Terminal board
DOPF6-120	720W	47kg	C	p.10,11	p.17	266mm	610mm	Busbar
DOPF10-15	150W	11kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF10-30	300W	17kg				133mm	550mm	
DOPF10-60	600W	23kg	B	p.9	p.15	177mm	610mm	Terminal board
DOPF20-7.5	150W	11kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF20-15	300W	17kg				133mm	550mm	
DOPF20-30	600W	23kg		p.7,8	p.14	177mm	610mm	
DOPF20-60	1200W	40kg	C	p.10,11	p.16	266mm	610mm	Terminal board
DOPF20-100	2000W	47kg		p.10,11	p.17			Busbar
DOPF25-6	150W	11kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF25-12	300W	17kg				133mm	550mm	
DOPF25-24	600W	23kg		p.7,8	p.14	177mm	610mm	
DOPF25-48	1200W	40kg	C	p.10,11	p.16	266mm	610mm	Terminal board
DOPF25-80	2000W	47kg		p.10,11	p.17			Busbar
DOPF30-40	1200W	40kg		p.10,11	p.16			Terminal board
DOPF45-3.3	150W	12kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF45-6.6	300W	17kg				133mm	550mm	
DOPF45-13.3	600W	23kg		p.7,8	p.14	177mm	610mm	
DOPF45-16	720W	23kg				177mm	610mm	
DOPF45-26.7	1200W	40kg	C	p.10,11	p.16	266mm	610mm	
DOPF45-44.4	2000W	47kg						

※1 Width is 483mm in all models.

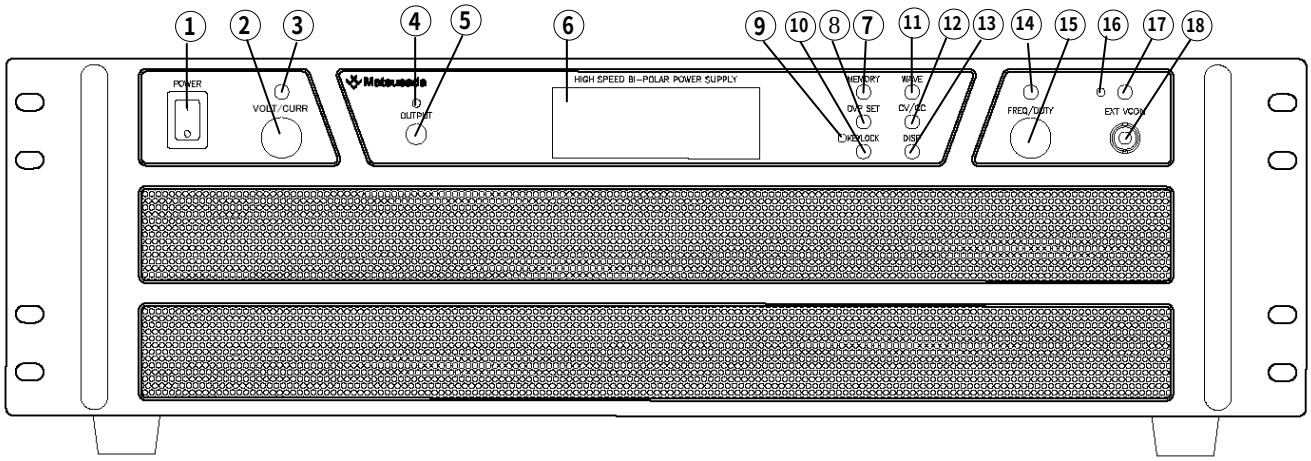
Correspondence list of model and exterior/dimension

Model	Output power	Weight	Exterior/Dimension view			Dimensions ※1		Output terminal
			Number	Exterior page	Dimension page	Height	Depth	
DOPF60-2.5	150W	12kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF60-5	300W	17kg				133mm	510mm	
DOPF60-10	600W	23kg		p.7,8	p.14	177mm	610mm	
DOPF60-20	1200W	40kg	C	p.10,11	p.16	266mm	610mm	
DOPF60-33.3	2000W	47kg						
DOPF70-17	1200W	40kg						
DOPF80-25	2000W	47kg						
DOPF120-2.5	300W	18kg	A	p.7,8	p.13	133mm	550mm	Terminal board
DOPF120-5	600W	30kg	D	p.12	p.18	266mm	610mm	
DOPF120-10	1200W	45kg	C	p.10,11	p.16	266mm	610mm	
DOPF150-2	300W	18kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF150-4	600W	30kg	D	p.12	p.18	266mm	610mm	
DOPF150-8	1200W	45kg	C	p.10,11	p.16	266mm	610mm	
DOPF200-1.5	300W	18kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF200-1.75	350W	18kg				133mm	550mm	
DOPF200-3	600W	30kg	D	p.12	p.18	266mm	610mm	
DOPF200-3.5	700W	30kg	C	p.10,11	p.16	266mm	610mm	
DOPF200-6	1200W	45kg						
DOPF300-1	300W	18kg	A	p.7,8	p.13	133mm	482mm	Terminal board
DOPF300-2	600W	30kg	D	p.12	p.18	266mm	610mm	
DOPF300-4	1200W	45kg	C	p.10,11	p.16	133mm	610mm	

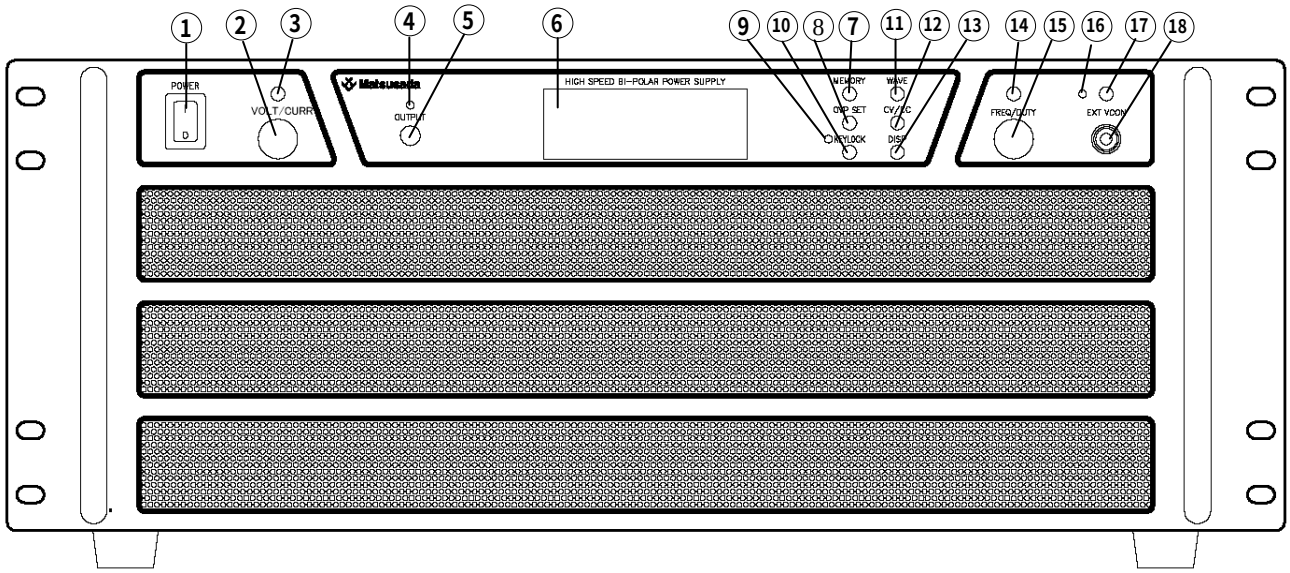
※1 Width is 483mm in all models.

A Exterior view diagram

[Front view]
Height 133mm

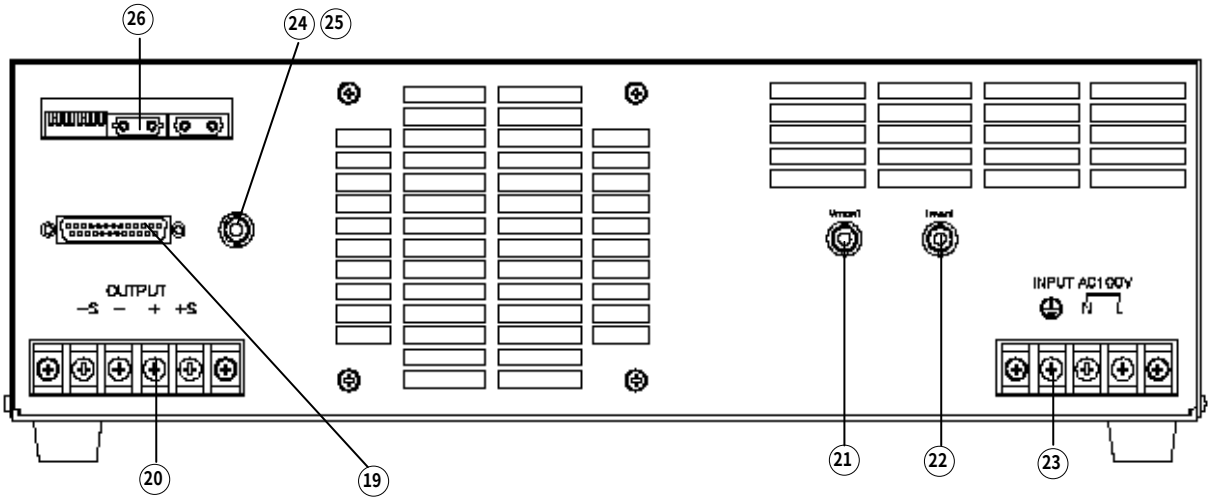


[Front view]
Height 177mm

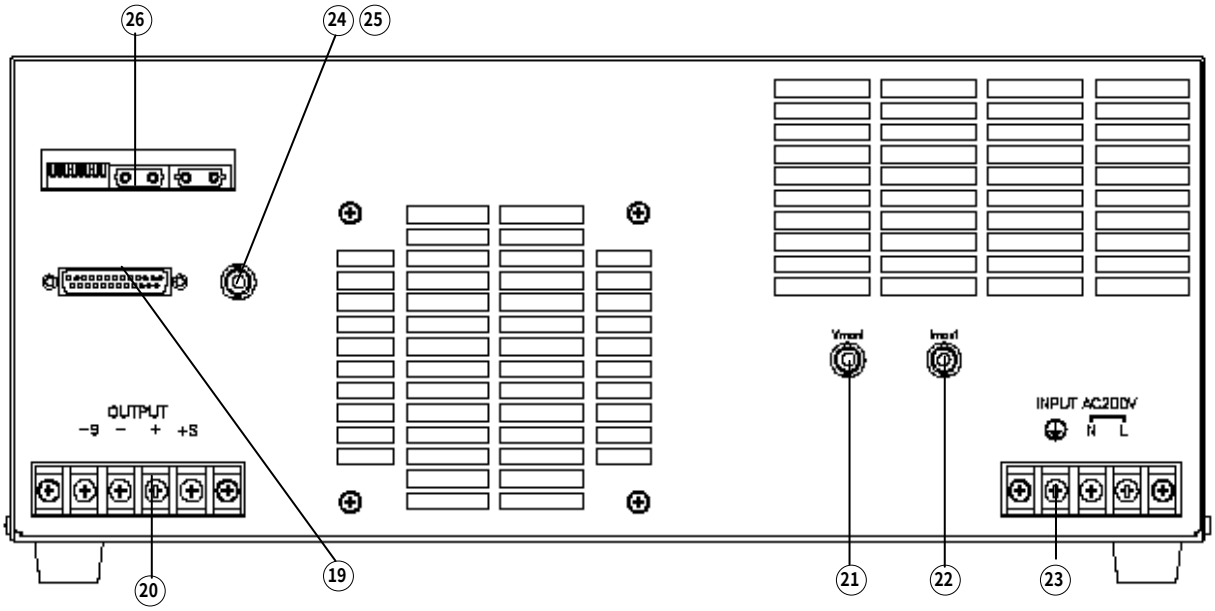


① POWER ON/OFF switch	⑩ KEYLOCK switch
② VOLT/CURR encoder	⑪ WAVE switch
③ VOLT/CURR switch	⑫ CV/CC switch
④ OUTPUT indication LED	⑬ DISP switch
⑤ OUTPUT ON/OFF switch	⑭ FREQ/Duty switch
⑥ LCD	⑮ FREQ/Duty encoder
⑦ MEMORY switch	⑯ EXT control signal(Vcon) indication LED
⑧ OVP SET switch	⑰ EXT control signal(Vcon) switch
⑨ KEYLOCK indication LED	⑱ EXT control signal(Vcon) terminal

[Rear view]
Height 133mm



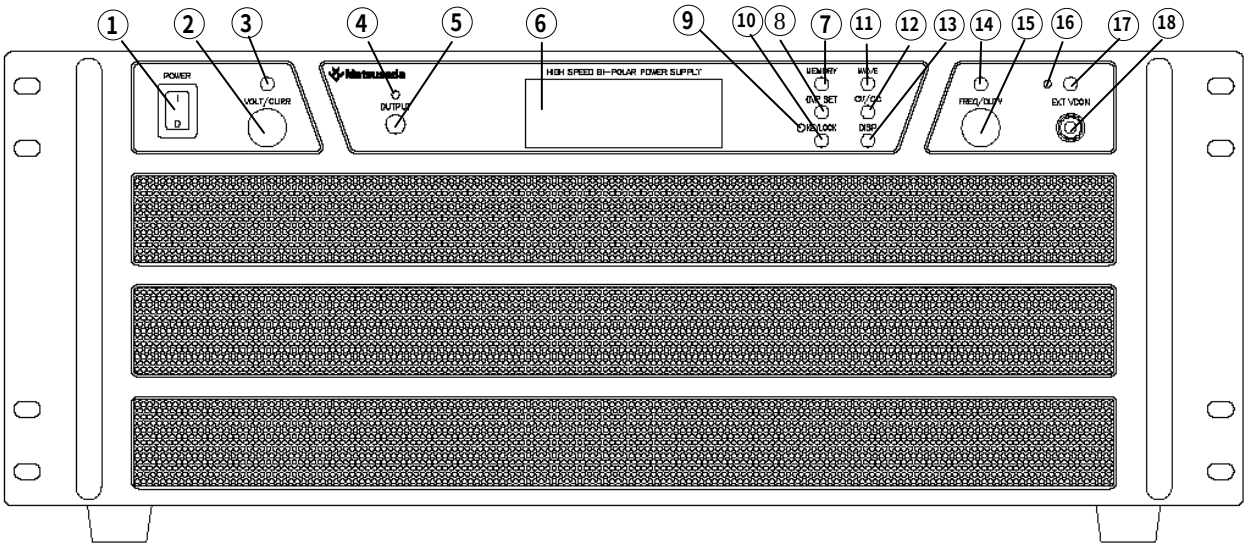
[Rear view]
Height 177mm



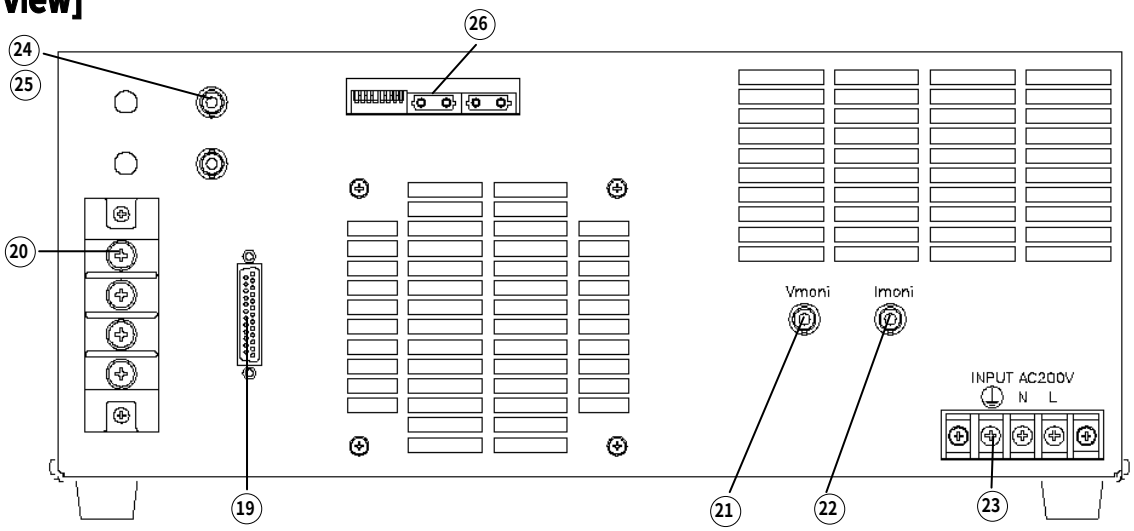
⑲ Connector for Master-slave (option)	㉓ AC input terminal
⑳ OUTPUT terminal	㉔ Remote switch (option)
㉑ Voltage monitor terminal	㉕ Interlock (option)
㉒ Current monitor terminal	㉖ Communication connector (option)

B Exterior view diagram

[Front view]



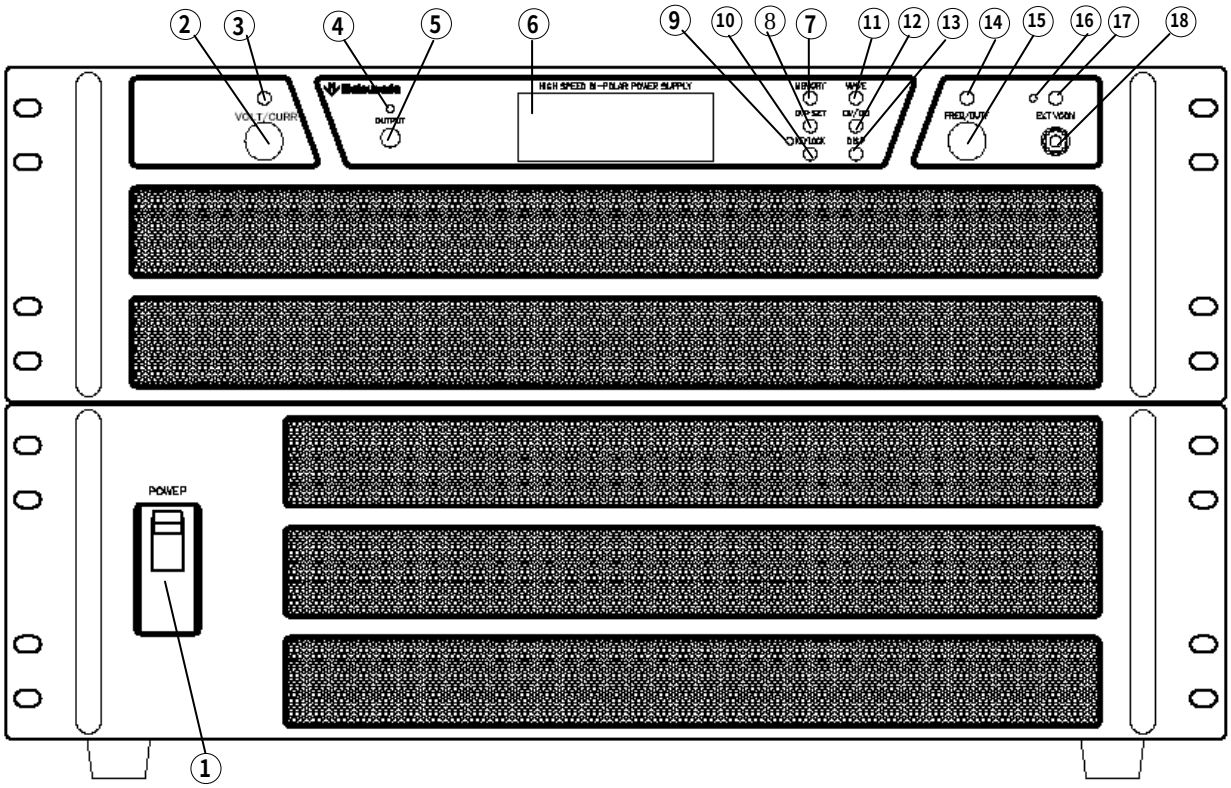
[Rear view]



① POWER ON/OFF switch	⑭ FREQ/Duty switch
② VOLT/CURR encoder	⑮ FREQ/Duty encoder
③ VOLT/CURR switch	⑯ EXT control signal(Vcon) indication LED
④ OUTPUT indication LED	⑰ EXT control signal(Vcon) switch
⑤ OUTPUT ON/OFF switch	⑱ EXT control signal(Vcon) terminal
⑥ LCD	⑲ Connector for Master-slave (option)
⑦ MEMORY switch	⑳ OUTPUT terminal
⑧ OVP SET switch	㉑ Voltage monitor terminal
⑨ KEYLOCK indication LED	㉒ Current monitor terminal
⑩ KEYLOCK switch	㉓ AC input terminal
⑪ WAVE switch	㉔ Remote switch (option)
⑫ CV/CC switch	㉕ Interlock (option)
⑬ DISP switch	㉖ Communication connector (option)

C Exterior view diagram

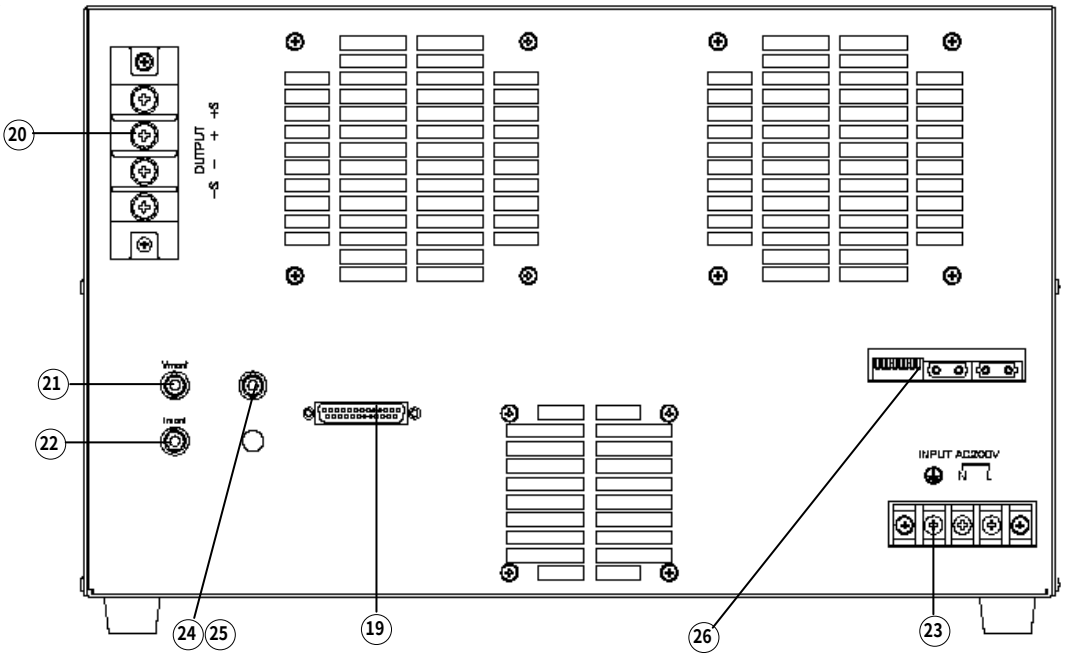
[Front view]



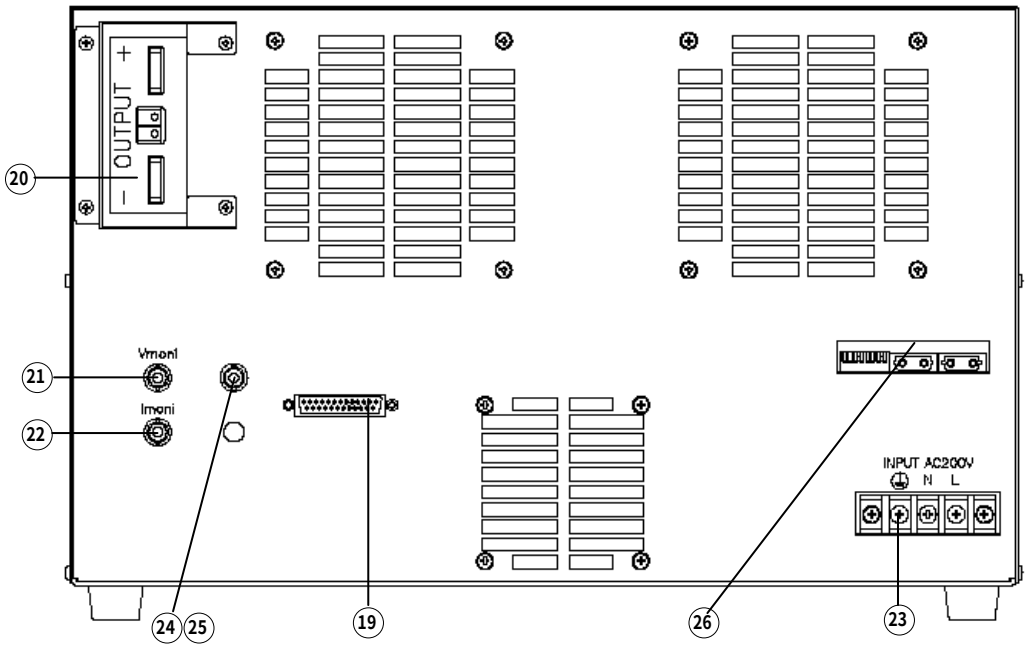
① POWER ON/OFF switch
② VOLT/CURR encoder
③ VOLT/CURR switch
④ OUTPUT indication LED
⑤ OUTPUT ON/OFF switch
⑥ LCD
⑦ MEMORY switch
⑧ OVP SET switch
⑨ KEYLOCK indication LED
⑩ KEYLOCK switch
⑪ WAVE switch
⑫ CV/CC switch
⑬ DISP switch
⑭ FREQ/Duty switch
⑮ FREQ/Duty encoder
⑯ EXT control signal(Vcon) indication LED
⑰ EXT control signal(Vcon) switch
⑱ EXT control signal(Vcon) terminal

C Exterior view diagram

[Rear view]
Terminal type



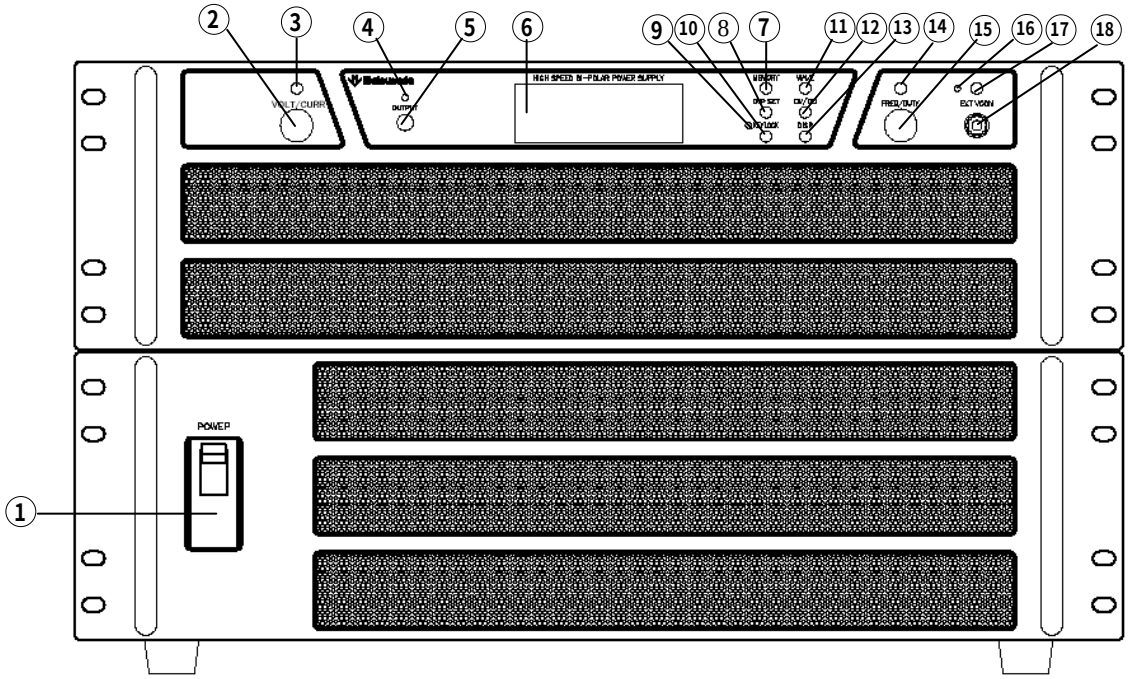
[Rear view]
Busbar type

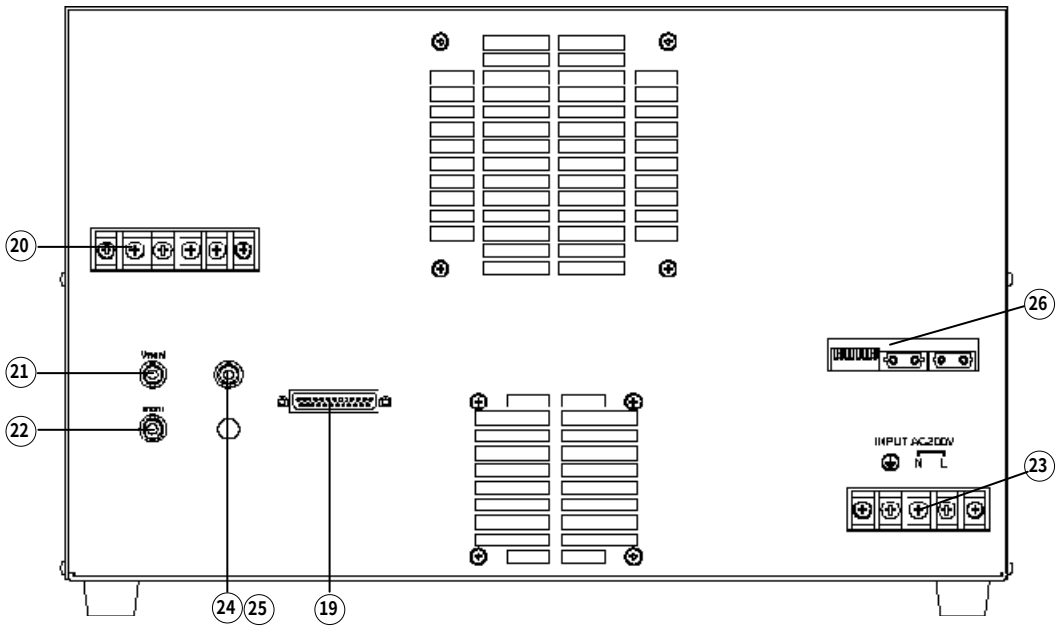


⑲ Connector for Master-slave (option)
⑳ OUTPUT terminal
㉑ Voltage monitor terminal
㉒ Current monitor terminal
㉓ AC input terminal
㉔ Remote switch (option)
㉕ Interlock (option)
㉖ Communication connector (option)

D Exterior view diagram

[Front view]



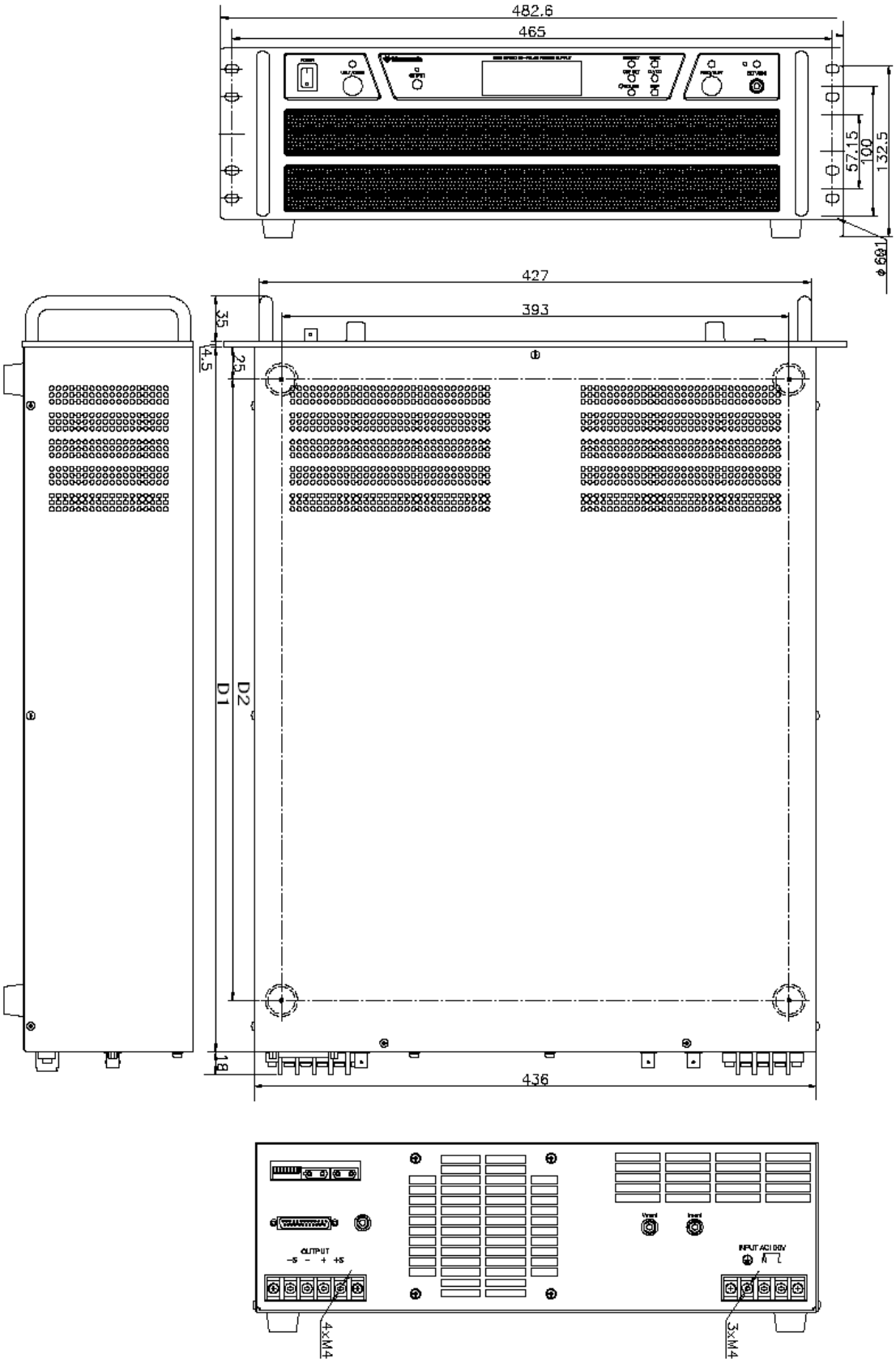


①	POWER ON/OFF switch	⑭	FREQ/Duty switch
②	VOLT/CURR encoder	⑮	FREQ/Duty encoder
③	VOLT/CURR switch	⑯	EXT control signal(Vcon) indication LED
④	OUTPUT indication LED	⑰	EXT control signal(Vcon) switch
⑤	OUTPUT ON/OFF switch	⑱	EXT control signal(Vcon) terminal
⑥	LCD	⑲	Connector for Master-slave (option)
⑦	MEMORY switch	⑳	OUTPUT terminal
⑧	OVP SET switch	㉑	Voltage monitor terminal
⑨	KEYLOCK indication LED	㉒	Current monitor terminal
⑩	KEYLOCK switch	㉓	AC input terminal
⑪	WAVE switch	㉔	Remote switch (option)
⑫	CV/CC switch	㉕	Interlock (option)
⑬	DISP switch	㉖	Communication connector (option)

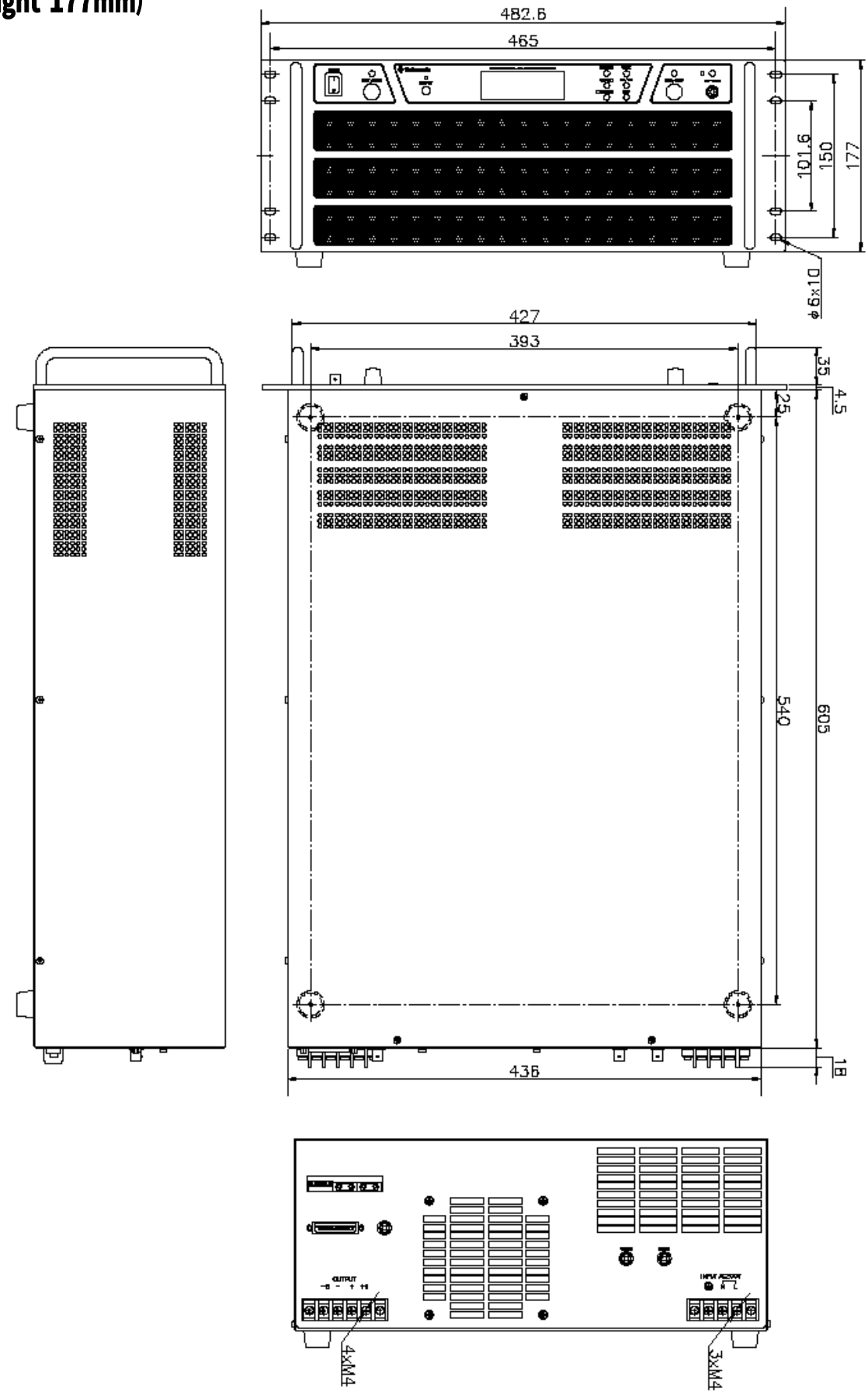
2-2. Dimensions

A Dimensions (Height 133mm)

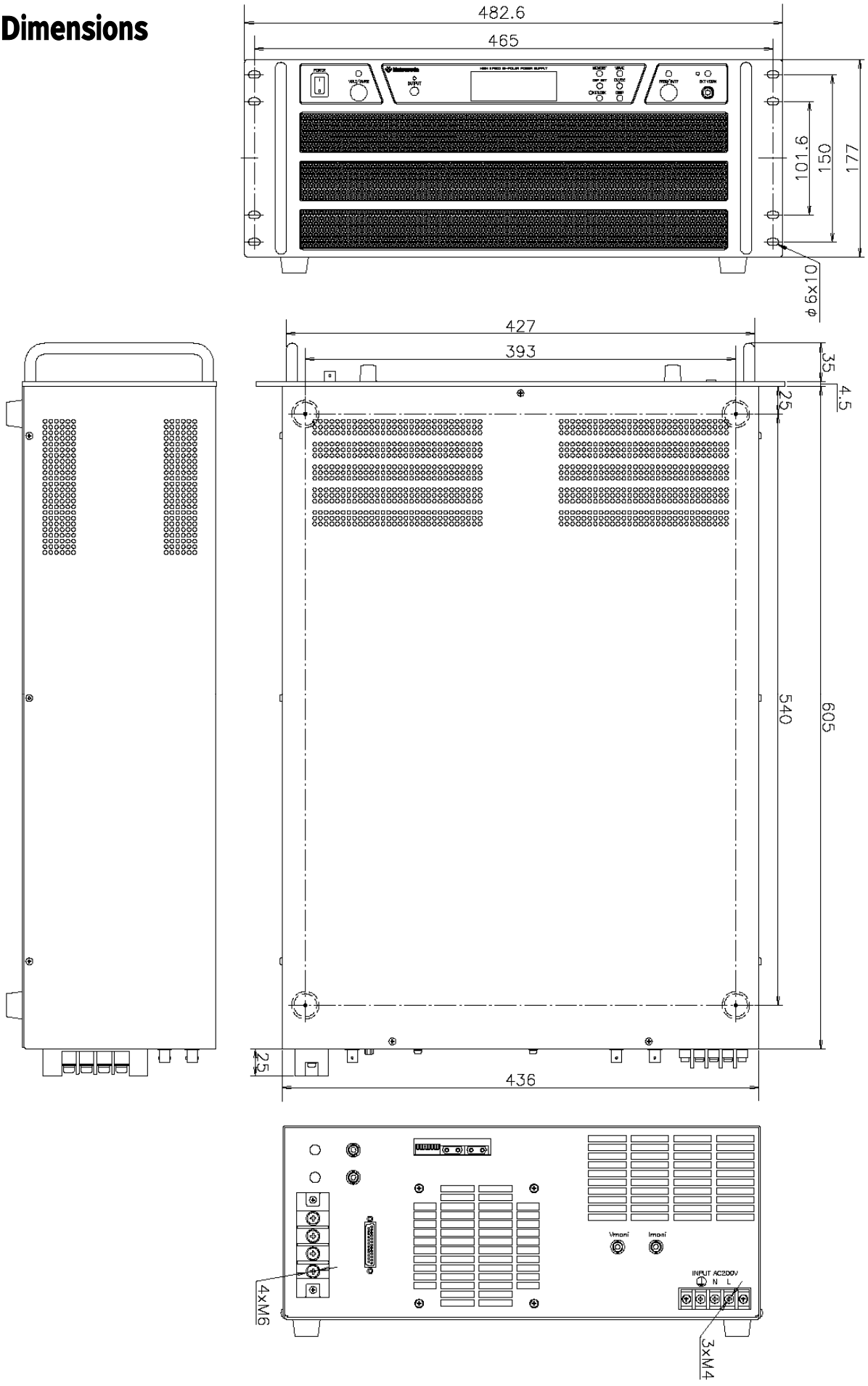
Model	D1	D2
150W (except POPF5-30)	478mm	401mm
300W、350W、POPF5-30	546mm	481mm



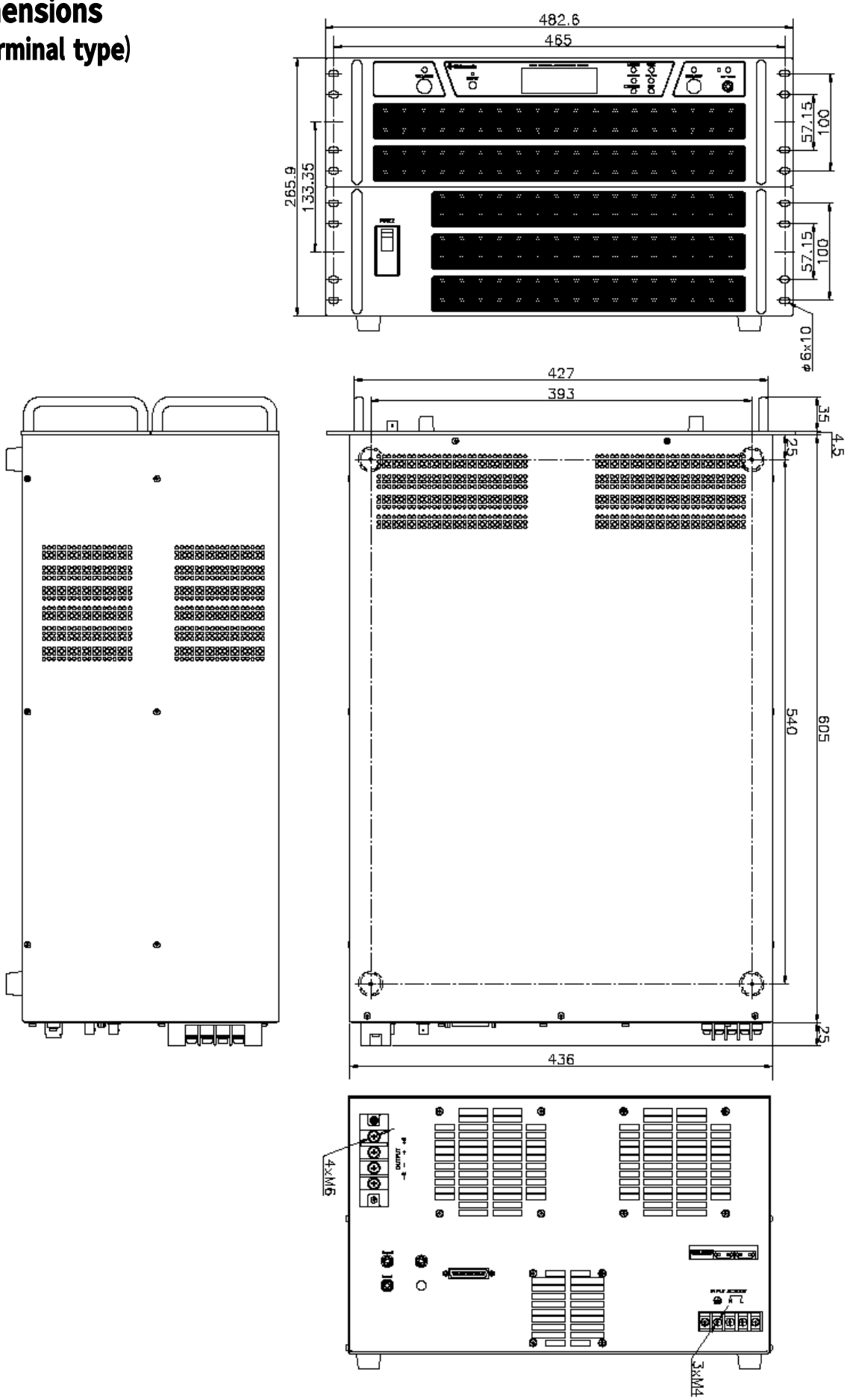
A Dimensions
(Height 177mm)



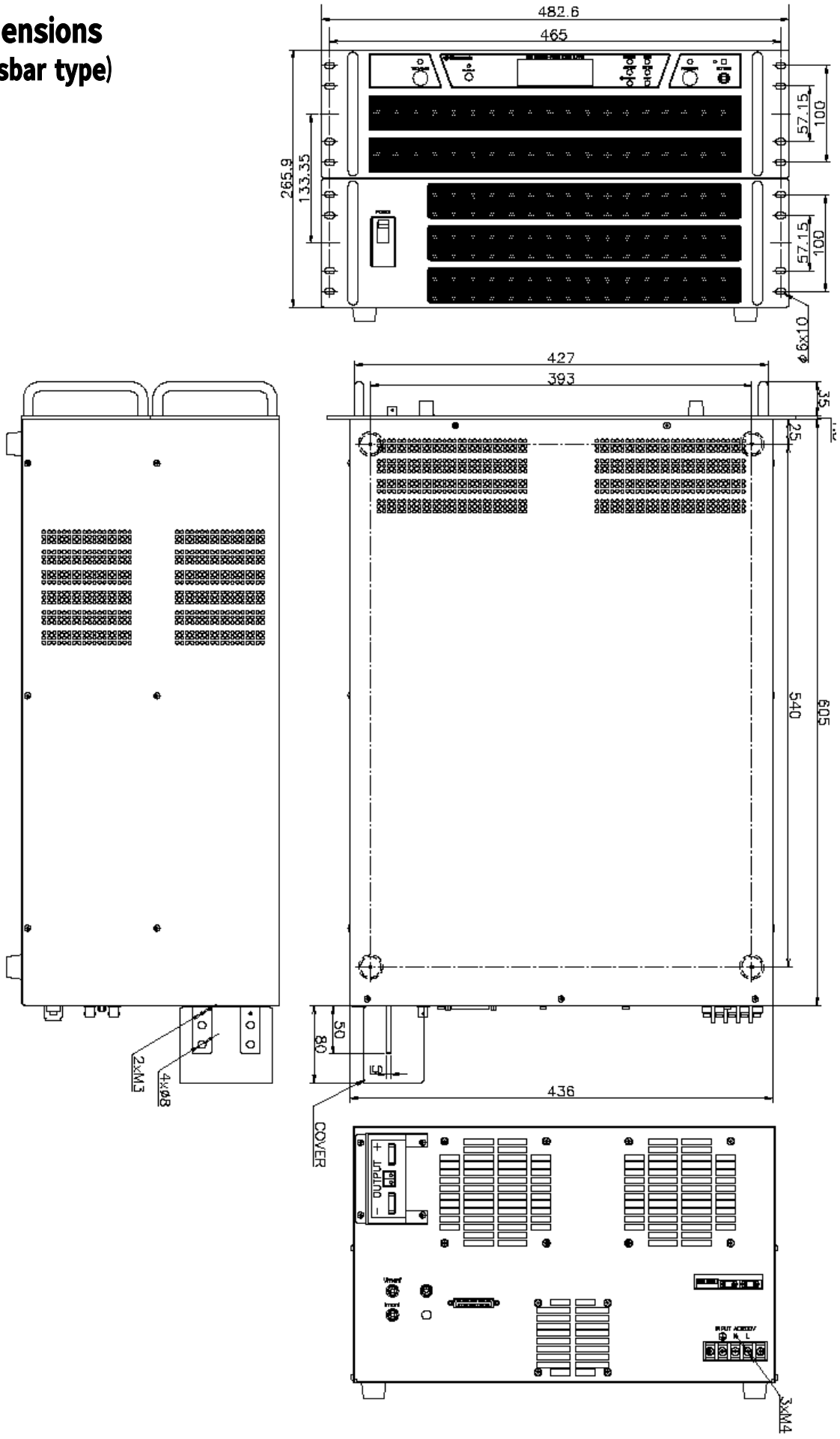
B Dimensions



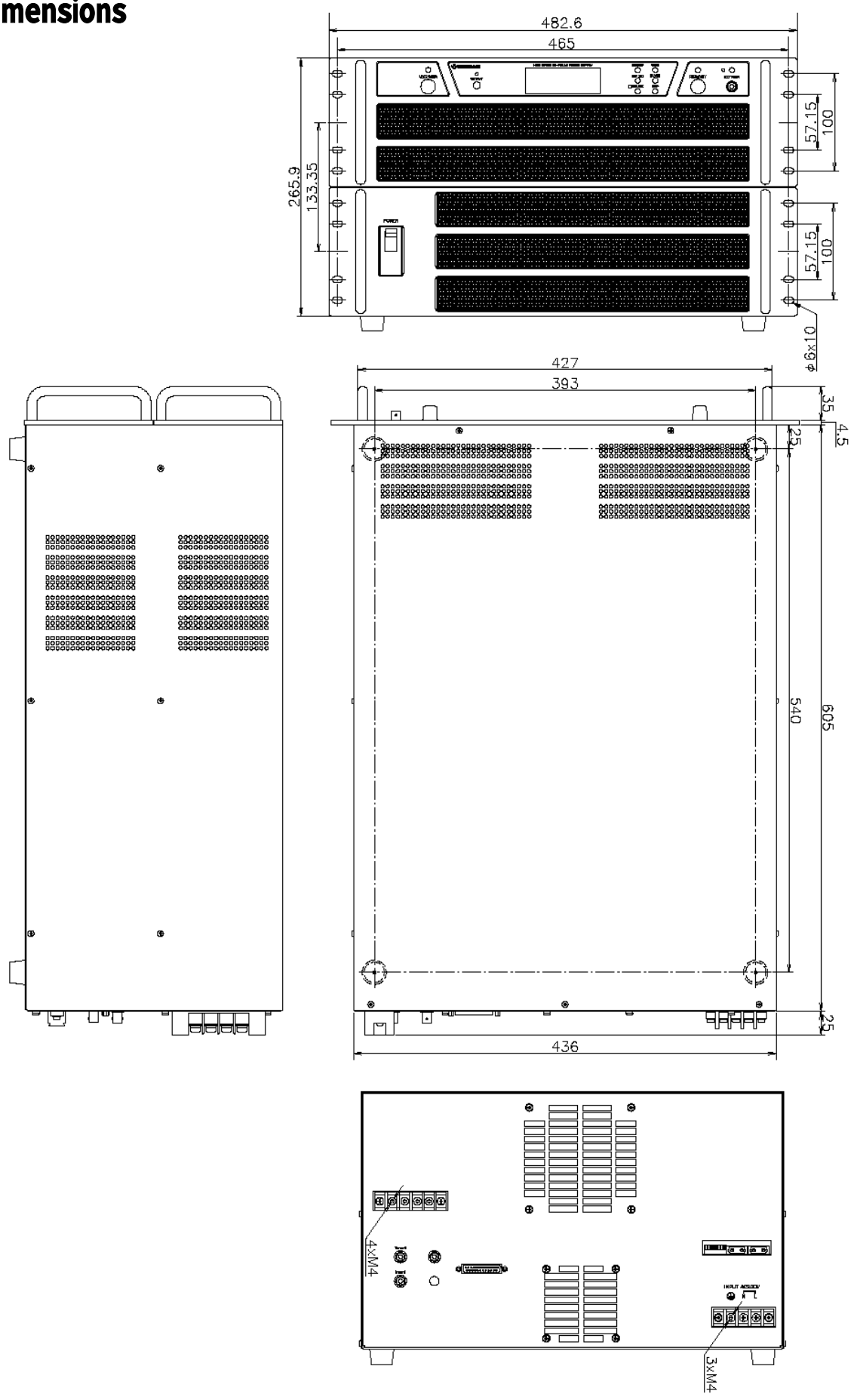
C Dimensions
(Terminal type)



C Dimensions (Busbar type)



D Dimensions



3 Instruction for handling

3-1 Overview

DOPF is high speed bi-polar amplifier that operate on constant voltage mode when set as constant voltage control, and operate constant current mode when set as constant current control, following internal control signal or external control signal.
Since DOPF supports all four quadrants, this product is capable to supplying source current and sink current.

3-2 Connection to the load

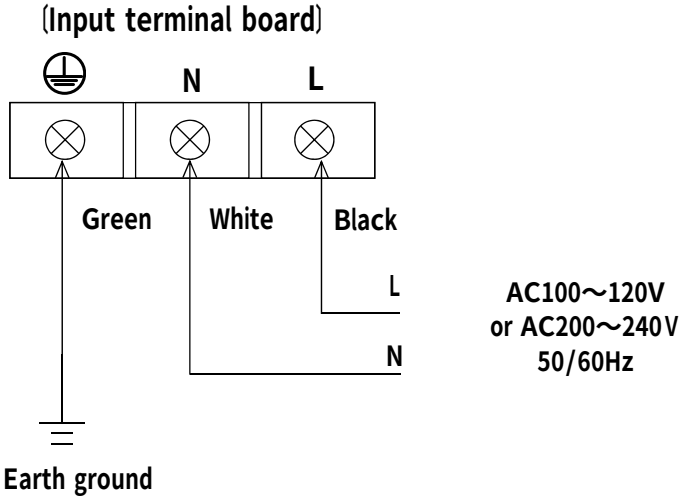
- Connect adequate thickness of short cable
- Use PCV cable(105°C) which withstand working voltage
  Consideration for current capacity, limitation of output cable(0.5V/lead) by sensing and so on are needed for connection to the load. See below table to determine appropriate cable.

AWG	mm^2	Peak current (A)	AWG	mm^2	Peak current (A)
18	1.1	2	4	21	106
16	1.3	7	2	33	170
14	2.1	11	1	42	209
12	3.3	18	1/0	53	270
10	5.3	23	2/0	67	330
8	8.4	39	3/0	85	350
6	13	67			

3-3 Connection of AC input cable

Attach crimping terminal to the AC input cable and connect to the distribution box of commercial power supply.
Power supply is AC100～120V or AC 200～240V , 50/60Hz , one phase.
(It depends on model. Confirm with rear panel display.)

distribution box
NEUTRAL = White
LINE = Black
EARTH (⏚) = Green



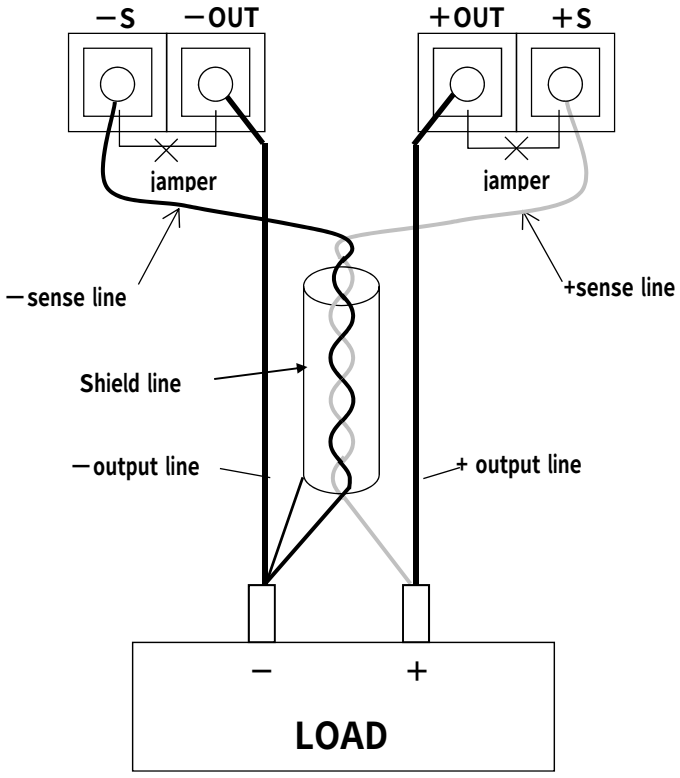
3-4 Remote sensing (DC output only)

CAUTION

+S and -S shall be connected with output terminal (+sense → +OUTPUT terminal , -sense → -OUTPUT terminal) when remote sense function is not used or when unit is connected in parallel or series.
If unit is operated without +sense and -sense connected with output terminal, it can cause failure.

With remote sense function, stabilize point of power supply can be set to other point than output terminal such as load or other point.
The loss of the lead is adjusted by 0.5 V maximum.
Use twisted or shielded wire as the lead for sensing.
The sense lines are provided at the sense connector on the rear panel. Make connections as described below:

1. Turn the power supply OFF, wait for five minutes and remove the jumpers between +S and +OUTPUT terminal, and -S and -OUTPUT terminal.
2. Connect the + Sense and - Sense as shown below. Connect the load in the same way.
3. Ground the shield at one point: power supply or load.
4. Turn the power ON.



3-5 Other Function

a. Over voltage Protection (OVP)

This unit has incorporated a protection against over voltage. Even at the time of abnormality, it is limited at OVP set value, protecting power supply and load against damages.

b. Over current Protection (OCP)

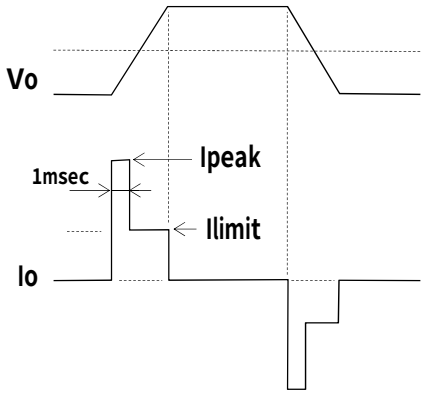
This unit has incorporated a protection against over current. Even at the time of abnormality, it is limited at OCP set value, protecting power supply and load against damages.

3-6 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. limits normal current within 1msec.

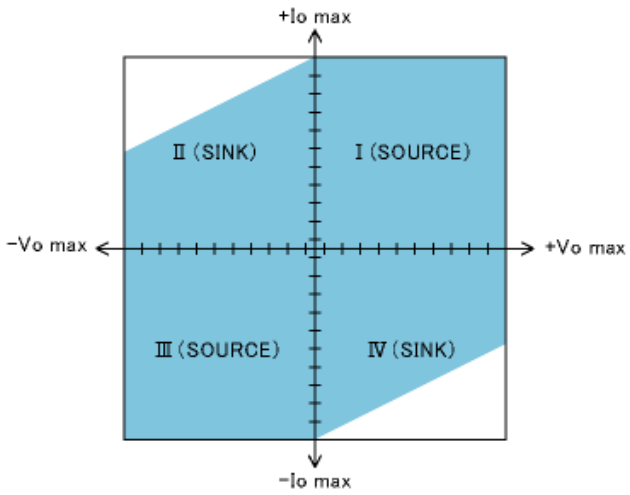
Another circuit is to limit pulse current at 2 times of the rated in case of swinging rectangle wave or charging capacitive in order to protect amp devices. Repeating high frequency, for instance, damages power supply since 2 times of the rated output current is expected at all time.

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



3-7 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.



AC Operating
(frequency 50Hz and over/duty 50% and)
DC Operating

Please avoid continuous use in high frequency.
It increases internal loss and leads to being in failure.

∗For your safety be sure to earth the GND terminal

3-8. Operation

This instruction manual explain the setting of signal source, output on / off and others.

This chapter is composed of two parts, “Normal Operation” and “Sequence Operation”.

3-8-1. Normal Operation

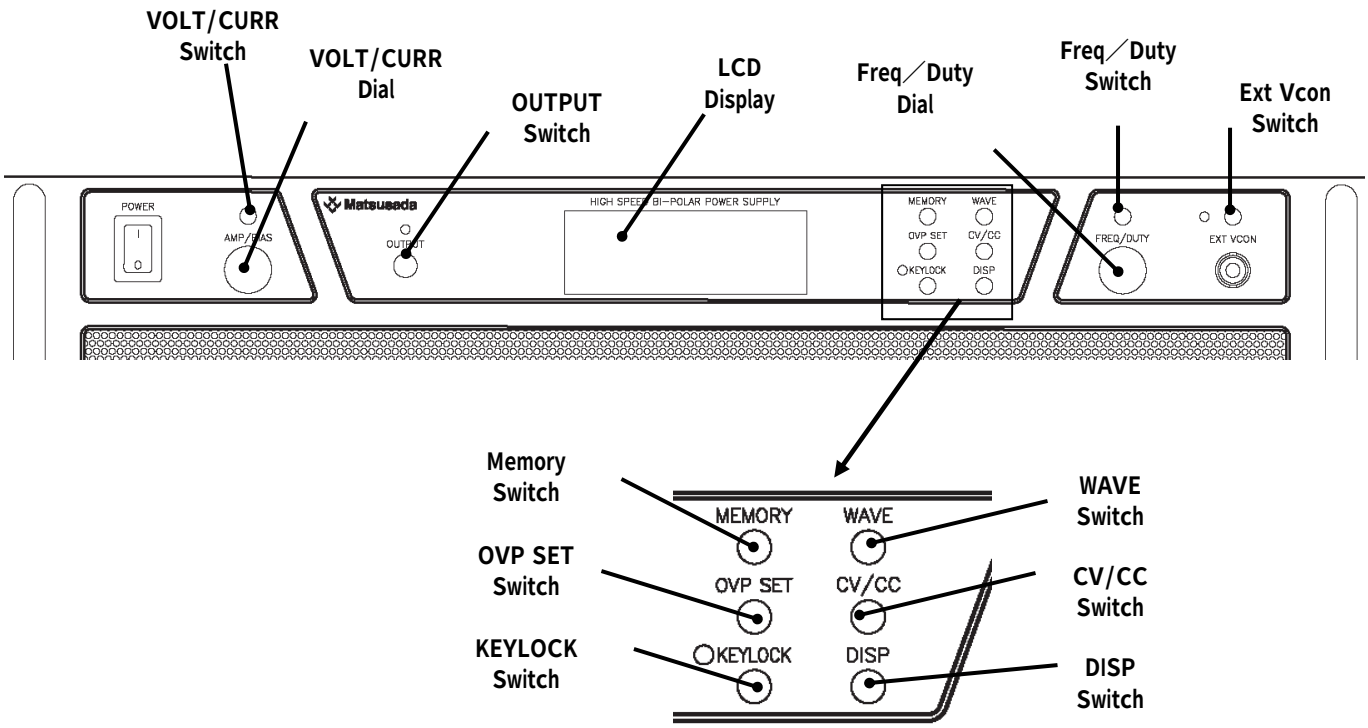
This part explain the operation procedures to conduct basic operation of DOPF series Such as operation procedures to output sine wave, square wave and others, Setting of protection, memory function and others.

3-8-2. Sequence Operation

This part explain the operation procedures to conduct programmable operation with sequence function.

We recommend you to read from the normal operation in sequence before use if you use this product for the first time and even if you use sequence function.

■Operation Panel (Normal Operation)



3-8-1. Normal Operation

In DOPF series, you can easily conduct basic operation by operating the switches on the front panel. The contents of setting and the state of operation can be checked by the display of LCD and LED.

The normal operation indicates basic action / operation / function of voltage, electric current and waveform setting other than sequence operation.

Table. Normal Operation List

Function	Description
OUTPUT ON / OFF	Output on or off.
MODE SET	Set cv mode (constant voltage) or cc mode (constant current)
SIGNAL SWITCH	Switch internal signal / external signal.
VOLTAGE / CURRENT SET	Set voltage value (in cv mode) or current value (in cc mode).
WAVEFORM SET	Set waveform of internal signal.
FREQUENCY SET	Set frequency value of internal signal.
PHASE / ON DUTY SET	Set phase of sine wave or on duty of square wave / triangle wave.
DISPLAY SET	Switch the screen to be display.
MEMORY	Save and recall settings of internal waveform.
OVP, OCP SET	Set OVP (over voltage protection) and OCP (over current protection) .
MEASURE SET	Set to one of four measurements, DC, AC, MAX and MIN.
KEY LOCK	Hold KEY LOCK and absolve of KEY LOCK.
Monitor signal	Output the two signals proportional to output voltage and output current.

※Notes

The internal signal indicates the voltage signal or the current signal of sine wave, square wave and others which is generated inside the power source.

Refer to > **3-8-1. Normal operation 3) Switch internal signal / external signal**

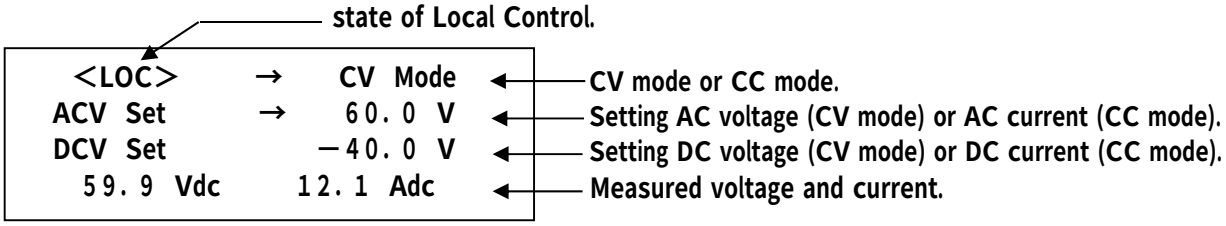
■Display contents of normal operation

As the displayed contents depend on the set value, refer to each part for details.

And also, the voltage value and the current value described in this manual is one example, and the displayed value varies according to the model of DOPF Series.

Refer to 3-8-1. Normal operation 4) Set voltage value, current value

①Voltage / Current set screen

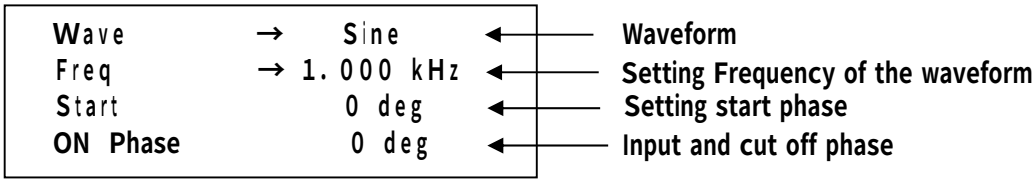


example) CV mode set screen

※Notes

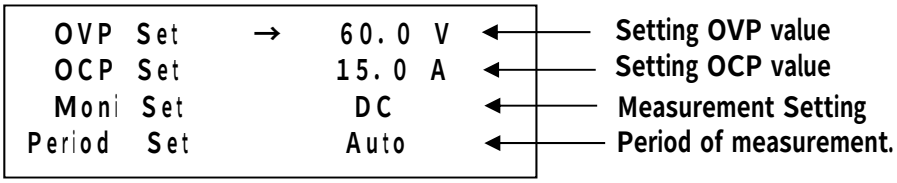
The state of Local Control is not used communication option, in this case, "LOC" appears on the display.
And when it use communication option and the state of Remote Control is active, "REN" appears on the display.
Refer to each communication option manual.

②Waveform set screen



example) set sine wave screen

③Protect(OVP, OCP) set screen

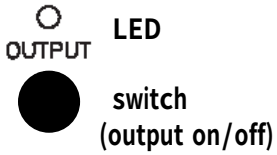


1) OUTPUT ON / OFF

The setting of OUTPUT on / off is conducted with "OUTPUT" switch.

When press the "OUTPUT" switch in state of output off,
Output is turn on and LED (red) is light on.

When press the "OUTPUT" switch in state of output on,
Output is turn off and LED (red) is light off.



⚠ CAUTION

In case of CC mode, if you turn output on even in the state where load is not connected to output terminal (open state) regardless of the current set value, voltage is output. Be careful about electrical shock. (even if the current set value is 0 A. a voltage is output.)

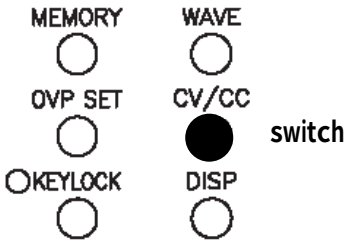
⚠ CAUTION

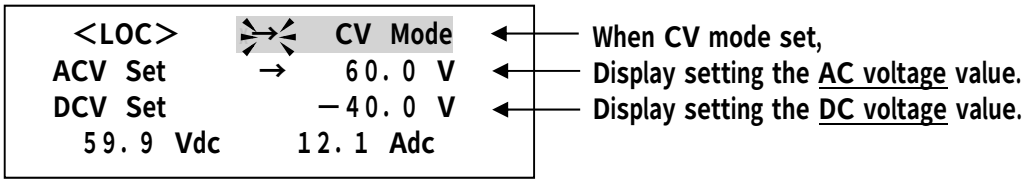
If load where energy is accumulated is connected, a current flows into the internal circuit of the equipment even if output is off. In some cases, the life of load may be affected.

2) Set CV mode / CC mode

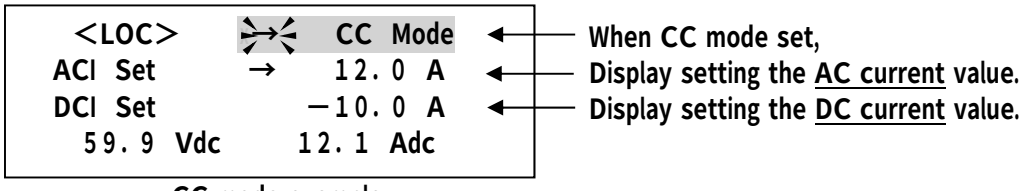
The setting of CV mode/CC mode is conducted with "CV/CC" switch.

The voltage setting is active in CV mode, and the other side,
In case of CC mode, the current setting is active.





CV mode example



CC mode example

⚠ Caution

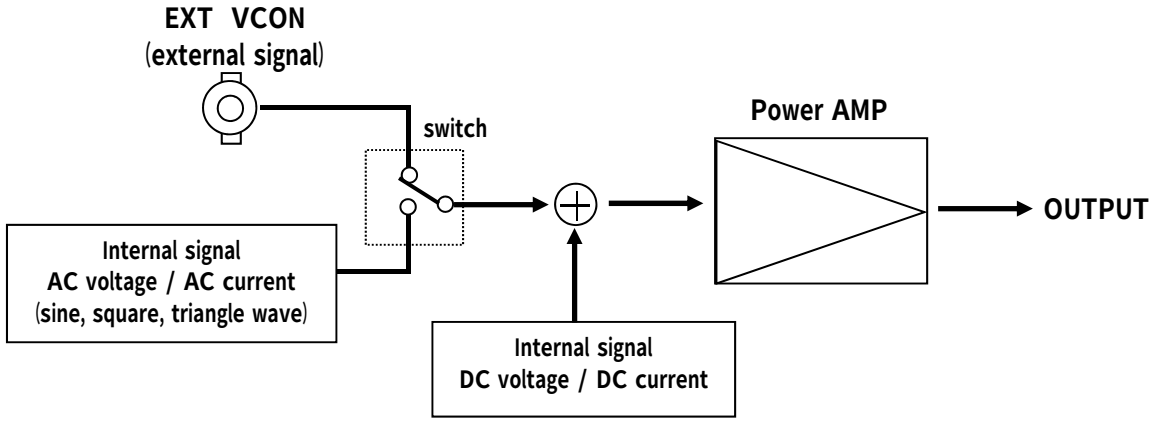
Output turn off, when CV / CC mode switch (press "CV/CC" switch) during output on.

3) Switch internal signal / external signal

In DOPF Series, it is possible to conduct switch between the internally-generated signal and the external signal with the switch. By enabling the external signal, DOPF can be operated as an amplifier.

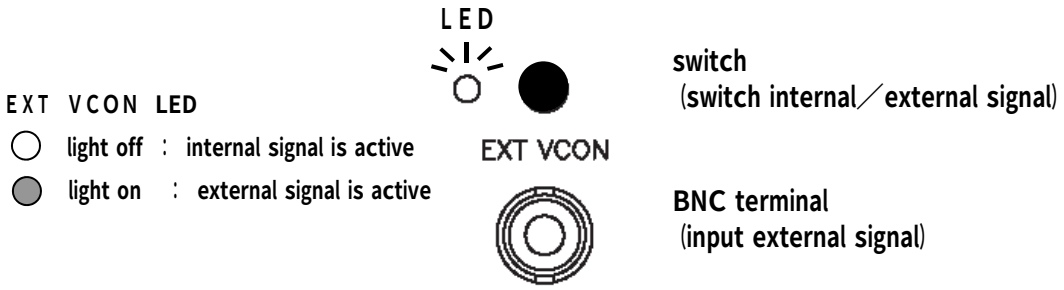
The internal signal indicates the signal which is set by waveform, frequency, voltage or current. If the external signal is used, this setting is cancelled.

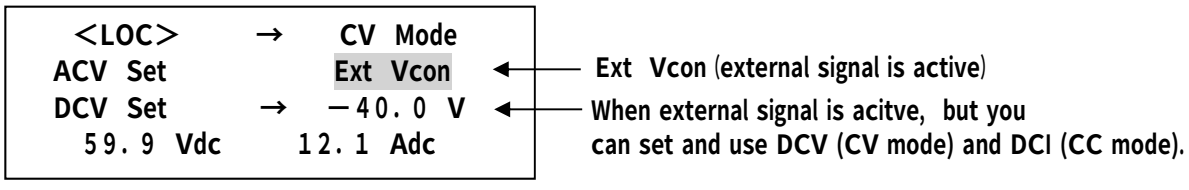
And also, DOPF is possible to set DC (voltage or current) by external signal operation and the output where DC voltage or DC current is superimposed on the arbitrary external signal.



When external signal is active, "EXT VCON" LED(green) is light on, on the contrary, internal signal is active, "EXT VCON" LED(green) is light off.
It the external waveform signal is active, "EXT VCON" appears at the display position of "ACV"(CV mode) or "ACI"(CC mode) on the display and AC voltage or AC current can not be set.
But DC (voltage or current) setting is active at each signal setting(internal or external).

Though the setting of waveform and frequency can be changed, the setting itself is disabled.
Impedance of external signal is 10kΩ. When external signal input 10V, output is rated value.





Set external signal (CV mode)

4) Set voltage value, current value

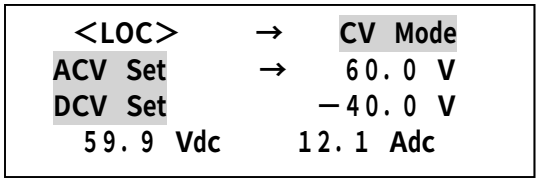
The setting of voltage(CV mode) or current(CC mode) is conducted with "VOLT/CURR" switch and dial. As for voltage and current, it is possible to set AC and DC separately, and the output where AC is superimposed on DC is possible.

Refer to 3-8-1. Normal operation 3) Swtich internal signal / external signal

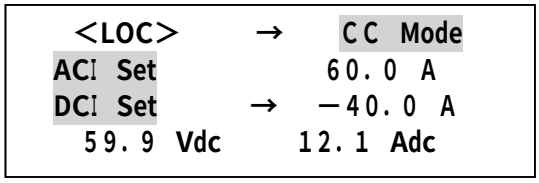
The displayed item and unit change by CV/CC mode setting and wave setting.

table. Display contents of AC and DC setting

	Set internal signal		Set external signal	
	CV mode	CC mode	CV mode	CC mode
AC setting	item:ACV Set unit:V	item:ACI Set unit:A	item:Ext Vcon ※refer to 3) Swtich internal signal / external signal	
DC setting	item:DCV Set unit:V	item:DCI Set unit:A	item:DCV Set unit:V	itemu:DCI Set unit:A



CV mode screen example

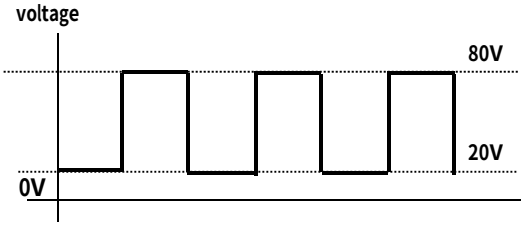


CC mode screen example

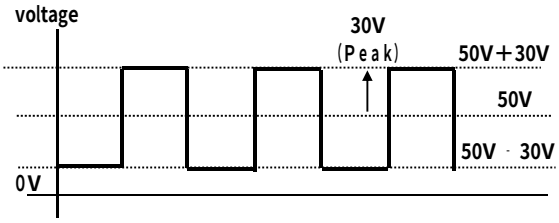
And setting unit of ACV (CV mode), ACI (CC mode) is peak value.

⚠ CAUTION

Setting value is not rms value or peak to peak value.



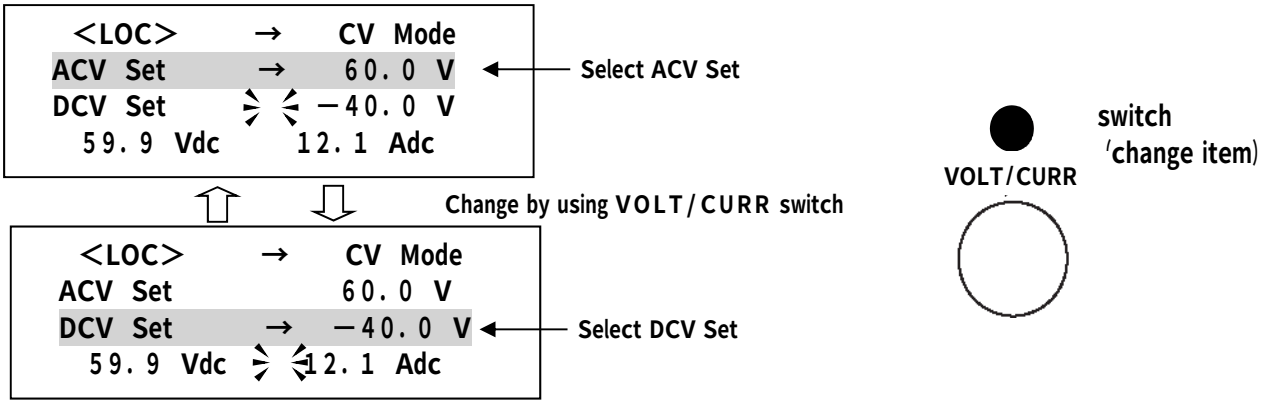
Example)in the case of range between 80V and 20V



Amplitude - 30V(center - 50V)
Setting - ACV = 30V, DCV =50

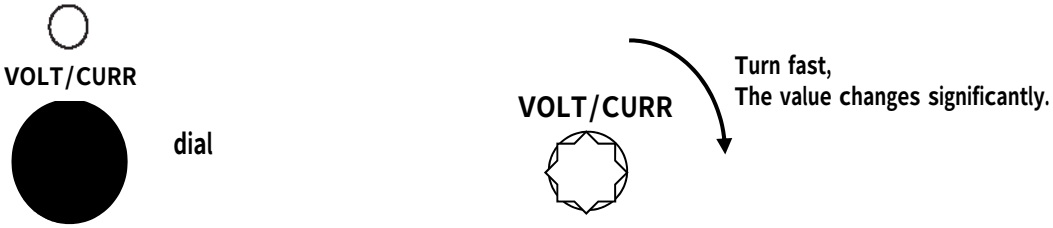
[change item]
it change item between AC setting and DC setting with press "VOLT/CURR" switch.
In case of CV mode, selected item- "→" blinks in "ACV Set" or "DCV Set" of the display.
(in case of CC mode, "ACI Set" or "DCI Set")

The value of item where "→" is blinking can be changed.



⚠ CAUTION
If the external waveform signal is active, AC can not be set.

[change the value]
The setting of voltage / current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.
And also, if you turn "VOLT/CURR" dial fast, the value changes significantly.



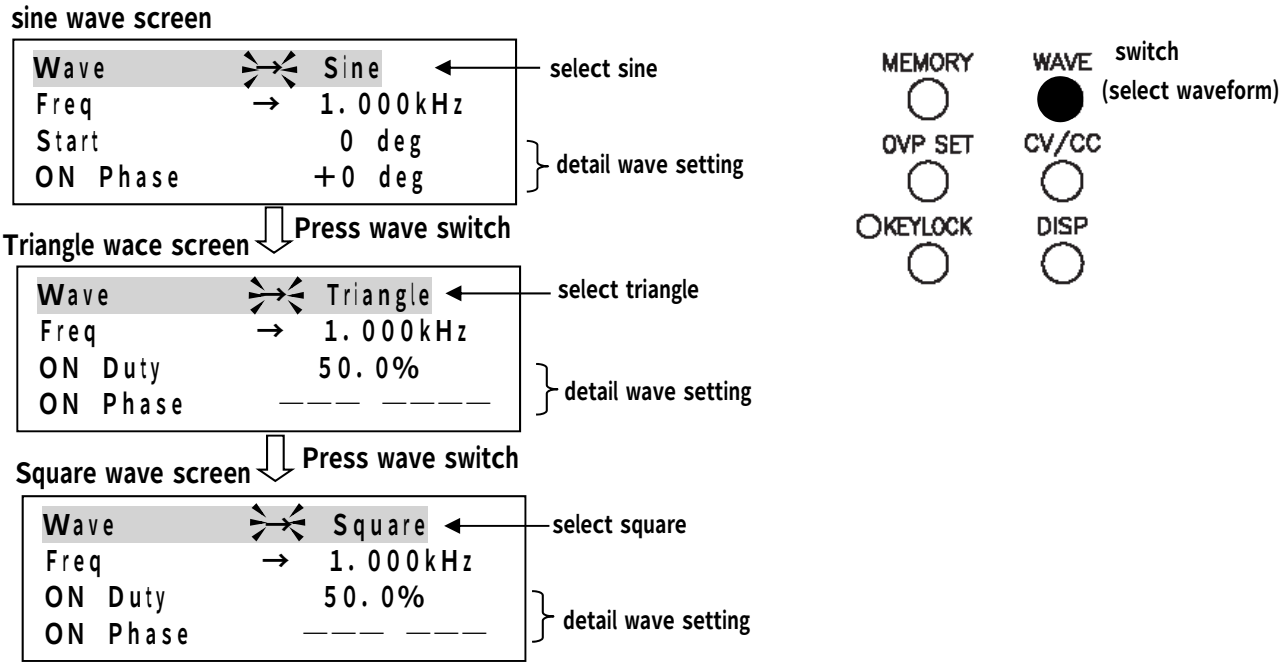
And also, the setting unit and range of AC value and DC value depend on the model, and they are shown in the table below.

table. Setting resolution and range of voltage(CV mode) or current(CC mode)

MODE	model	resolution	setting range	
			Item disp	range
CV mode	below 100V model	0.1V	ACI Set	0 ～ rated value
			DCI Set	−rated value ～ rated value
	above 100V model	1V	ACI Set	0 ～ rated value
			DCI Set	−rated value ～ rated value
CC mode	below 10A model	0.01A	ACI Set	0 ～ rated value
			DCI Set	−rated value ～ rated value
	above 10A model	0.1A	ACI Set	0 ～ rated value
			DCI Set	−rated value ～ rated value

5) Set waveform

The internal waveform signal can be selected from sine wave, triangle wave and square wave by pressing "**WAVE**" switch.
The detailed setting of waveform such as a phase, duty ratio and others varies according to the selected waveform.

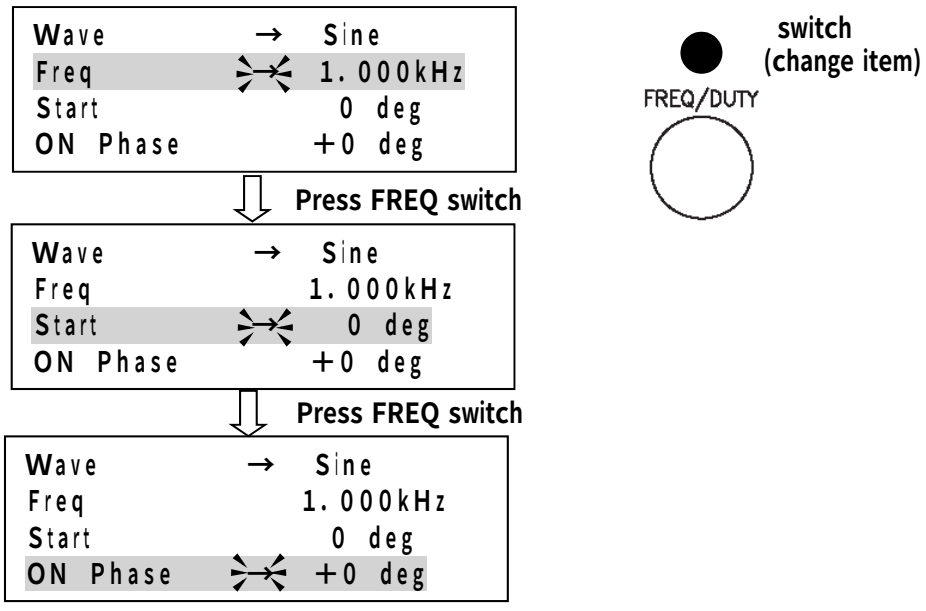


⚠ CAUTION

When the exteral waveform signal is active, the set waveform is not output even if the internal waveform setting and detailed setting are conducted.

Refer to **3-8-1. Normal operation 3) Swtich internal signal / external signal**

The item of detail setting can be changed by pressed "**FREQ/DUTY**" switch.
The value of the item where "→" is blinking can be changed.

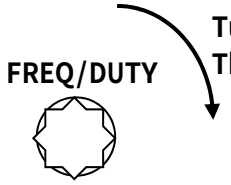


6) Set frequency

[change the value]
When frequency item is selected, the setting of frequency value is conducted with "FREQ/DUTY" dial.

If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.
And also, if you turn "FREQ/DUTY" dial fast, the value changes significantly.

dial
(change the value)



Turn fast,
The value changes significantly.

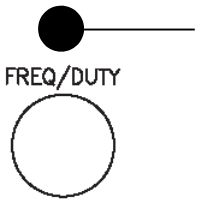
[range of frequency] 10mHz ～ 20kHz (Part of models is 30kHz)

※change the frequency value

The long press of "FREQ/DUYT" switch varies frequency. Use the function if you change the frequency significantly.

If you hold down the switch for 2 seconds, the frequency becomes 1Hz, and the frequency changes every second if you continue to press it.
At the frequency which you want to set, release the switch.

(every 2 sec, frequency value change in the order at 1Hz、5Hz、10Hz、50Hz、100Hz、500Hz、1kHz、5kHz、10kHz、15kHz、20kHz、10mHz、50mHz、100mHz、500mHz)



Press down for 2 sec and more,
The frequency change significantly.

※resolution of frequency set range

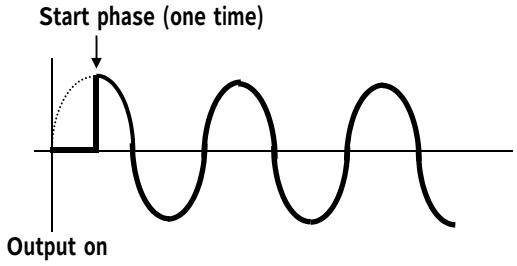
You can set four figures. The minimum unit which can be set depends on the display frequency.
example1) 1.000Hz range ： 0.001Hz
example2) 1.000kHz range ： 0.001kHz
example3) 10.00kHz range ： 0.01kHz

7) Set phase (sine wave), on duty (square, triangle wave)

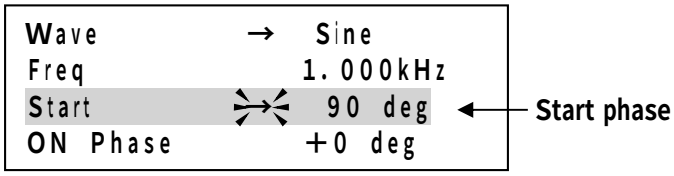
You can set the detail setting of waveform. The detail setting of waveform differ by selected waveform. (sine wave or square wave and triangle wave)

●Selected sine wave

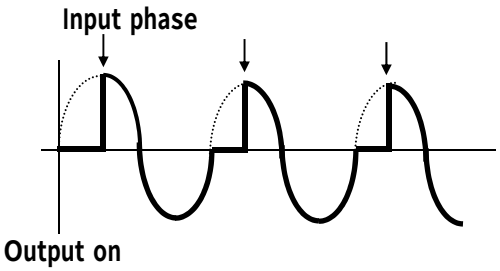
When you select sine wave, you can set start phase and on phase (input phase and cut off phase). The unit of this setting is degree.



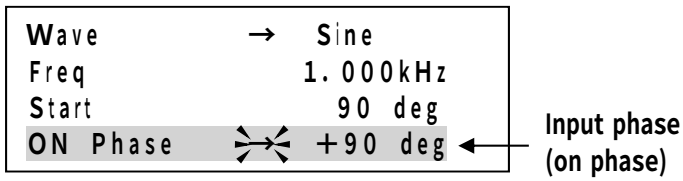
example1) start phase =90deg



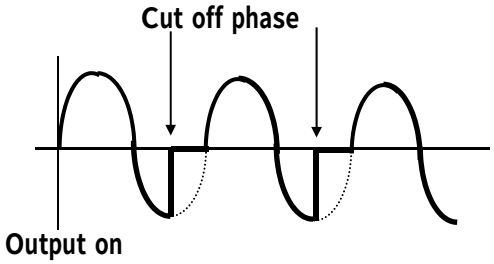
Start phase set 90deg



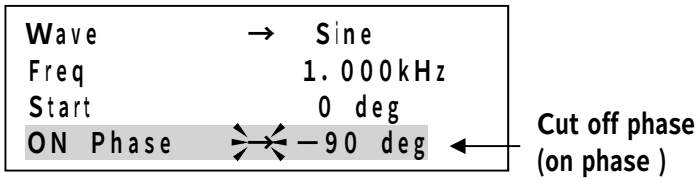
example2) input phase =90deg



on phase set +90deg

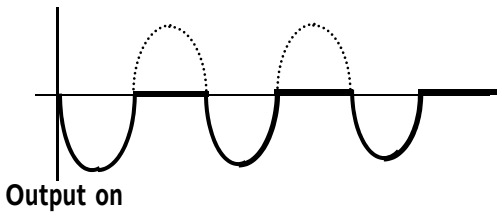


example3) cut off phase =−90deg

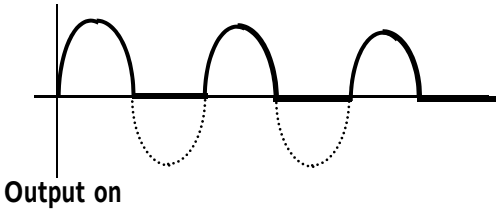


on phase set −90deg

※if you set the phase at 180deg, you get negative half wave of sine wave, and also set the phase at -180deg, you get positive half wave.



example4) input phase = 180deg



example5) cut off phase =−180deg

※Notes

When the polarity of on phase is positive, it attitude input phase.
on the contrary, When it's negative, it attitude cut off phase.

[change item]
The changing item is conduct with "**FREQ/DUTY**" switch.
selected item –"'→" blinks in display.
The valued of the item where "→" is blinking ca be changed.

switch
(change item)

dial
(change the value)

[change the value]
The setting of phase value is conducted with "**FREQ/DUTY**" dial.
If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.

[range of start phase] 0 ～ 315deg, resolution：45deg

[range of on phase] -180deg ～ 180deg, resolution：1deg

●Selected square wave and triangle wave

When you select square wave and triangle wave, you can set on duty.
The unit of this setting is percentage.

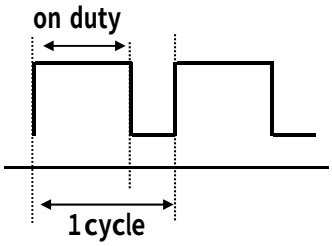


図. square wave

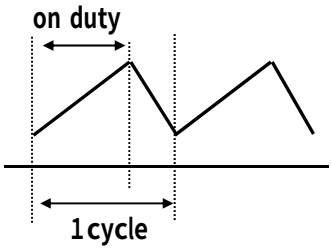
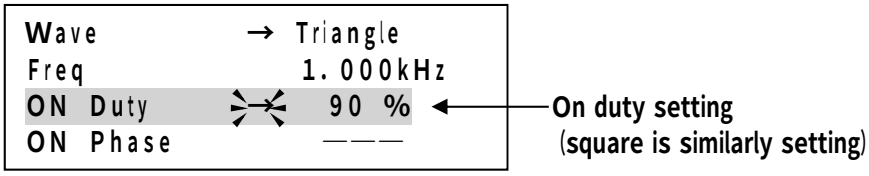
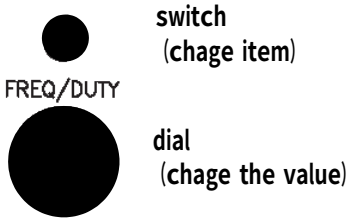


図. Triangle wave



example) triangle wave, on duty=90% screen

[change item]
The changing item is conduct with "FREQ/DUTY" switch.
selected item ""→" blinks in display.
The valued of the item where "→" is blinking can be changed.

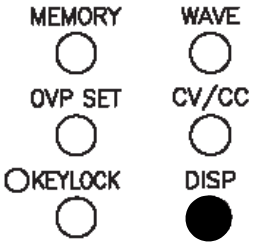


[change the value]
The setting of duty value is conducted with "FREQ/DUTY" dial.
If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.

[range of duty] 1.0 ～ 99.0%、 resolution：0.1%

8) change screen

By pressing "DISP" switch, you can switch between voltage setting screen and wave setting screen.
Use the function for the check of setting during operations.



switch
(change screen)

voltage set screen (CV mode)

<LOC> → CV Mode
ACV Set → 60.0 V
DCV Set −40.0 V
59.9 Vdc 12.1 Adc

DISP swtich

Wave → Sine
Freq → 1.000 kHz
Start 0 deg
ON Phase 0 deg

wave set screen

9) Memory function

This product have ten memory of the basic setting data, you can save and recall setting data that are used often. If you turn off power, the data is not erased.
You can register the frequently-used setting and call it as necessary.

[save data]

- CV mode / CC mode
- voltage value (CV mode) / current value (CC mode)
- internal signal waveform (sine, square, triangle)
- frequency of internal signal
- phase (sine wave), on duty (square, triangle)
- OVP, OCP

⚠CAUTION

Can't save setting of internal / external signal and key lock..
And also, the data of sequence can be registered and called as another data.

Refer to > 3-8-2. Sequence operation

[change recall / store]

By press "Memory" switch, screen can switch ①**memory recall screen** and ②**memory store screen.**
If the screen is memory store, the normal screen(voltage setting screen) appears when you press "Memory" switch.

[change memory number]

The change of memory number is conducted with "VOLT/CURR" dial, Current memory number blink on the display.
If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.

[fix setting]

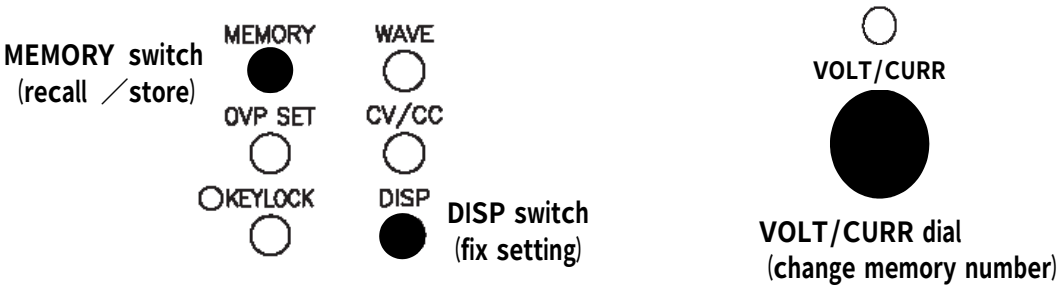
If you fix setting data that you specified, press "DISP" switch.

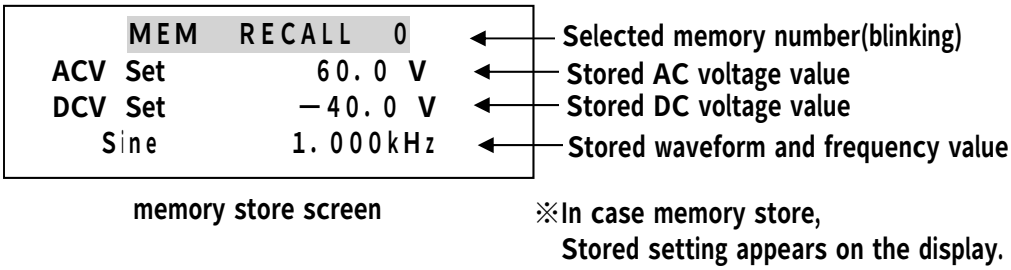
If the screen is ①**memory recalls screen**, the setting of the equipment is conducted and the normal screen (voltage setting screen) appears when you press "DISP" switch.

And also, If the screen is ②**memory store screen**, ③**confirm screen** appears when you press "DISP" switch. Moreover, if the screen is ③**confirm screen**, the setting data save and normal screen(voltage setting screen) appears when you press "DISP" switch.

[cancel]

If you press Except "Memory" switch and "DISP" switch, memory function is canceled and normal screen(voltage setting screen) appears.

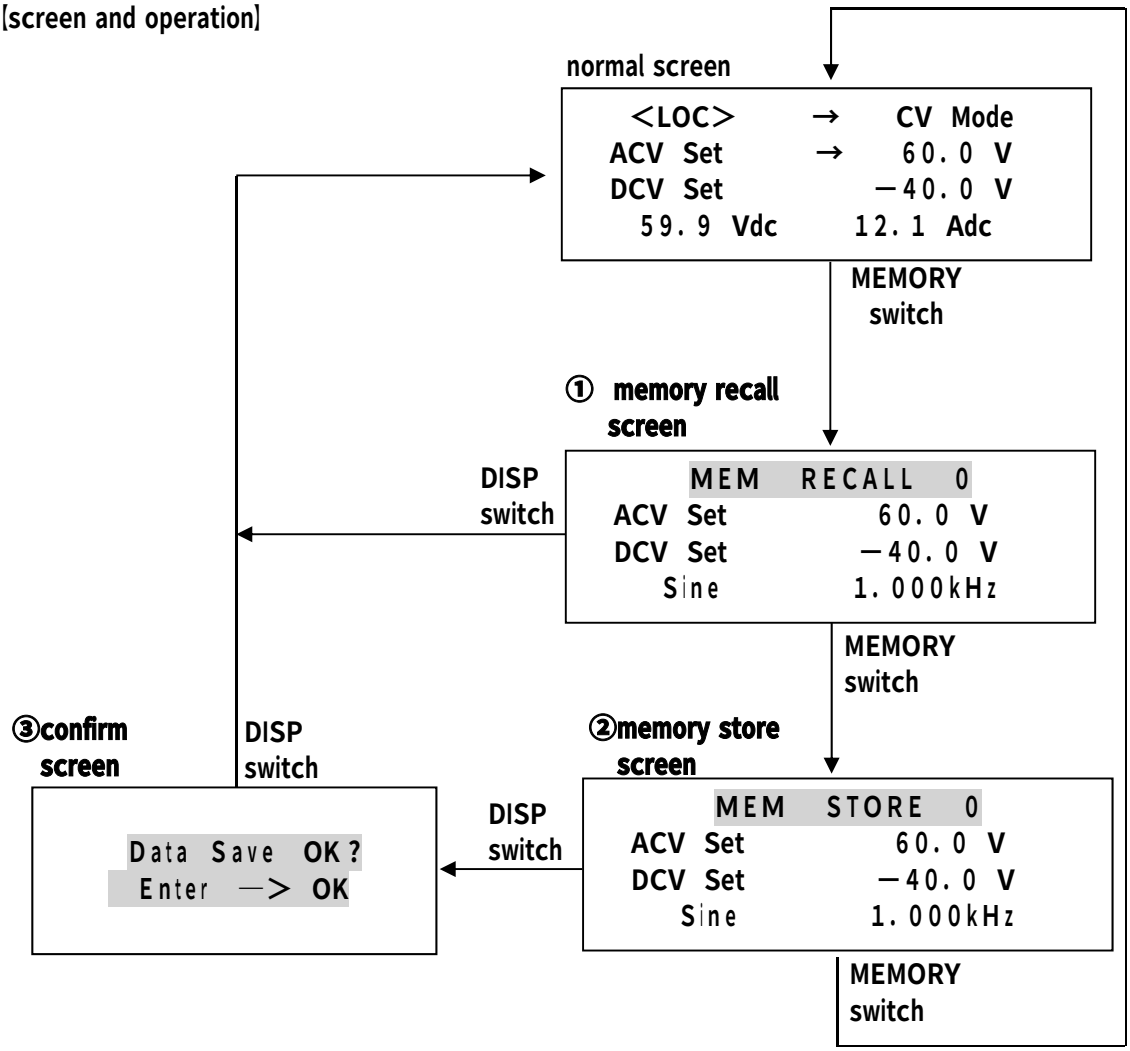




memory store screen

※In case memory store,
Stored setting appears on the display.

[screen and operation]

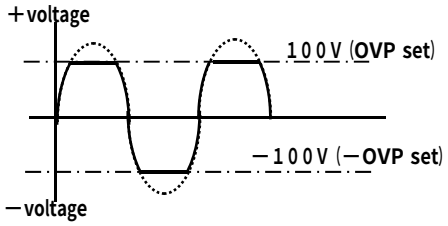


10) OVP (Over voltage protection) / OCP (over current protection)

You can change and reset OVP (over voltage protection) value, OCP (over current protection) value, measured setting.

As for OVP and OCP, the protection is limit operation, and only the positive side can be set. However, the protection operates at the same value in the two poles.

example) if OVP is set at 100V, OVP operates at -100V in the negative side.



example) voltage limit by OVP

[change screen]

If the screen is normal screen, OVP/OCP setting screen appears when you press "OVP SET" switch. Moreover, if the screen is OVP/OCP setting screen, normal screen(voltage setting screen) appears when you press "OVP SET" switch.

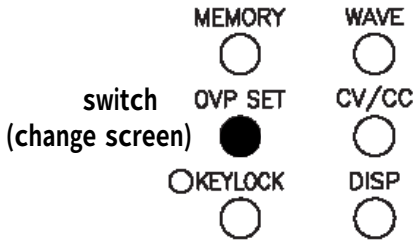
normal screen

<LOC>	→	CV Mode
ACV Set	→	60.0 V
DCV Set		−40.0 V
59.9 Vdc		12.1 Adc

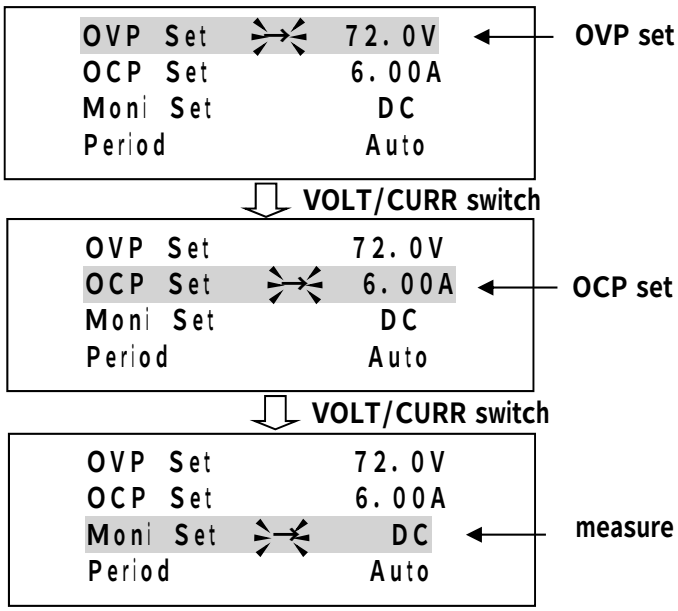
⇧ ⇩ OVP SET switch

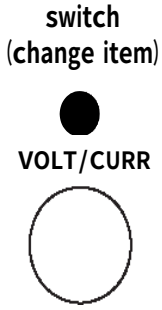
OVP Set		72.0V
OCP Set	→	6.00A
Moni Set		DC
Period		Auto

OVP／OCP set screen



[change item]
The changing item is conduct with "VOLT/CURR" switch.
selected item "→" blinks in display.
The valued of the item where "→" is blinking can be changed.



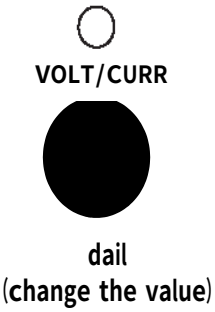


⚠ CAUTION
Note that only switches which are used are active in the setting screen.
And in the case of GPIB option, the setting screen (UNIT number) is added.
Refer to GPIB option manual.

[change the value]
"VOLT/CURR" dail is used change the value of OVP and OCP.

[range of OVP] 0 ～ rated value x 120%

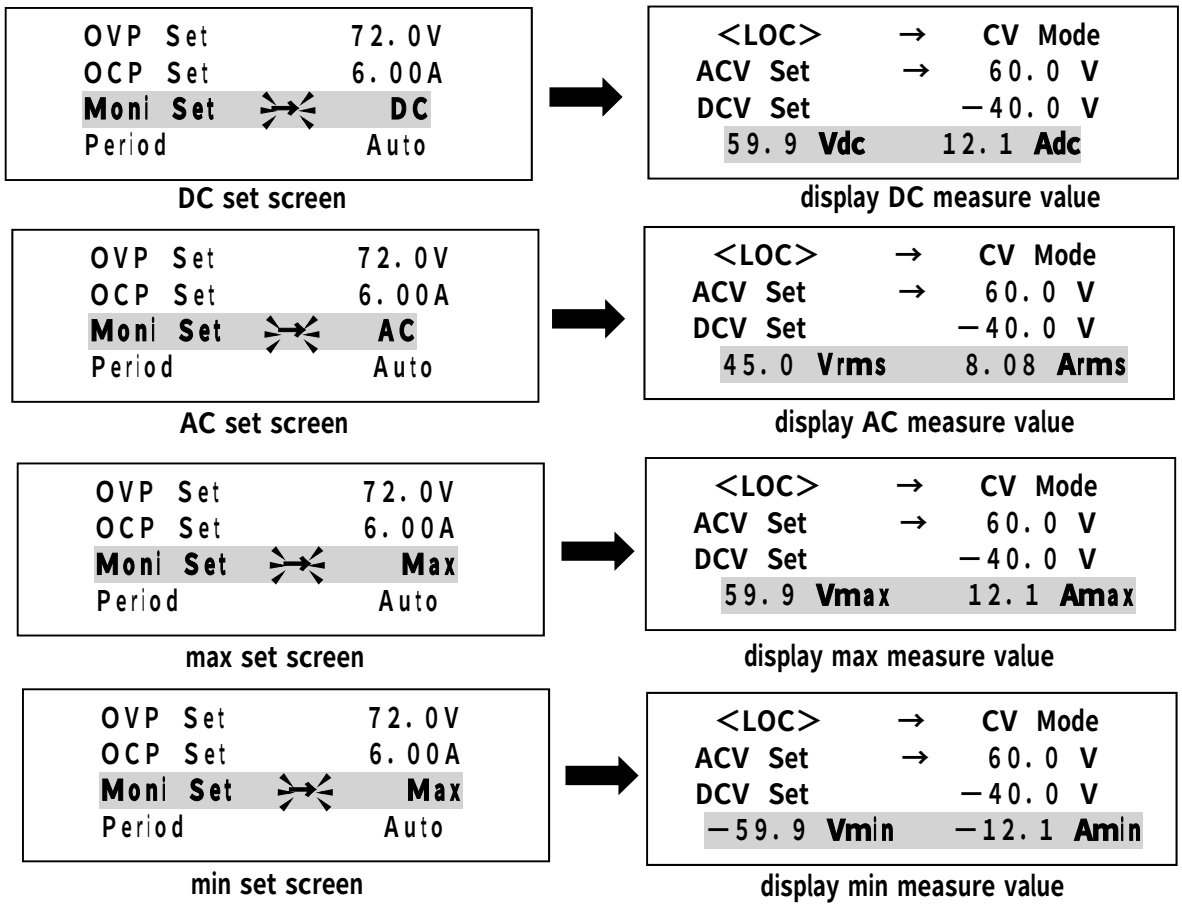
[range of OCP] 0 ～ rated value x 120%

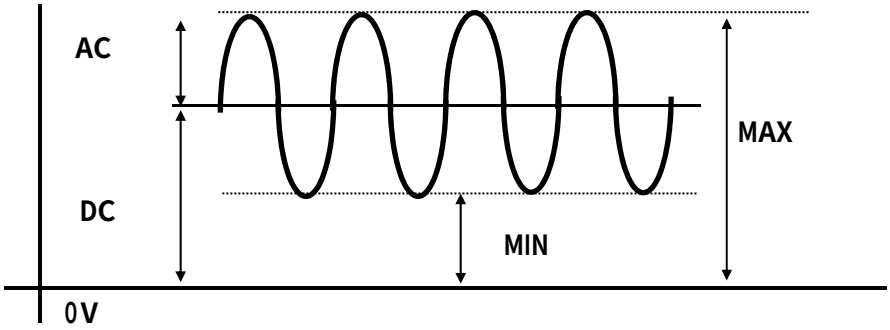


11) Set measurement

You can select measurement setting, DC value, AC value, Max value, Min value, on the OVP/OCP set screen.
Relation between measurement setting and unit are shown in the figure below.

[measurement setting screen] [normal screen(measurement unit)]





[relation measurement setting and measure value]

[range of measurement]
If you input and use the external signal, it is necessary to adjust the range of measurement to the frequency of the signal which is input.
The range of measurement is the measurement time of one time (measurement point of one time - 10,000 point).

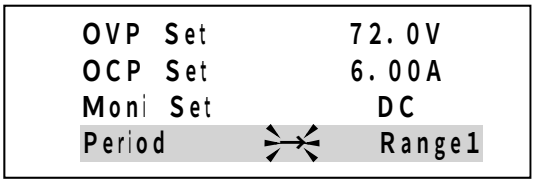
Refer to > 3-8-1. Normal operation 4) Set voltage value, current value

The Relation between external signal and frequency are shown in the table below.

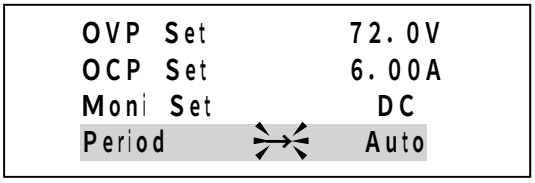
table. Relation between external signal frequency and measure range setting

Frequency of External signal	measure range	Period of display
above 500Hz	Range1	under 1 sec
500Hz～50Hz	Range2	under 1 sec
50～5Hz	Range3	under 2 sec
below 5Hz	Rnage4	About 5 sec

Use it after setting according to the external signal which is input.
If internal signal is used, it is set automatically. (display – "Auto")

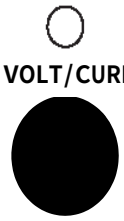


example)external signal screen (Range1)



example)internal signal screen(auto)

[change the value]
"VOLT/CURR" dail is used change the value of measurement setting..



dail
(change the value)

12) KEY LOCK

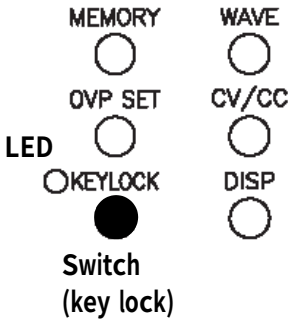
If you hold down "KEYLOCK" switch for more than 5 seconds, the key is locked.
In key-locked state, LED(green) light, and only "KEYLOCK" switch is active.

To release the lock, hold down the switch for more than 5 seconds in the key-locked state similarly.
If it is released, LED(green) which light goes out.

KEYLOCK LED

○ light OFF : release KEY LOCK

● light ON : KEY LOCK



⚠ CAUTION

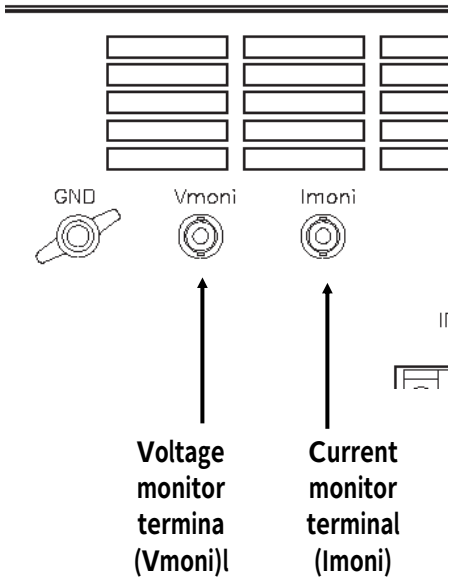
If operation is sequence, you can not use KEY LOCK.

13) Voltage monitor

Output 0 to ±10V against rated output voltage. Output impedance is 1kΩ.

14) Current monitor

Output 0 to ±10V against rated output current. Output impedance is 1kΩ.



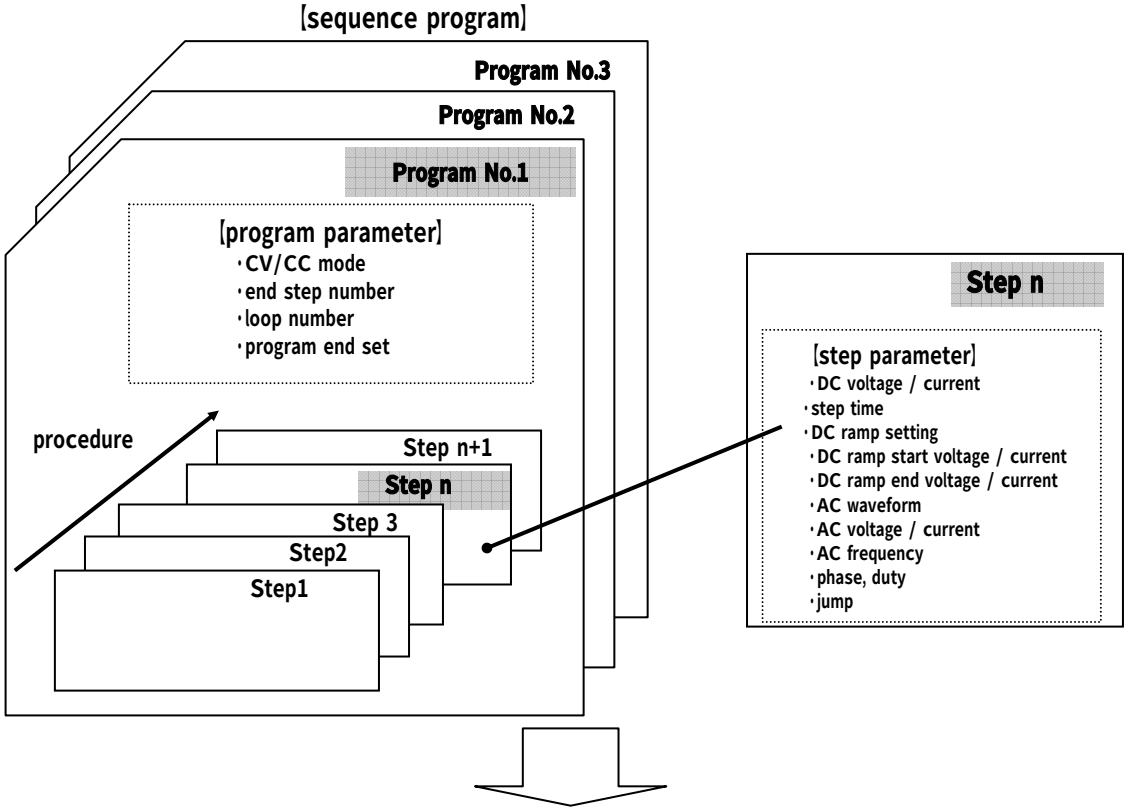
3-8-2. Sequence

1) sequence feature

Sequence function is mounted in DOPF Series, and continuous operation at programmed output voltage or output current is possible.

The sequence operation produces arbitrary waveforms by sequentially running the steps which have been set as a minimum unit of waveform or by jumping to an arbitrary step, and one program consists of a gathering of these steps. The data of up to 16 steps can be set in one program.

And the program includes the settings of program itself such as switching of CV/CC mode, setting of program termination state and others, the steps includes the setting of waveform which is output such as setting of DC voltage, DC ramp, AC voltage and others, and the data is not lost if the power is turned off.
Furthermore, the program itself can save up to 3 programs.



Create steps and programs, edit them, run them in sequence mode, and output an arbitrary waveform

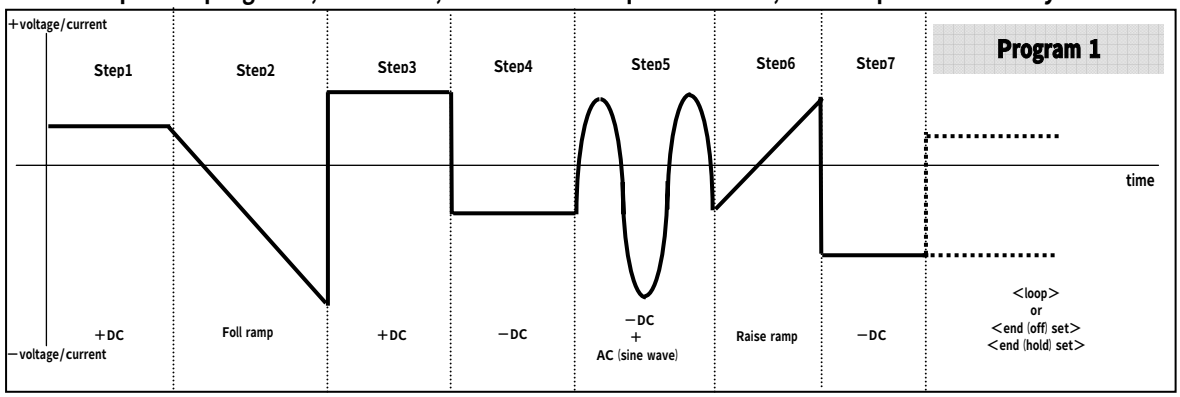


figure. sequence example

2) Sequence Spec

Program No	:3 program
Step No	:1～16 step within 1 program
LOOP Number	:1～999, infinity(∞)
Program End Set	:OUTPUT OFF / OUTPUT HOLD(end step)
Sequence control	:start, pause, resume, end
DC setting range	:－rated value ～ ＋rated value (CV mode:voltage CC mode:current)
RAMP setting range	:－rated value ～ ＋rated value (CV mode:voltage CC mode:current)
AC setting range	:－rated value ～ ＋rated value (CV mode:voltage CC mode:current)
AC setting range	:sine, square, triangle
Frequency setting range	:10mHz ～ 20kHz (30kHz)
Step time range	:50ms ～ 1999s999ms, setting resolution 1ms (10ms can be set only if the both of DC ramp and AC setting are not used.)
Step Jump	:jump off, 1～255

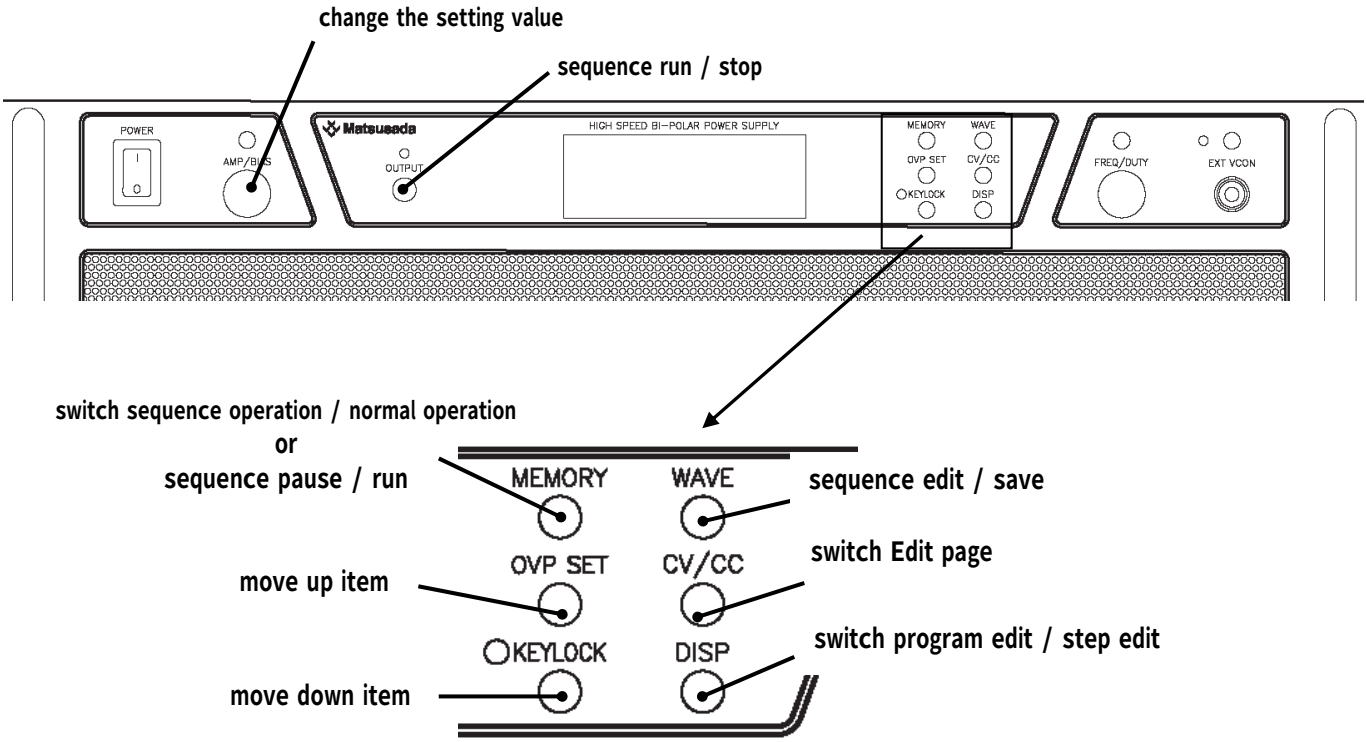
⚠ CAUTION
The rated value of AC and DC depend on the model.

■Sequence operation Quick Reference

Sequence operation	reference
How to switch sequence operation from normal operation?	3-8-2 3) transit to sequence operation
How to switch normal operation form sequence operation?	3-8-2 3) transit to sequence operation
How to run sequence program?	3-8-2 4) state of sequence program (A) sequence run
How to stop sequence program?	3-8-2 4) state of sequence program (B) sequence stop
How to pause sequence program? How to resume sequence program?	3-8-2 4) state of sequence program (C) sequence pause and resume
How to recall the program which is run in the sequence operation?	3-8-2 5) recall of the program data whose program number is specified
How to know the parameters which can be set in the sequence operation?	3-8-2 6) sequence program and parameter
How to edit program parameter?	3-8-2 7) procedure for parameter of program
How to edit step parameters?	3-8-2 8) procedure for parameter of step
How to save the sequence program?	3-8-2 9) save sequence program

■Operation Panel (Sequence Operation)

The switches which are used in the sequence operation and edit are shown in the diagram below.
The role of switch differs from that in the normal operation mode.



switch indication	normal operation	sequence operation
OUTPUT	OUTPUT ON／OFF	sequence Run / Stop (OUTPUT ON / OFF)
VOLT/CURR	change item (ACV / DCV or ACI / DCI)	unused
MEMORY	transit to sequence operation (press and hold down for 2sec)	transit to normal operation (press and hold down for 2sec)
	memory recall / store	sequence pause / resume
OVP SET	OVP, OCP setting	move up edit item
KEYLOCK	unused	move down edit item
WAVE	set waveform	sequence edit or save
CV／CC	set CV / CC	switch next page (program page1～2, edit page1～4)
DISP	change screen	switch program edit page and step edit page
FREQ／DUTY	change item (frequency / phase / duty)	unused
EXT VCON	switch internal / external signal	unused

Table.The difference of switch function between normal operation and sequence operation

3) transit to sequence operation (from normal operation)

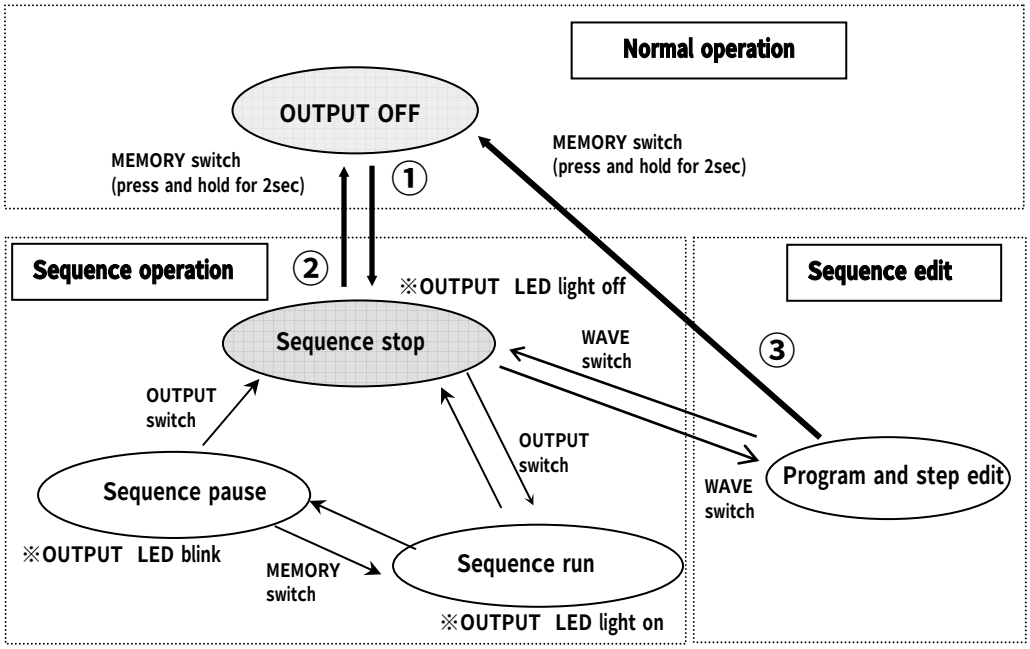
To execute the sequence operation, first, it is necessary to create the state where the sequence operation and edit can be done.

Normally, when the power is turned on, it starts in the state where the normal operation such as sine wave, square wave and others is executed (normal operation), and when "MEMORY" switch is pressed for 2 seconds in this state, the normal operation switchs to the sequence operation. (figure ⟶ ①)

and also, conversely, when you shift from the sequence operation to the normal operation, you can return to the normal operation by pressing "MEMORY" switch for 2 seconds in the state where output is off. (figure ⟶ ②)

in the same operation, you can return to the normal operation while editing sequence. (figure ⟶ ③)

[state transit of normal and sequence operation]



●normal operation

Normal operation chapter explain the operation procedures to conduct basic operation.

Refer to > 3-8-2. Normal operation

●state of sequence program

This chapter explain method to used program such as sequence run, stop, pause and others.

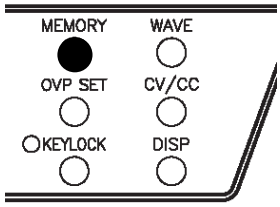
Refer to > 3-8-2. sequence operation 4) state of sequnce

●sequence edit

This chapter explain method of setting and edit program data.

Refer to > 3-8-2. Sequence operation 7) program edit

Refer to > 3-8-2. Sequence operation 8) step edit



[switch Normal operation/Sequence operation]
press and hold "MEMORY" switch for 2sec and more.
(output off)

Normal operation screen(output off)

```
  <LOC>        →    CV Mode
ACV Set        →    60.0 V
DCV Set             −40.0 V
  59.9 Vdc       12.1 Adc
```

⇧ ⇩ MEMORY switch for 2 sec and more

```
[SQC Stop]  Prog 1   CV
   Loop  1    Step  1
   Time       000s000ms
    0.0 Vdc      0.0Adc
```

Sequence operation screen(output off)

⚠ CAUTION

In the initial state after shifting from the normal operation to the sequence operation, data fo sequence program number **1** has been loaded. If you change the sequence program number, you must change the program number of sequence.

Refer to > **3-8-2. sequence program 5) call of the program data whose program number is specified**

Recall program number 1

```
[SQC Stop]  Prog 1   CV
   Loop  1    Step  1
   Time       000s000ms
    0.0 Vdc      0.0Adc
```

immediately after switch sequence operation screen

4) state of sequence program

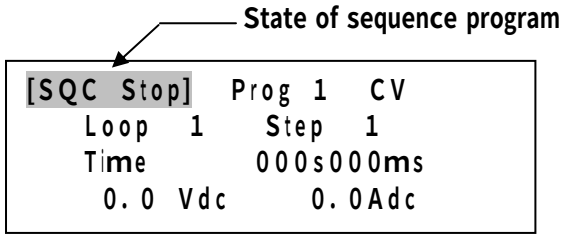
The sequence operation of DOPF includes 3 operation states, run, stop, pause (holding of output).
When sequence program which have been running terminate, sequence stop state(output off) or holding of final state(output on) is achieved.

(A) sequence run
This state is programed sequence is progressing. (output on)

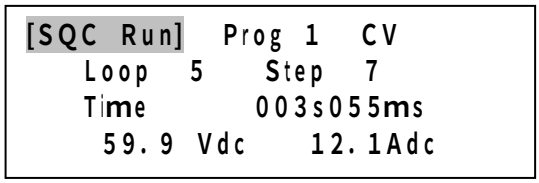
(B) sequence stop
This state is programed sequence stop.
(program end set "hold" : output on, "off" : output off)

(C) sequence pause
The state programed sequence is pausing. (output on)

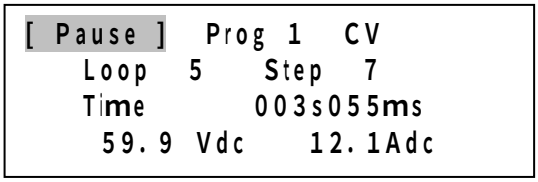
During the sequence operation, the information related to the state and the step which is being run is shown.
And also, OUTPUT LED, light on, light off, blink according to the output state.



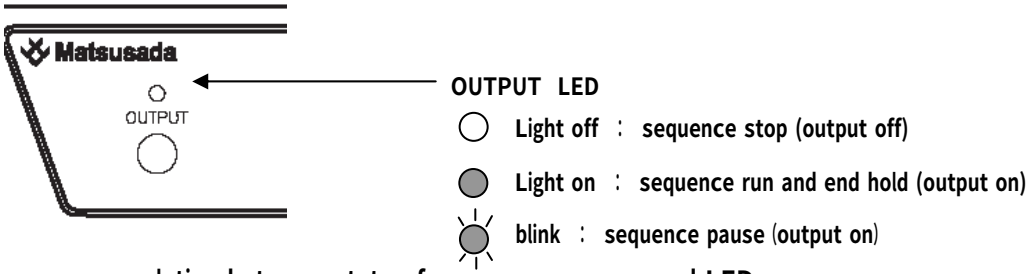
Sequence stop screen (output off)



Sequence run screen (output on)



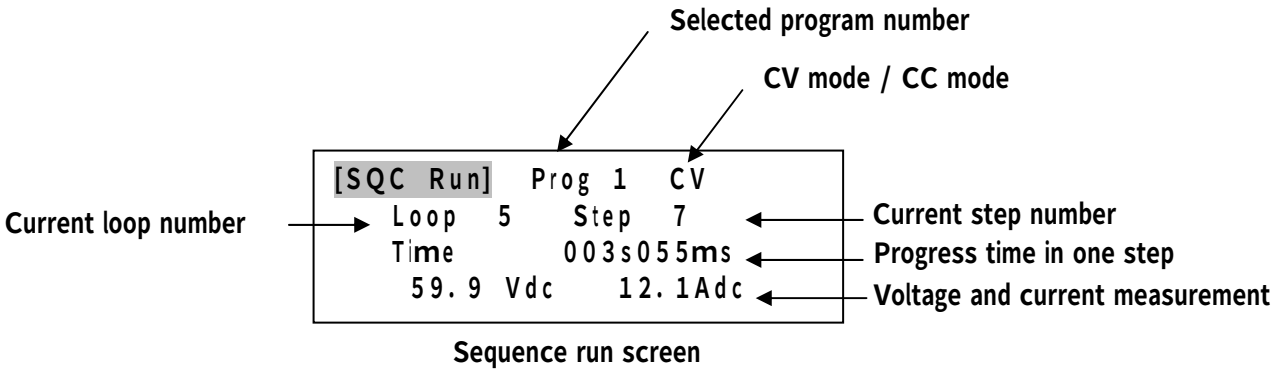
Sequence pause screen (output on)



relation between state of sequence program and LED

■sequence run screen

When sequence program is progressing, current information of sequence and step appear on the display.



Sequence run screen

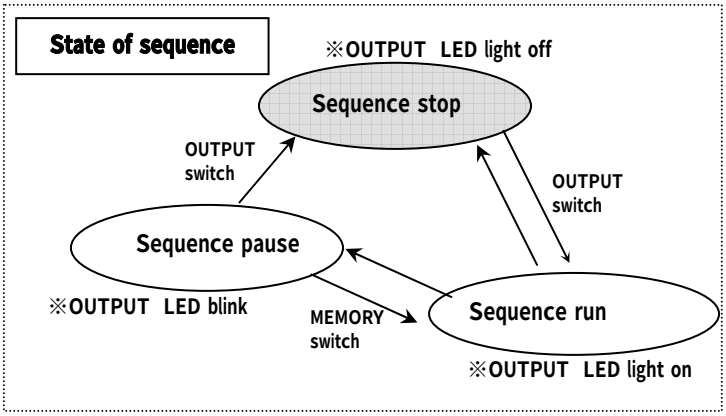
⚠ CAUTION

Measurement is only DC during sequence operation and you can not set it.

■sequence state flow

The change of state is conducted with “OUTPUT” switch and “MEMORY” switch.

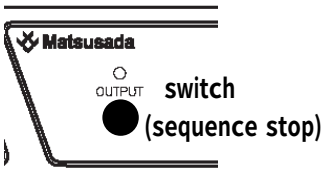
The state changes not only by the operation of switch but also when the program of sequence terminates.
(when the setting of program termination is Hold, output is on. Others - output is off)



(A) sequence run (output on)

When "OUTPUT" switch is pressed in the state where the Sequence stops, the sequence runs and the program starts.

(while the sequence is running, "[SQC Run]" is displayed in the upper left part.)



Sequence stop screen

```
[SQC Stop]  Prog 1   CV
   Loop  1    Step  1
   Time       000s000ms
    0.0 Vdc      0.0Adc
```

OUTPUT switch
(sequence run)

```
[SQC Run]   Prog 1   CV
   Loop  5    Step  7
   Time       003s055ms
    59.9 Vdc    12.1Adc
```

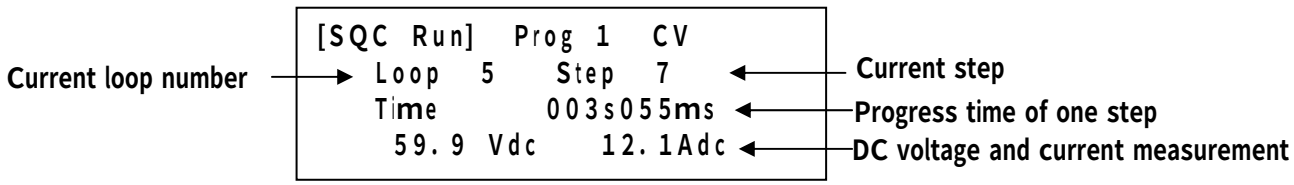
Sequence run screen

OUTPUT LED

○ light off : sequence stop (output off)

● light on : sequence run (output on)

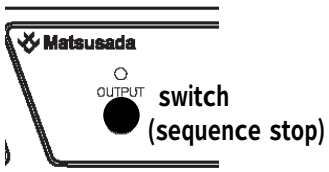
When the sequence runs, the information of program which is being executed is displayed, and it is updated as program progresses.



Sequence run screen

(B) sequence stop

When "OUTPUT" switch is pressed in the state where the sequence run, the sequence program stop and output is off.
And "OUTPUT" LED turn off.



When sequence program which have been running terminate, the sequence stops and output is turned off if the end setting of sequence is output off.

(when the sequence stop, "[SQC Stop]" is displayed in the upper left part.)

Sequence run screen

```
[SQC Run]   Prog 1   CV
   Loop   5    Step   7
   Time        003s055ms
    59.9 Vdc     12.1Adc
```

⇩ OUTPUT switch (sequence stop)

```
[SQC Stop]  Prog 1   CV
   Loop   1    Step   1
   Time        000s000ms
    0.0 Vdc      0.0Adc
```

Sequence stop screen

OUTPUT LED

● Light on : sequence run (output on)

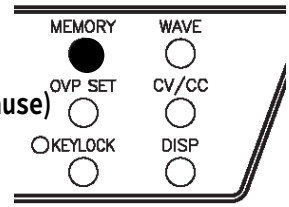
⇩

○ Light off : sequence stop (output off)

(C) sequence pause and resume

When “MEMORY” switch is pressed in the state where the sequence is running, the sequence is paused at the step and at that point.

switch (sequence pause)



Output is not turned off and output at suspension is held.

And also, LED blink while paused.
(while the sequence is pausing, “[Pause]” is displayed in the upper left part.)

Sequence run screen

```
[SQC Run]  Prog 1   CV
   Loop   5    Step   7
   Time       003s055ms
    59.9 Vdc    12.1Adc
```

⇩

```
[ Pause ]  Prog 1   CV
   Loop   5    Step   7
   Time       003s055ms
    59.9 Vdc    12.1Adc
```

Sequence pause screen

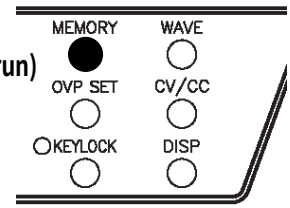
OUTPUT LED
Light on : sequence run (output on)

⇩

blink : sequence pause (output on)

When “MEMORY” switch is pressed in the state where the Sequence is paused, the sequence resume from the step where and From the time when if suspended.

switch (sequence run)



Sequence pause screen

```
[ Pause ]  Prog 1   CV
   Loop   5    Step   7
   Time       003s055ms
    59.9 Vdc    12.1Adc
```

⇩ Resume sequence program

```
[SQC Run]  Prog 1   CV
   Loop   5    Step   7
   Time       003s055ms
    59.9 Vdc    12.1Adc
```

Sequence run screen (resume)

OUTPUT LED
blink : sequence pause (output on)

⇩

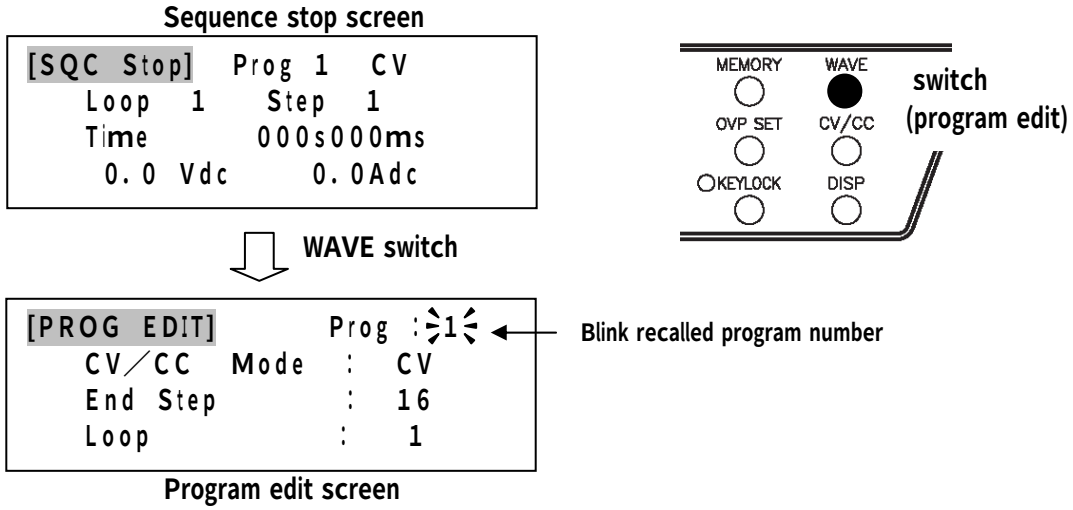
Light on : sequence run (output on)

5) Recall of the program data whose program number is specified

Up to 3 sequence programs can be stored in memory.
You can run specify the number of these 3 programs to run them.

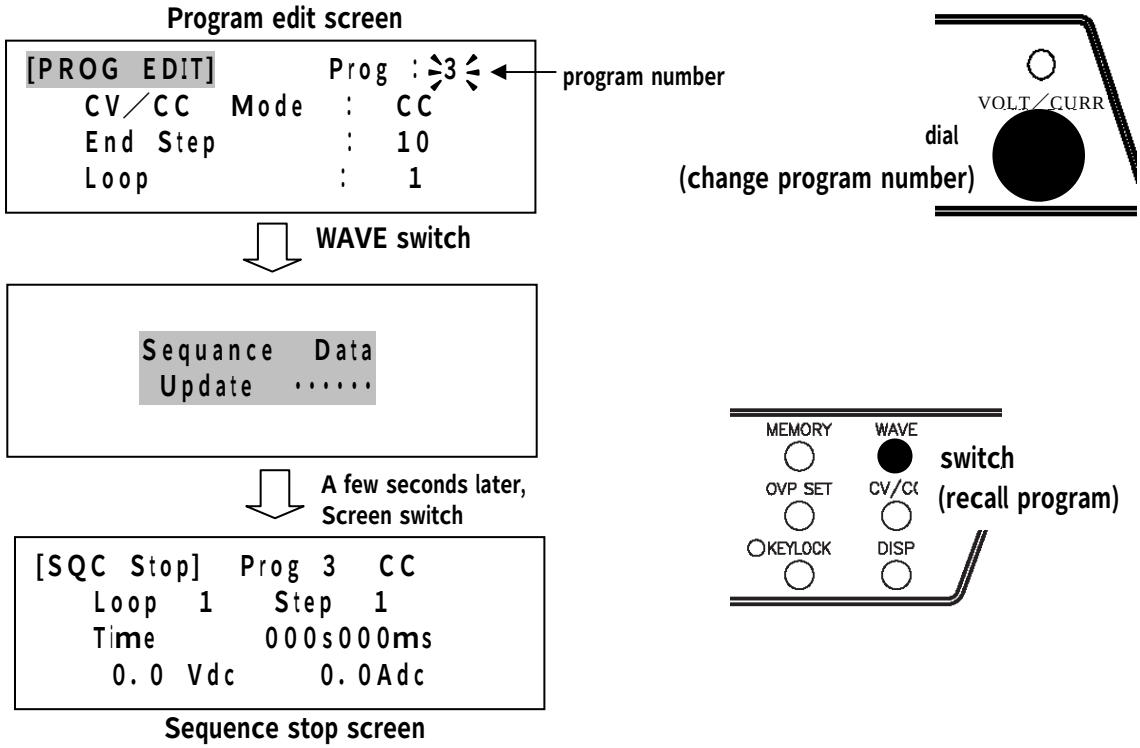
Execute the call of specified data in sequence stop state.
The specified program data cannot be recalled in sequence run state or pause state.

[process1]
Press "WAVE" switch to change from program stop state to program edit state.
("[PROG EDIT]" is displayed in the upper left part.)
Then, the program number which is being loaded is blinking.



[process2]
"VOLT/CURR" dial changes the program number which is blinking.

When "WAVE" switch is pressed agein at the specified program number, the recall of data terminates and the sequence stops.
The recall of specified program is completed.



6) sequence program and parameters

The sequence is run by using the program which is a gathering of steps.
This program and step include the settings (hereinafger, parameter) individually.

①parameters of program

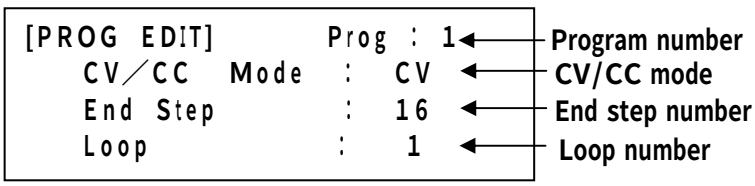
The program has 5 parameters, and the sequence operation is determined by setting them.
Parameters of program are shown in the table below.

table. parameters of program

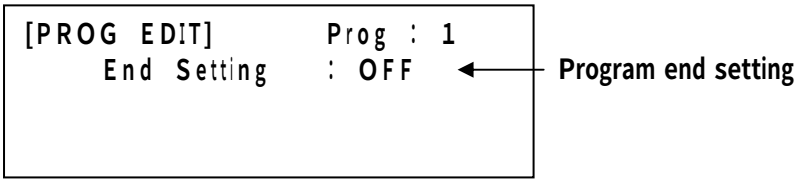
parameter	description	Setting range	Edit page
Program number	Number of sequence program It is possible to save 3 programs and use them.	1～3	1
CV/CC mode	Set CV mode or CC mode in one program.	CV／CC	1
End step number ※1	Step number of program end. In the case of loop setting - the number of times that this end step terminates.	1～16	1
Loop number ※2	Setting of the number of times that the operation from start step (step 1) to end step is repeated. When reaching the end step, the number of loop is counted.	infinity、1～999	1
Program end setting ※3	Setting of output state when all program terminate. Set output off or hold (holding of final state, output on).	OFF／HOLD	2

The configuration parameter of these programs is displayed on program edit screen.

Program edit page1 screen

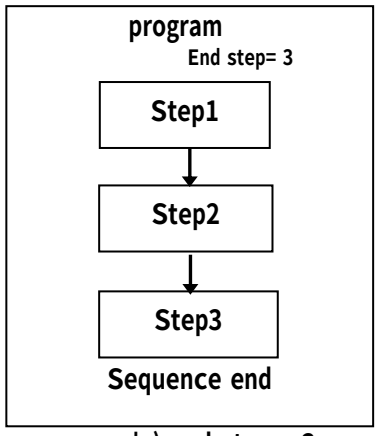


Program edit page2 screen



※1 As for end step number

When the step which has been set terminates, the sequence program terminates.
In the program where the number of steps is small and the output of one-shot pulse, it is used.



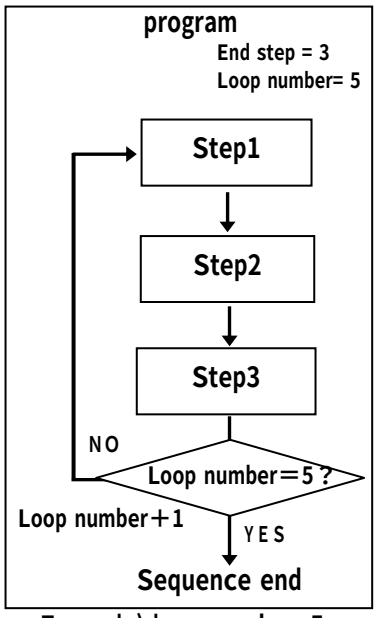
example) end step = 3

※2 As for loop number

If the loop number is more than 2, when the end step terminates, +1 is counted and step 1 starts again if the number of times does not coincide with that of the loop which has been set.

If the number of times coincides with that of loop which has been set, the sequence program terminates.

<u>If the loop is not conducted, set the number of loop number at 1.</u>

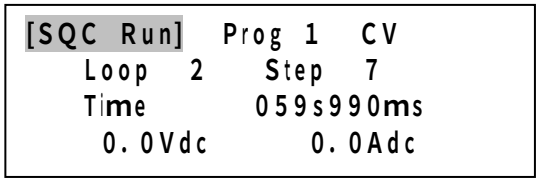


Example) loop number=5

※3 As for program end setting

if the program termination setting is OFF, output is turned off when the sequence program terminates.
("OUTPUT" LED turn off.)

And, when the setting is Hold, the output at end of the final step is held.
The sequence terminates in the state where output is on. (OUTPUT LED light on)



sequence program complete
(end setting = Hold)

OUTPUT
Light on : program complete (output on)

To turn off output or run the sequence program again, you must press "OUTPUT" switch and stop the sequence.

②parameter of step

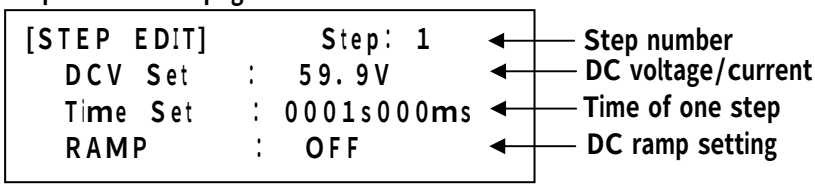
Each step has 14 parameters, and the output waveform of each step is determined by setting them. Like the normal operation, it is possible to output DC voltage/current and AC voltage/current simultaneously.
Parameters of step are shown in the table below.

table. parameters of step

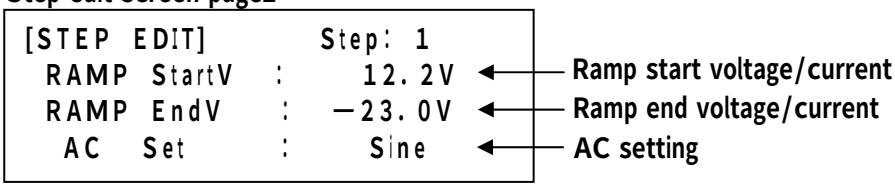
item	description	setting range	edit page
step number	number of edit step	1～16	1
DC voltage ／DC current	Setting of DC voltage(CV mode) or DC current(CC mode). Voltage or current is determined by the setting of CV/CC mode of program edit. If DC ramp is not ON in the setting, this setting is neglected.	－rated value ～ ＋rated value	1
time ※2	time of one step.	50ms (10ms) ～ 1999s 999ms	1
DC ramp ※1	Setting of DC ramp. If this DC ramp is ON in the setting, DC voltage/current setting is neglected.	ON／OFF	1
Start DC Voltage/Current (DC ramp)	The start voltage/current value of DC ramp. If DC ramp is not ON in the setting, this setting is disabled.	－rated value ～ ＋rated value	2
End DC Voltage/Current (DC ramp)	The end voltage/current value of DC ramp. If DC ramp is not ON in the setting, this setting is disabled.	－rated value ～ ＋rated value	2
AC wave ※2	Setting of AC waveform. If the setting of AC waveform is not conducted, the configuration parameters such as AC voltage / current, frequency and others are neglected.	OFF／Sine ／Square ／Triangle	2
AC voltage ／AC current	The value of AC voltage/current. If the setting of AC wave is OFF, this setting is neglected.	－rated value ～ ＋rated value	3
AC Frequency	The value of AC frequency. If the setting of AC wave is OFF, this setting is neglected.	10mHz ～ 20kHz (30kHz)	3
start phase	The value of start phase (sine wave). If the setting of AC wave is OFF and except sine wave, this setting is neglected.	0 ～315deg (resolution: 45deg)	3
On duty	The value of on duty (square wave or triangle wave). If the setting of AC wave is OFF or sine wave, this setting is neglected.	1.0 ～ 99.0% (resolution:0.1%)	3
Jump setting ※3	When the step which has been set terminates, it is possible to jump to a specified step. In the setting of ON, step jump is active. To run the next step without jump, set to OFF.	OFF／ON	4
number of step to jump ※3	When the jump setting is ON, the number of step to which it is jumped. If jump setting is OFF, this setting is neglected.	1～16	4
jump number ※3	When the jump setting is ON, the number of jumps can be determined. Jump is conducted up to the set number of times, and after that, the shift to the next step is conducted. If jump setting is OFF, this setting is neglected.	1～255	4

And those parameters of step are displayed on the step edit screen.

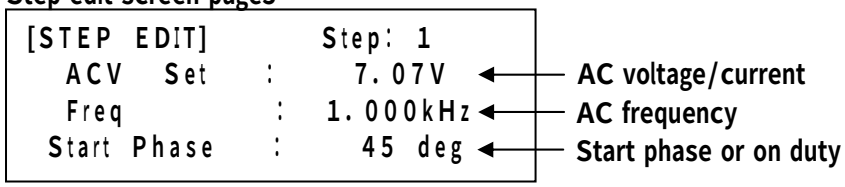
Step edit screen page1



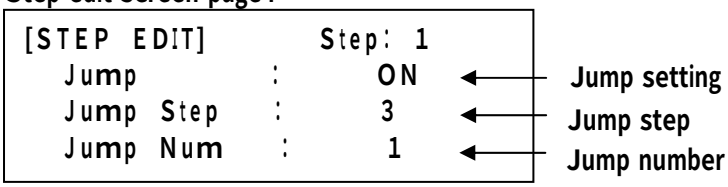
Step edit screen page2



Step edit screen page3



Step edit screen page4



※1 As for DC ramp

Output that changes from the DC start voltage/current to the DC end voltage/current which is set based on the elapsed time.

If the setting of DC ramp is ON, DC voltage/current value is neglected.

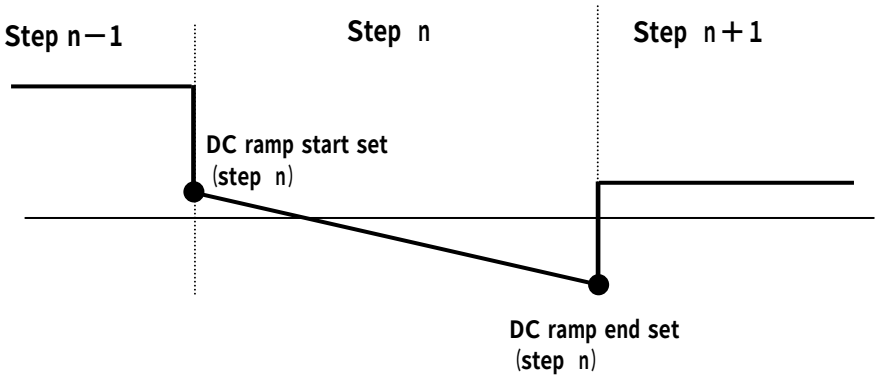


Figure. DC ramp setting

※2 As for minimum step time

Though the minimum time of step is 50ms, 10ms(minimum) can be set only if the both of DC ramp and AC output are not used (both - OFF setting).

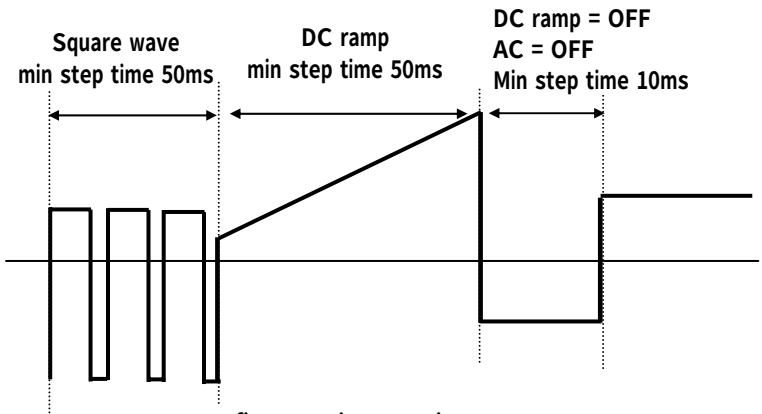


figure. min step time

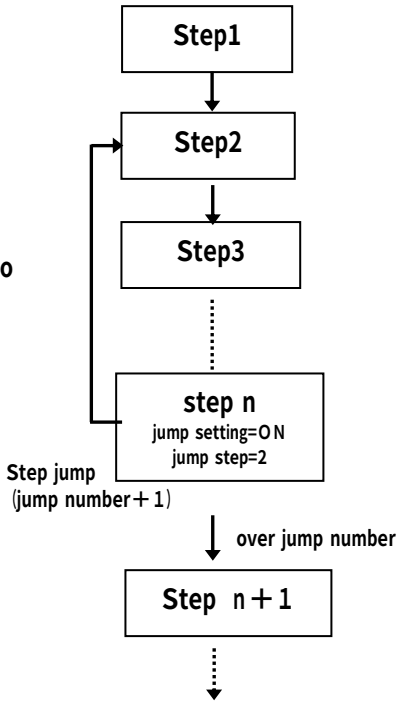
※3 As for step jump

When the jump setting is ON, the step is jumped to the specified step.
(In the case of OFF, the step shifts to the next step.)

The example of the diagram on the right the flow of step
(if the setting of jump is ON in Step n and the jump step is set to Step 2).

And also by setting the number of jumps, the number of jumps from Step n to Step 2 can be specified.

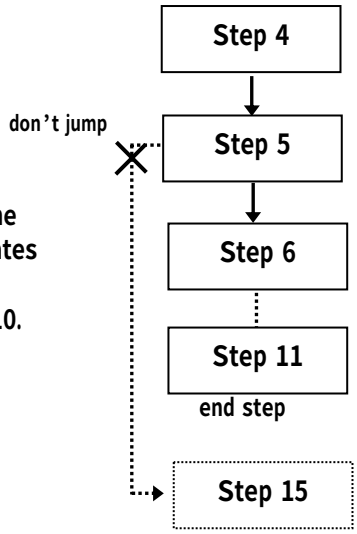
If the specified number of jumps is exceeded, the next step of Step n is not Step 2 but Step n+1.



example) jump to step 2 from step n

And also, if the jump step is set to the step whose number is larger than the termination step, jump is not conducted and the step shifts to the next step.
(And also, it is not possible to jump to the final step)

Though the jump step is set to Step 15 in the example of the diagram on the right, the shift to Step 6 is conducted without jumping when Step 5 terminates as it is behind termination Step 11 of the program.
As the final step is Step 11, the jump step which can be set is up to Step 10.



example) end setting is step 11 and
jump to step 15 from step 5

※4 As for on phase setting in case of sequence operation

If the sine wave is output into the step of sequence, the input/cut off phase cannot be set in each step.
The set value of input/cut off phase in the normal operation is set in the sine wave of all steps.

As for the phase setting of normal operation

Refer to > **3-8-1. Normal operation 7) set phase (sine) , on duty (square)**

7) procedure for parameters of program

The parameter edit procedure of the program is shown sequentially.
The sequence has 5 parameter of program, ①program number, ②CV/CC mode, ③end step, ④loop number, ⑤program end.

Refer to 3-8-2. Sequence operation 6) sequence program and parameters

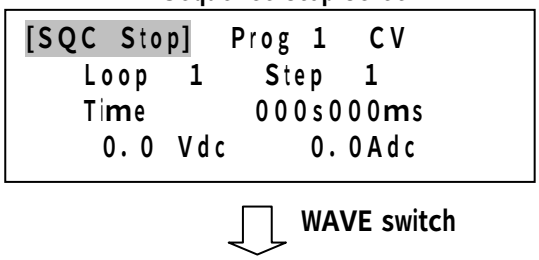
Operation of editing: switching of editing page - "CV/CC" switch, down movement of item - "KEYLOCK" switch, up movement - "OVP SET" switch, change of value - "VOLT/CURR" dial.

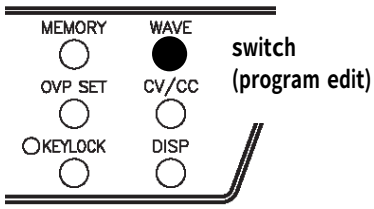
①set program number

Call the data of specified program in the state where the program stops.
The data of specified program cannot be called in the state where the program is running or paused.
And also, the number of program which can be changed is 1~3.

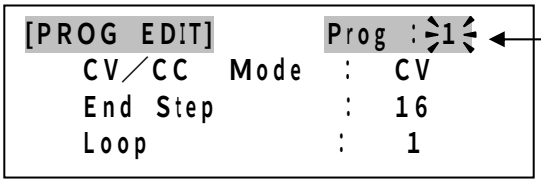
[process1]
When "WAVE" switch is pressed in the state where the sequence stop, the state is sequence edit.
("[PROG EDIT]" is displayed in the upper left part.)
Then, the number of program which is being loaded is blinking.

Sequence stop screen



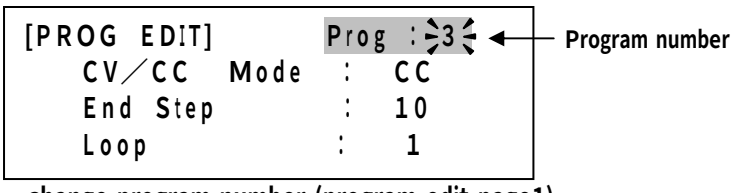


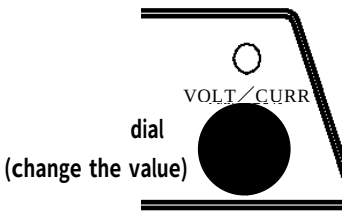
WAVE switch



Program edit page1 screen

[process2]
The change of program number value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decrease, and if you turn it clockwise, the value increases.





change program number (program edit page1)

How to save the program without changing other setting?

Refer to 3-8-2. sequence operation 9) save sequence program

How to edit the step without editing other programs?

Refer to 3-8-2.sequence operation 8) procedure for parameter of step

② Set CV mode / CC mode

Set CV mode / CC mode on one program.

[process 1]

By pressing "KEYLOCK" switch, the item move down from the setting of program number.
The Current setting of CV mode/CC mode blink on the display.

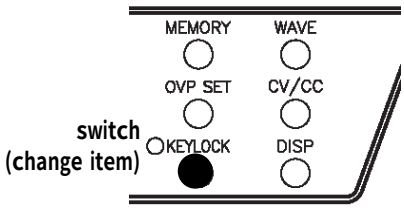
Select program number (program edit page1)

```
[PROG EDIT]        Prog : 3
   CV/CC  Mode     :  CC
   End Step        :  10
   Loop            :   1
```

KEYLOCK switch

```
[PROG EDIT]        Prog : 3
   CV/CC  Mode     :  CC
   End Step        :  10
   Loop            :   1
```

Select CV/CC mode (program edit page1)

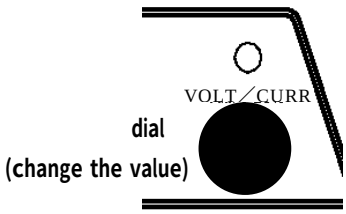


[process 2]

The change of CV/CC mode is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, CV mode set, and if you turn it clockwise, CC mode set.

```
[PROG EDIT]        Prog : 3
   CV/CC  Mode     :  CV   <-- CV mode/CC mode
   End Step        :  16
   Loop            :   1
```

Change CV mode/CC mode (program edit page1)



How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the step without editing other programs?

Refer to > 3-8-2.sequence operation 8) procedure for parameter of step

③ set end step

Set step number of program end. This setting is 1～16.

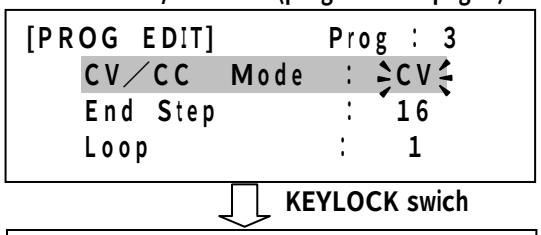
As for end step number

Refer to 3-8-2. Sequence operation 6) sequence program and parameters

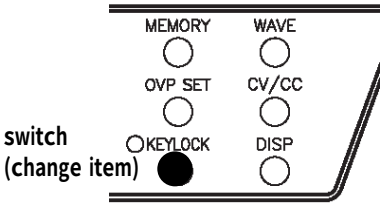
[process 1]

By pressing "KEYLOCK" switch, the item move down from the setting of CV/CC mode.
The Current setting of end step blink on the display.

Select CV/CC mode(program edit page1)

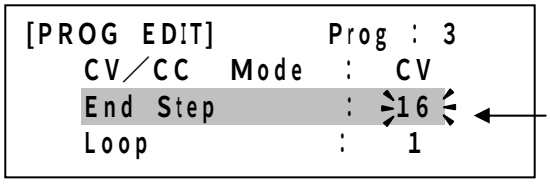


End step number(program edit page1)

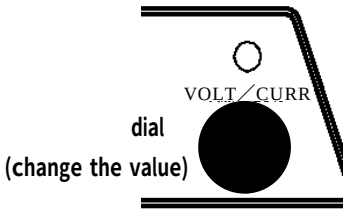


[process 2]

The change of end step number is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.



Change end step number(program edit page1)



How to save the program without changing other setting?

Refer to 3-8-2. sequence operation 9) save sequence program

How to edit the step without editing other programs?

Refer to 3-8-2.sequence operation 8) procedure for parameter of step

④ Set loop number

Change the number of loop that the program conducts in the termination step.
The set valued is 1～999, and infinite(displayed "----").

As for loop of program

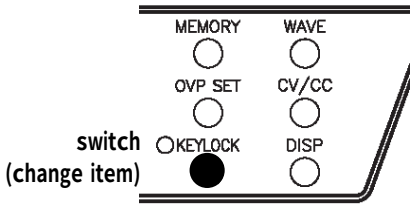
Refer to > 3-8-2. Sequence operation 6) sequence program and parameters

[process 1]

By pressing "KEYLOCK" switch, the item move down from the setting of end step.
The Current setting of loop number blink on the display.

Select end step number (program edit page1)

```
[PROG EDIT]        Prog : 3
    CV/CC  Mode    :  CV
    End Step       : >16<
    Loop           :   1
```



⇩ KEYLOCK switch

```
[PROG EDIT]        Prog : 3
    CV/CC  Mode    :  CV
    End Step       :  16
    Loop           : >1<
```

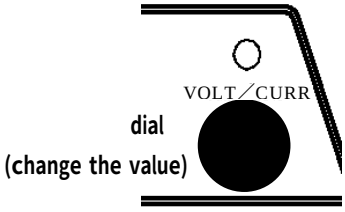
Select loop number (program edit page1)

[process 2]

The change of loop number is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[PROG EDIT]        Prog : 3
    CV/CC  Mode    :  CV
    End Step       :  16
    Loop           : >100<   ← Loop number
```

change loop number(program edit page1)



When the setting of loop number is infinity, "- - -" is displayed.

```
[PROG EDIT]        Prog : 3
    CV/CC  Mode    :  CV
    End Step       :  16
    Loop           :  ---
```

Loop number = infinity (program edit page1)

How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the step without editing other programs?

Refer to > 3-8-2.sequence operation 8) procedure for parameter of step

⑤ Set program end

Set the setting of output state when all program terminate. This setting is HOLD or OFF.

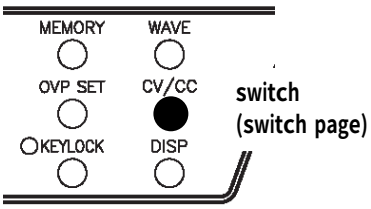
[process 1]

By pressing "CV/CC" switch, the screen switch to program edit page2 from program edit page1.

and by pressing "KEYLOCK" switch, the item move down from the setting of program number.
The Current setting of program end blink on the display.

Select loop number (program edit page1)

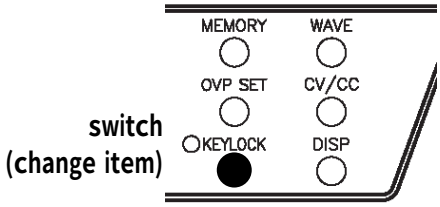
```
[PROG EDIT]        Prog : 3
   CV／CC  Mode    :  CV
   End Step        :  16
   Loop            :  >1<
```



CV／CC switch

Select program number (**program edit page2**)

```
[PROG EDIT]        Prog : >3<
   End Setting     :  OFF
```



KEYLOCK switch

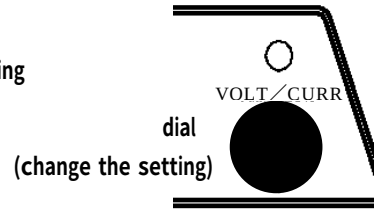
```
[PROG EDIT]        Prog : 3
   End Setting     : >OFF<
```

Select end setting (program edit page2)

[process 2]

The change of program end setting is conducted with "VOLT/CURR" dial.

```
[PROG EDIT]        Prog : 3
   End Setting     : >HOLD<   ← Program end setting
```



Change end setting (program edit page2)

How to save the program without changing other setting?

Refer to 3-8-2. sequence operation 9) save sequence program

How to edit the step without editing other programs?

Refer to 3-8-2.sequence operation 8) procedure for parameter of step

8) Procedure for parameters of step

The parameter edit procedure of the program is shown sequentially.

The sequence has 14 parameter of program.
Operation of editing: switching of editing page - "CV/CC" switch, down movement of item - "KEYLOCK" switch, up movement - "OVP SET" switch, change of value - "VOLT/CURR" dial.

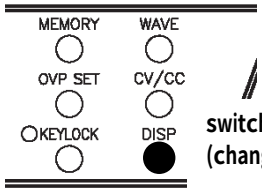
①Set step number

Set number of edit step.
You don not need to set the parameter of unused step such as steps behind the termination step. However, all parameters of used steps should be set. The number of steps is 1～16 in one program.

[process1]
When "DISP"switch is pressed in the state of program edit, the screen switch step edit from program edit and the setting of step number blink on the display.

select end setting (program edit page2)

```
[PROG EDIT]        Prog : 3
  End Setting    : >HOLD<
```



switch
(change program edit /step edit)

DISP switch

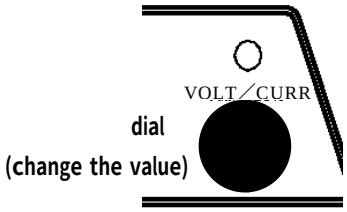
select step number (step edit page1)

```
[STEP EDIT]      Step : >1<
  DCV Set      :   59.9 V
  Time Set     :0100 s000 ms
   RAMP        :    OFF
```

[process2]
The change of step number is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]      Step : >15<   <-- step number
  DCV Set      :   59.9 V
  Time Set     :0100 s000 ms
   RAMP        :    OFF
```

Change step number(step edit page1)



How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

②Set DC voltage value, current value

Set the value of DC voltage(CV mode) or DC current(CC mode).

The rated value and range depend on the model.

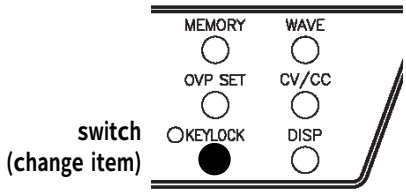
[process1]

by pressing "KEYLOCK" switch, the item move down from the setting of step number.
The Current value of DC voltage or current blink on the display.

As for the item, "DCV" is displayed if the program is CV mode, and "DCI" is displayed if it is CC mode, and the unit of set value changes.

select step number (step edit page1)

```
[STEP EDIT]      Step : >15<
  DCV Set      :   59.9 V
  Time Set     :0100 s000 ms
  RAMP         :    OFF
```



⇩ KEYLOCK switch

```
[STEP EDIT]      Step : 15
  DCV Set      : >59.9<V
  Time Set     :0100 s000 ms
  RAMP         :    OFF
```

select DC voltage (step edit page1)

```
[STEP EDIT]      Step : 15
  DCI Set      : >12.2<A
  Time Set     :0100 s000 ms
  RAMP         :    OFF
```

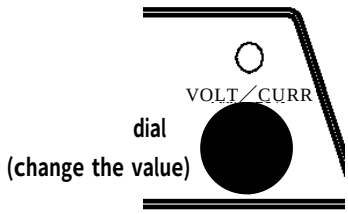
select DC current(in case of CC mode)

[process2]

The setting of DC voltage/current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]      Step : 15
  DCV Set      : >18.9<V   ← DC voltage/current
  Time Set     :0100 s000 ms
  RAMP         :    OFF
```

change DC voltage value(step edit page1)



How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

③Set step time

Set the step time, the step time should be set in each step.
The minimum time of step is 50ms (10ms - both of DC ramp and AC output are off)

Refer to > 3-8-2. sequence operation 6) sequence program and parameter

[process1]

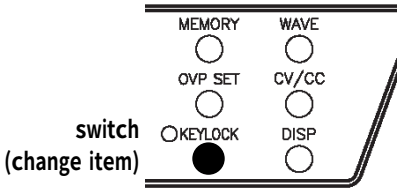
by pressing "KEYLOCK" switch, the item move down from the setting of DC voltage or current.
And the s (second) unit of step time blink on the display.
As for the setting of step time, s unit and ms unit should be set individually.

Moreover, by pressing "KEYLOCK" switch, the item move right from the setting of s (second) unit of step time.
And the ms (milli-second) unit of step time blink on the display.

On the contrary,by pressing "OVP SET" switch, the item move left from the setting of ms (milli-second) unit of step time.
The s (second) unit of step time blink on the display.

select DC voltage/current(step edit page1)

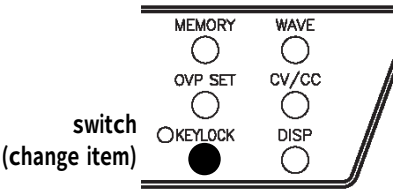
```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9 V
 Time Set     :0100 s000 ms
  RAMP        :    OFF
```



KEYLOCK switch

select step time of sec unit (step edit page1)

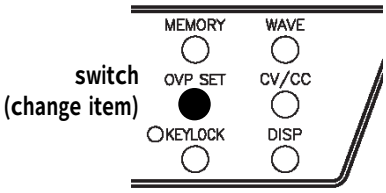
```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9 V
 Time Set     :0100 s000 ms
  RAMP        :    OFF
```



OVP SET switch KEYLOCK switch

select step time of msec unit (step edit page1)

```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9 V
 Time Set     :0100 s000 ms
  RAMP        :    OFF
```

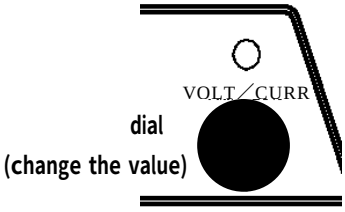


[process2]

The setting of step time value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9 V
 Time Set     :0100 s000 ms
  RAMP        :    OFF
```

step time of sec unit



change step time of sec unit(step edit page1)

```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9V
 Time Set     :0100 s000 ms
  RAMP        :    OFF
```

step time of msec unit

change step time of msec unit(step edit page1)

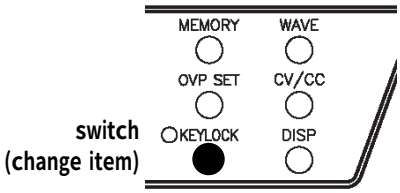
④Set DC ramp

Refer to > 3-8-2. sequence operation 6) sequence program and parameter

[process1]
By pressing "KEYLOCK" switch, the item move down from ms unit of step time .
And the setting of DC ramp blink on the display.

select step time of msec unit (step edit page1)

```
[STEP EDIT]     Step : 15
 DCV Set     :  18.9 V
 Time Set    :0100 s000 ms
  RAMP       :   OFF
```



KEYLOCK switch

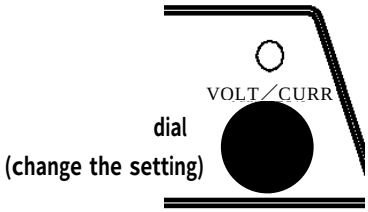
```
[STEP EDIT]     Step : 15
 DCV Set     :  18.9 V
 Time Set    :0100 s000 ms
  RAMP       :   OFF
```

select ramp setting (step edit page1)

[process2]
The ramp setting is conducted with "VOLT/CURR" dial.

```
[STEP EDIT]     Step : 15
 DCV Set     :  18.9 V
 Time Set    :0100 s000 ms
  RAMP       :   OFF   <-- ramp setting
```

change ramp setting (step edit page1)



⚠ Notes
In the case of DC ramp output, it is necessary to set DC ramp to ON, and set ⑤the start of DC ramp and ⑥the end of DC ramp.
And also, when DC ramp is on, the setting of DC voltage is neglected.

How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

⑤Set DC ramp start voltage value, current value

Set the value of DC ramp start voltage/current.
If DC ramp is ON in the setting, this setting is enabled.

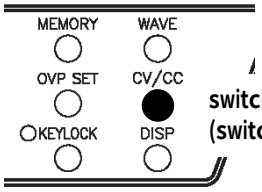
The rated value and range depend on the model.

[process1]
By pressing "CV/CC" switch, the screen switch to step edit page2 from step edit page1.

And by pressing "KEYLOCK" switch, the item move down from the setting of step number.
The Current setting of DC ramp start voltage/ current blink on the display.

select ramp setting (step edit page1)

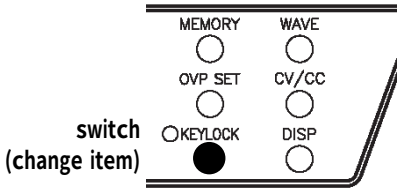
```
[STEP EDIT]      Step : 15
 DCV Set      :  18.9 V
 Time Set     :0100 s000 ms
  RAMP        :  >OFF<
```



⇩ CV/CC switch

select step number (**step edit page2**)

```
[STEP EDIT]       Step: >15<
 RAMP StartV  :    12.2 V
 RAMP EndV    :   −23.0 V
  AC  Set     :     Sine
```



⇩ KEYLOCK switch

```
[STEP EDIT]       Step: 15
 RAMP StartV  :   >12.2<V
 RAMP EndV    :   −23.0 V
  AC  Set     :     Sine
```

select DC ramp start voltage(step edit page2)

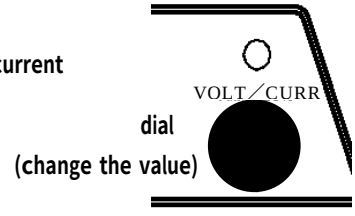
```
[STEP EDIT]       Step: 15
 RAMP StartI  :   >5.05<A
 RAMP EndI    :   −3.01 A
  AC  Set     :     Sine
```

select DC ramp start current(in case of CC mode)

[process2]
The setting of DC ramp start voltage/current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]       Step: 15
 RAMP StartV  :   >12.2<V   ← DC ramp start voltage/current
 RAMP EndV    :   −23.0 V
  AC  Set     :     Sine
```

change DC ramp start voltage(step edit page2)



⚠ CAUTION

In the case of DC ramp output, it is necessary to set DC ramp to ON.

step edit

⑥Set DC ramp end voltage value, current value

Set the value of DC ramp end voltage/current.
If DC ramp is ON in the setting, this setting is enabled.

The rated value and range depend on the model.

[process1]

By pressing "KEYLOCK" switch, the item move down from the setting of DC ramp start voltage/current.
The Current setting of DC ramp end voltage/ current blink on the display.

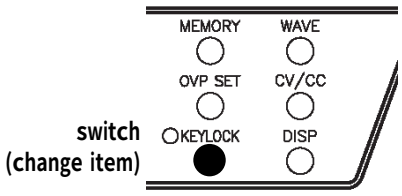
select DC ramp start voltage(step edit page2)

```
[STEP EDIT]        Step: 15
 RAMP StartV   :    12.2 V
 RAMP EndV     :   -23.0 V
  AC  Set      :     Sine
```

KEYLOCK switch

```
[STEP EDIT]        Step: 15
 RAMP StartV   :    12.2 V
 RAMP EndV     :   -23.0 V
  AC  Set      :     Sine
```

select DC ramp end voltage(step edit page2)




```
[STEP EDIT]        Step: 15
 RAMP StartI   :    5.05 A
 RAMP EndI     :   -3.01 A
  AC  Set      :     Sine
```

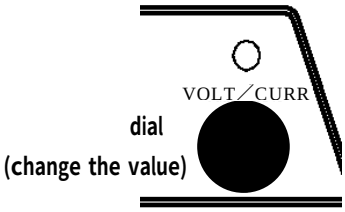
select DC ramp end current(in case of CC mode)

[process2]

The setting of DC ramp end voltage/current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
 RAMP StartV   :    12.2 V
 RAMP EndV     :   -23.0 V   <-- DC ramp end voltage
  AC  Set      :     Sine
```

change DC ramp end voltage(step edit page2)



⚠ Notes

Te case of DC ramp output, it is necessary to set the start of DC ramp and set DC ramp to on.

How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

⑦Set AC waveform

In the case of AC waveform output, AC waveform should be set.

[process1]

By pressing "KEYLOCK" switch, the item move down from the setting of DC ramp end voltage/current.
The Current setting of AC waveform blink on the display.

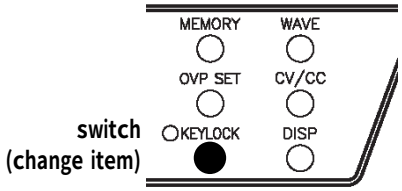
select DC ramp end voltage(step edit page2)

```
[STEP EDIT]        Step: 15
 RAMP StartV  :     12.2 V
 RAMP EndV    :   >-23.0<V
  AC  Set     :     Sine
```

KEYLOCK switch

```
[STEP EDIT]        Step: 15
 RAMP StartV  :     12.2 V
 RAMP EndV    :    -23.0 V
  AC  Set     :   >Sine<
```

select AC setting (step edit page2)

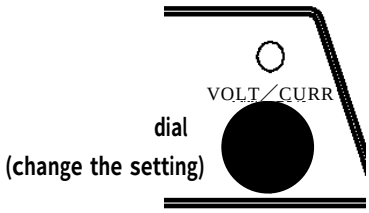


[process2]

The setting of DC ramp end voltage/current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
 RAMP StartV  :     12.2 V
 RAMP EndV    :    -23.0 V
  AC  Set     :   >Sine<  <-- AC setting
```

change AC setting (step edit page2)



How to save the program without changing other setting?

Refer to > **3-8-2. sequence operation 9) save sequence program**

How to edit the program without editing other steps?

Refer to > **3-8-2.sequence operation 7) procedure for parameter of program**

step edit

⑧set AC voltage value, current value

Set the value of AC voltage/current.
This setting is active only if the setting of AC waveform is sine wave, square wave and triangle wave. When the setting of AC waveform is OFF, this the setting is neglected.

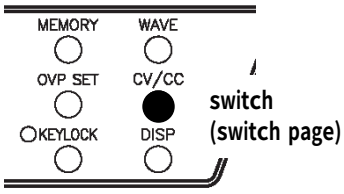
The rated value and range depend on the model.

[process1]
By pressing "CV/CC" switch, the screen switch to step edit page3 from step edit page2.

And by pressing "KEYLOCK" switch, the item move down from the setting of step number.
The Current setting of AC voltage/ current blink on the display.

select AC setting (step edit page2)

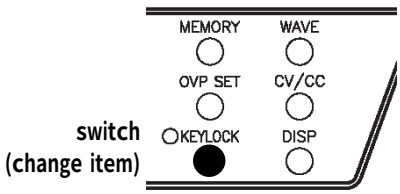
```
[STEP EDIT]        Step: 15
 RAMP StartV   :     12.2 V
 RAMP EndV     :   −23.0 V
  AC  Set      :    ≥Sine≤
```



CV/CC switch

select step number (**step edit page3**)

```
[STEP EDIT]        Step: ≥15≤
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
 Start Phase  :     45 deg
```



KEYLOCK switch

```
[STEP EDIT]        Step: 15
  ACV  Set    :    ≥7.07≤V
  Freq        :  1.000 kHz
 Start Phase  :     45 deg
```

select AC voltage (step edit page3)

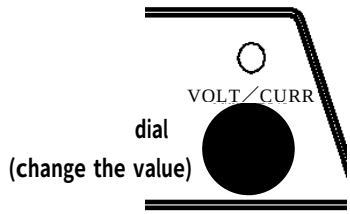
```
[STEP EDIT]        Step: 15
  ACI  Set    :    ≥7.07≤A
  Freq        :  1.000 kHz
 Start Phase  :     45 deg
```

select AC current(in case of CC mode)

[process2]
The setting of AC voltage/current value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
  ACV  Set    :    ≥7.07≤V   ← AC voltage
  Freq        :  1.000 kHz
 Start Phase  :     45 deg
```

change AC voltage/current (step edit page3)



⚠ CAUTION
In the case of AC waveform output, AC waveform should be set.

⑨set AC frequency

Set the value of AC frequency. And the range of frequency is 10mHz ～ 20kHz (part of models is 30kHz).

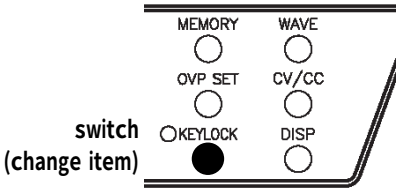
This setting is active only if the setting of AC waveform is sine wave, square wave and triangle wave. When the setting of AC waveform is OFF, this the setting is neglected.

[process1]

By pressing "KEYLOCK" switch, the item move down from the setting of AC voltage/current.
The Current setting of AC frequency blink on the display.

select AC voltage(step edit page3)

```
[STEP EDIT]        Step: 15
  ACV  Set    :    7.07 V
  Freq        :   1.000 kHz
 Start Phase  :     45 deg
```



KEYLOCK switch

```
[STEP EDIT]        Step: 15
  ACV  Set    :    7.07 V
  Freq        :   1.000 kHz
 Start Phase  :     45 deg
```

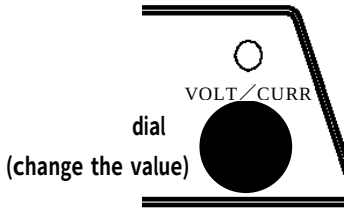
select AC frequency(step edit page3)

[process2]

The setting of AC frequency value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
  ACV  Set    :    7.07 V
  Freq        :   1.000 kHz   <-- AC frequency
 Start Phase  :     45 deg
```

change AC frequency (step edit page3)



⚠ CAUTION

In the case of AC waveform output, AC waveform should be set.

How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

⑩set start phase (sine wave)

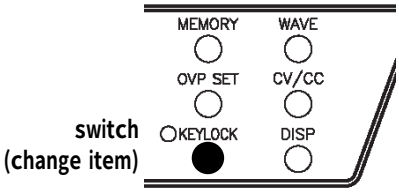
Set start phase of sine wave.
The range is 0～315deg, and resolution of this setting is 45deg.

If AC waveform is sine wave in the setting, this setting is enabled.

[process1]
by pressing "KEYLOCK" switch, the item move down from the setting of AC frequency.
The Current setting of start phase blink on the display.

select AC frequency(step edit page3)

```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  ≻1.000≺kHz
 Start Phase  :     45 deg
```



KEYLOCK switch

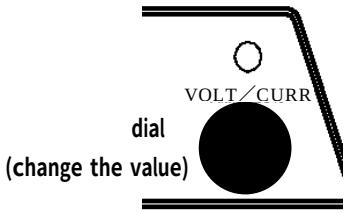
```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
 Start Phase  :    ≻45≺deg
```

select start phase(step edit page3)

[process2]
The setting of start phase value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
 Start Phase  :    ≻45≺deg  ← Start phase
```

change start phase (step edit page3)



How to save the program without changing other setting?

Refer to > **3-8-2. sequence operation 9) save sequence program**

How to edit the program without editing other steps?

Refer to > **3-8-2.sequence operation 7) procedure for parameter of program**

step edit

⑪set on duty (square wave, triangle wave)

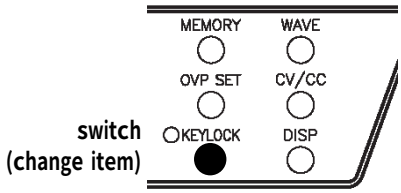
Set on duty of square wave or triangle wave.
The range is 1.0%～99.0%, and resolution of this setting is 0.1%.

If AC waveform is square wave or triangle wave in the setting, this setting is enabled.

[process1]
by pressing "KEYLOCK" switch, the item move down from the setting of AC frequency.
The Current setting of on duty blink on the display.

select AC frequency(step edit page3)

```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  ≥1.000≤kHz
  Duty        :     25.0 %
```



KEYLOCK switch

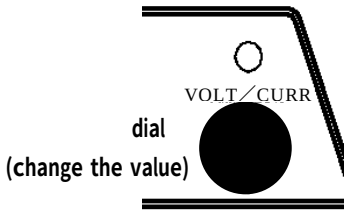
```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
  Duty        :   ≥25.0≤%
```

select on duty(step edit page3)

[process2]
The setting of on duty value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
  Duty        :   ≥25.0≤%   ← on duty
```

change on duty (step edit page3)



How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

Step edit

⑫set step jump

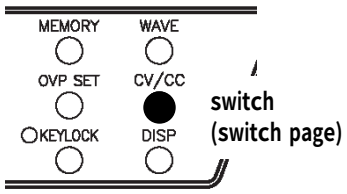
If this setting is ON, you can step jump in the sequence program.
To run the next step without jump, set to OFF.

[prcess1]
By pressing "CV/CC" switch, the screen switch to step edit page4 from step edit page3.

And by pressing "KEYLOCK" switch, the item move down from the setting of step number.
The Current setting of step jump on the display.

select start phase (step edit page3)

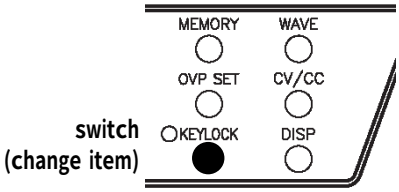
```
[STEP EDIT]        Step: 15
  ACV  Set    :     7.07 V
  Freq        :  1.000 kHz
 Start Phase  :    >45<deg
```



CV/CC switch

select step number (**step edit page4**)

```
[STEP EDIT]        Step:>15<
    Jump       :    ON
  Jump Step    :     4
  Jump Num     :     1
```



KEYLOCK switch

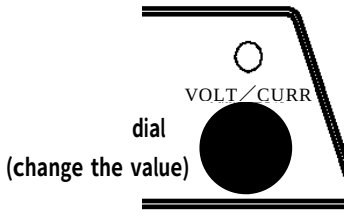
```
[STEP EDIT]        Step: 15
    Jump       :   >ON<
  Jump Step    :    4
  Jump Num     :    1
```

select jump setting (step edit page4)

[process2]
The setting of jump setting is conducted with "VOLT/CURR" dial.

```
[STEP EDIT]        Step: 15
    Jump       :   >OFF<   <-- jump setting
  Jump Step    :    4
  Jump Num     :    1
```

change jump setting (step edit page4)



How to save the program without changing other setting?

Refer to > **3-8-2. sequence operation 9) save sequence program**

How to edit the program without editing other steps?

Refer to > **3-8-2.sequence operation 7) procedure for parameter of program**

Step edit

⑬set jump step

Set number of step jump, and this number is less than end step.

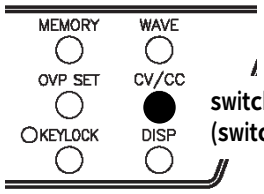
If step jump is ON in the setting, this setting is enabled.

[process1]

By pressing "KEYLOCK" switch, the item move down from the setting of step jump.
The Current setting of jump step on the display.

select jump setting (step edit page4)

```
[STEP EDIT]        Step: 6
    Jump       :   ON
  Jump Step    :   10
  Jump Num     :    1
```



switch (switch page)

KEYLOCK switch

```
[STEP EDIT]        Step: 6
    Jump       :   ON
  Jump Step    :   10
  Jump Num     :    1
```

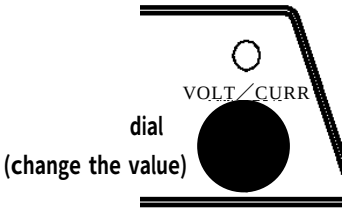
select jump step (step edit page4)

[process2]

The setting of on jump step value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 6
    Jump       :   ON
  Jump Step    :   13   <-- jump step
  Jump Num     :    1
```

change jump step (step edit page4)



dial (change the value)

How to save the program without changing other setting?

Refer to > 3-8-2. sequence operation 9) save sequence program

How to edit the program without editing other steps?

Refer to > 3-8-2.sequence operation 7) procedure for parameter of program

Step edit

⑭set number of step jump

Set number of jump, and the set value is 1～255.

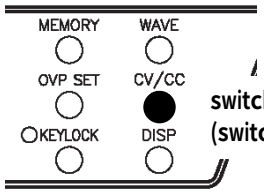
If step jump is ON in the setting, this setting is enabled.

[process1]

By pressing "KEYLOCK" switch, the item move down from the setting of jump step.
The Current setting of step jump on the display.

select jump step (step edit page4)

```
[STEP EDIT]        Step: 6
    Jump       :    ON
  Jump Step    :   ▲10▼
  Jump Num     :    1
```



switch
(switch page)

KEYLOCK switch

```
[STEP EDIT]        Step: 6
    Jump       :    ON
  Jump Step    :    10
  Jump Num     :   ▲1▼
```

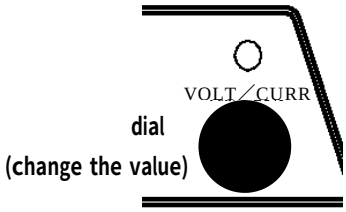
select jump number (step edit page4)

[process2]

The setting of jump number value is conducted with "VOLT/CURR" dial.
If you turn this dial counterclockwise, the value decreases, and if you turn it clockwise, the value increases.

```
[STEP EDIT]        Step: 6
    Jump       :    ON
  Jump Step    :    10
  Jump Num     :   ▲1▼   ←— jump number
```

change jump number (step edit page4)



dial
(change the value)

How to save the program without changing other setting?

Refer to > **3-8-2. sequence operation 9) save sequence program**

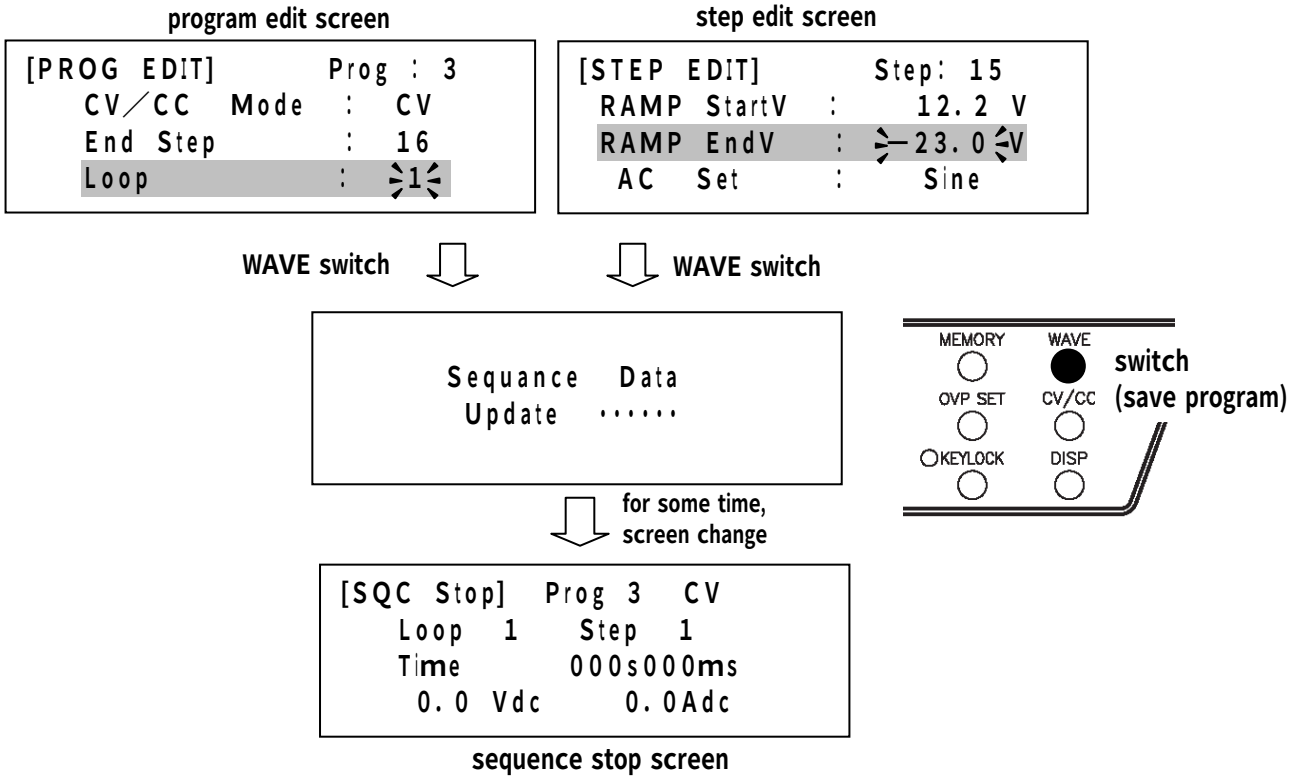
How to edit the program without editing other steps?

Refer to > **3-8-2.sequence operation 7) procedure for parameter of program**

9) save sequence program

As for the storage of sequence program, by pressing “WAVE” switch in the state of program edit or step edit, the data of program is stored and the state is shifted to the sequence operation state.

The storage can be started from any page (program edit page 1～2, step edit page 1～4).



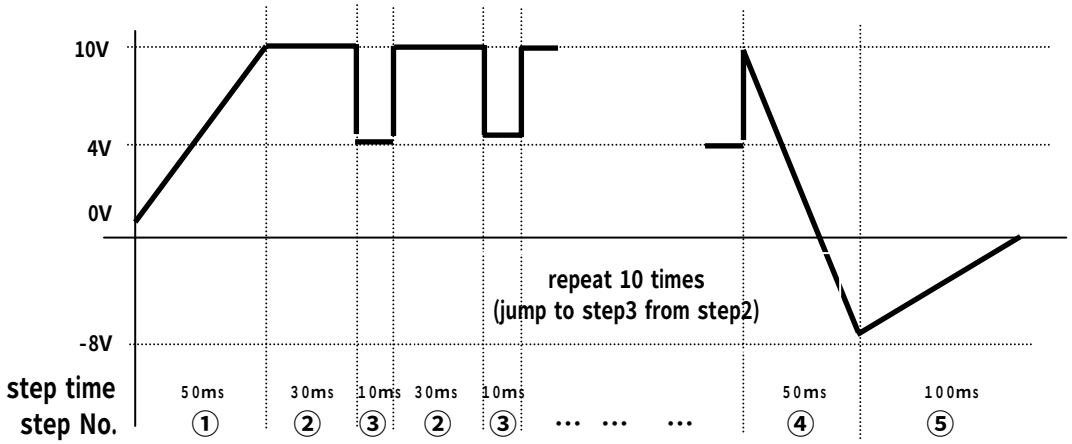
※Notes

If the sequence program or edit data of step is cancelled, the changed data is not saved by pressing “MEMORY” switch for 2seconds to return to the normal operation without conducting save process.

sequence program example

example1) DC、DC ramp、step jump

1) Change to the sequence operation state by pressing “MEMORY” switch for 2 seconds.
2) Change to edit mode by pressing “WAVE” switch.



3) Edit the program configration parameter with “CV/CC” switch(change of page), “OVP SET” switch (up movement of item), “KEYLOCK” switch (down movement of item), “VOLT/CURR” dial (change the value) in the edit screen of program.

list. program parameter

program number	1 ～ 3
CV／CC	CV
end step number	5
loop number	1
end setting	off

program edit screen (page1)

```
[PROG    EDIT]      Prog : 1
CV ／CC Mode        :  CV
End   Step          :   5
 Loop               :   1
```

program edit screen (page2)

```
[PROG    EDIT]      Prog : 1
 End  Setting       :   OFF
```

4) Edit the step configration parameter with "CV/CC" switch(change of page), "OVP SET" switch (up movement of item), "KEYLOCK" switch (down movement of item), "VOLT/CURR" dial (change the value) in the edit screen of step.

list. setting of each step

step number	1	2	3	4	5
DC voltage	—	10V	4V	—	—
step time	50ms	30ms	10ms	50ms	100ms
DC ramp setting	ON	OFF	OFF	ON	ON
DC ramp start voltage	0V	—	—	10V	-8V
DC ramp end voltage	10V	—	—	-8V	8V
AC setting	OFF	OFF	OFF	OFF	OFF
AC voltage	—	—	—	—	—
AC frequency	—	—	—	—	—
start phase (on duty)	—	—	—	—	—
jump setting	OFF	OFF	ON	OFF	OFF
jmp step	—	—	2	—	—
jump number	—	—	9	—	—

example) edit screen of step 3

step edit (page1)

```
[STEP    EDIT]      Step : 3
DCV   Set           : 4.00  A
Time   Set          : 000s010ms
  RAMP              : OFF
```

step edit (page2)

```
[STEP    EDIT]      Step : 3
RAMP  StartV    :    — V
RAMP  EndV      :    — V
AC  Set         :    OFF
```

step edit (page3)

```
[STEP    EDIT]      Step : 3
ACV   Set       :    — V
Freq            :    — kHz
Duty            :    — %
```

step edit (page4)

```
[STEP    EDIT]      Step : 3
    Jump        :    ON
Jump  Step      :    2
Jump  Num       :    9
```

5) Change form sequence edit to sequence stop state by pressing "WAVE" switch.
(The data save screen is displayed, and it changes to the screen of stop state after saving)

save screen

```
Sequence   Data
     Update .....
```

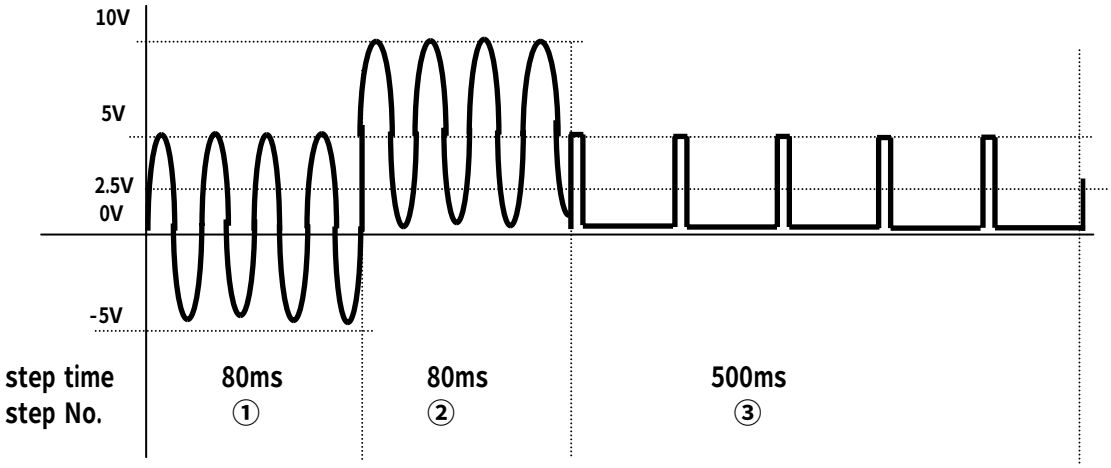
sequence stop screen

```
[SQC  Stop]  Prog  1     CV
   Loop  1        Step  1
    Time        000s000ms
    0.0Vdc       0.0Adc
```

6) Start the sequence operation by pressing "OUTPUT" switch.

example2) AC、 AC＋DC

1) Change to the sequence operation state by pressing “MEMORY” switch for 2 seconds.
2) Change to edit mode by pressing “WAVE” switch.



3) Edit the program configration parameter with “CV/CC” switch(change of page), “OVP SET” switch (up movement of item), “KEYLOCK” switch (down movement of item), “VOLT/CURR” dial (change the value) in the edit screen of program.

list. program parameter

program number	1 ～ 3
CV／CC	CV
end step number	3
loop number	1
end setting	off

program edit (page1)

```
[PROG    EDIT]      Prog : 2
CV ／CC Mode        :  CV
End   Step          :   3
 Loop               :   1
```

program edit (page2)

```
[PROG    EDIT]      Prog : 2
 End Setting        :  OFF
```

4) dit the step configration parameter with "CV/CC" switch(change of page), "OVP SET" switch (up movement of item), "KEYLOCK" switch (down movement of item), "VOLT/CURR" dial (change the value) in the edit screen of step.

list. setting of each step

step number	1	2	3
DC voltage	0V	5V	2.5V
step time	80ms	80ms	500ms
DC ramp setting	OFF	OFF	OFF
DC ramp start voltage	—	—	—
DC ramp end voltage	—	—	—
AC setting	5V	5V	2.5V
AC voltage	Sine	Sine	Squa
AC frequency	50Hz	50Hz	10Hz
start phase (on duty)	0deg	0deg	20%
jump setting	OFF	OFF	OFF
jump step	—	—	—
jump number	—	—	—

example) edit screen of step 2

step edit (page1)

```
[STEP    EDIT]        Step : 2
DCIV  Set             :  0.00  V
Time    Set           :  000s080ms
  RAMP                :  OFF
```

step edit (page2)

```
[STEP    EDIT]        Step : 2
RAMP  StartV      :     —  V
RAMP  EndV        :     —  V
AC  Set                 :    Sine
```

step edit (page3)

```
[STEP    EDIT]        Step : 2
ACV   Set         :     5.00  V
Freq              :     50.00Hz
Start             :     0  deg
```

step edit (page4)

```
[STEP    EDIT]        Step : 2
     Jump         :     OFF
Jump   Step       :     —
Jump   Num        :     —
```

5) Change form sequence edit to sequence stop state by pressing "WAVE" switch.
(The data save screen is displayed, and it changes to the screen of stop state after saving)

save screen

```
Sequence    Data
      Update ·····
```

sequence stop screen

```
[SQC  Stop]  Prog  1     CV
   Loop  1        Step  1
    Time        000s000ms
    0.0Vdc        0.0Adc
```

6) Start the sequence operation by pressing "OUTPUT" switch.

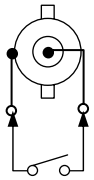
4 LS Option

4-1. Features

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

[connection diagram and on/off logic]

Remote switch action with switch



Terminal for remote switch

REMOTE SWITCH ACTION	
Short	····· Output ON
Open	····· Output OFF

Remote switch action by open collector. *1

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

In case remote switch action is not used.

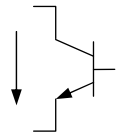
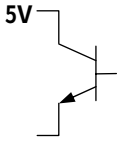
short

If connect an attached short hardware, Remote ON/OFF function will not work.

*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	 Short	 VCE 0.4V or less (10mA)
OFF	 Open	 VCE 2V or more (Open 5V)

Remote switch does not work because the LS has been short-circuited by a short terminal attached at the time of shipment.

4-2. How to use

1) If you do not want to use the remote switch.
Attach a short terminal, by the front of the switch make the output on / off. It will be the same as the normal operation. Also the operation of the run and stop of sequence will be the same.

2) If you want to use the remote switch.
By changing to short the remote switch form open in the output is off, output will be turn on.
On the contrary,
By changing to open the remote switch form short in the output is on, output will be turn off.
Also the operation of the run and stop of sequence will be the same.

Matsusada Precision Inc.

Headquarters / Factory
745 Aoji-cho Kusatsu Shiga 525-0041 Japan

Contact Us www.matsusada.com