1.BP4630 SPECIFICATIONS

A value with the accuracy is the guaranteed value, but a value without the accuracy is the reference value or representative value (shown as typ.).

All of the adjusted characteristics valuesare also for reference value only.

The reference value shows the supplemental data for reference when the product is used, and is not under the guarantee.

1.1 Specification Conditions

Specifications are valid under the following settings and conditions and after a warm-up period of 30 minutes at least, unless otherwise noted.

Item	Description
Power input	AC200 V± 10 V, 50 Hz
Output frequency	1 kHz
Signal	External input signal
Output waveform	Sine wave (DC = 0 V)
Output voltage	±60 V
Output current	±30 A
Load	2.0 Ω resistance
Response characteristics	Fixed characteristics
Output voltage limiter setting	±62 V
Output current limiter setting	±78 A

In this chapter, the terms “fixed characteristics” and “adjusted characteristics” have the following meanings.

■ Fixed characteristics

These characteristics are fixed when this product is shipped and cannot be changed by the user. They are set with the aim to achieve both wide frequency band characteristics and load stability.

■ Adjusted characteristics

These characteristics are adjusted by the user for the CV or CC mode using the response calibration function, so as to achieve the fastest possible step response waveform rise time and fall time, as well as overshoot, undershoot, and sag that fall within ±12 % of the P-P amplitude in the CV mode or within ±5 % of the P-P amplitude in the CC mode.

1.2 Output

■ Output in the constant voltage (CV) mode

Item			Description
Maximum output voltage	DC *1		+115 V (+Vo limit 117 V, −Vo limit −7 V setting) −115 V (+Vo limit 7 V, −Vo limit −117 V setting)
	Adjusted characteristics	DC to 0.5 kHz	±60 V
		0.5 kHz to 40 kHz	±60 V *2
		40 kHz to 150 kHz	±50 V
	Fixed characteristics	DC to 0.5 kHz	±60 V
		0.5 kHz to 40 kHz	±60 V *2
Small amplitude frequency characteristics *3	Adjusted characteristics	DC to 20 kHz	±0.5 dB
		20 kHz to 200 kHz	+1, −3 dB
	Fixed characteristic	DC to 10 kHz	±0.5 dB
		10 kHz to 35 kHz	+1, −3 dB
Harmonic distortion			1 % or less (10 Hz to 10 kHz)
Rise/fall time			2.5 μs (adjusted characteristics, square wave ±60 V)
Output impedance *4			2.3 mΩ + 0.43 μH
Line regulation (typ.) *5			±0.1 % or less
Output DC offset *6			±0.1 V or less
Residual noise (rms, typ.) *7			50 mV or less

*1: For the following load.

Item	Description
Resistance load	7.7 Ω

*2: For the following load.

Item	Description
Resistance load	1.3 Ω

*3: Output amplitude 12 Vp-p, 500 Hz reference.
*4: Adjusted characteristics.
*5: Power supply voltage of 180 V to 250 V
*6: Input terminal short.
*7: Input terminal short, measurement band 10 Hz to 300 kHz

■ Output in the constant voltage (CC) mode

Item			Description
Maximum output current	Adjusted characteristics	DC to 0.5 kHz	±30 A
		0.5 kHz to 30 kHz	±45 A *1
		30 kHz to 70 kHz	±24.9 A
	Fixed characteristics	DC to 0.5 kHz	±30 A
		0.5 kHz to 3 kHz	±45 A *1
		3 kHz to 10 kHz	±39 A *1
Small amplitude frequency characteristics *2	Adjusted characteristics	DC to 20 kHz	±0.5 dB
		20 kHz to 70 kHz	+1, –3 dB
	Fixed characteristics	DC to 2 kHz	±0.5 dB
		2 kHz to 8 kHz	+1, –3 dB
Harmonic distortion			1 % or less (10 Hz to 10 kHz)
Rise/fall time *3			4 μs
Output impedance *4			3.3 kΩ // 1.35 μF
Line regulation (typ.) *5			±0.1 % or less
Output DC offset *6			±0.15 A or less
Residual noise (rms, typ.) *7			24 mA or less

*1: For the following load.

Item	Description
Resistance load	1.3 Ω

*2: Output amplitude 12 Vp-p, 500 Hz reference.

*3: Adjusted characteristics, square wave, for the following current.

Item	Description
Current	±30 A

*4: Adjusted characteristics.

*5: Power supply voltage of 180 V to 250 V

*6: Input terminal short.

*7: Input terminal short, measurement band 10 Hz to 300 kHz

■ Output terminal

Item	Description
Output terminal *1	M6 screw

*1: Output terminal block is on the rear panel, common in the CV and CC mode. The Lo side is connected to the chassis.

■ Output voltage, current supply range

☞ Refer to “8.19 Output Voltage and Output Current Supply Ranges”.

■ Response characteristics switching

Fixed characteristics or adjusted characteristics

■ Response calibration function

If adjusted characteristics are selected as the response characteristics, the response characteristics adjusted by the user can be used. The distortion of the output waveform associated with the load conditions can be improved through adjustments. Higher or lower speed than the fixed characteristics can be achieved through adjustments.
Adjustments are performed by operating the three adjustment knobs (located beneath the operation panel) for the time constant, voltage feedback amount, and current feedback amount, while watching the output voltage and current waveform on an external oscilloscope.

1.3 Output Limiters

■ Output voltage limiters

Item	Description
+ voltage setting range (+Vo limit)	+7 V to +117 V (initial value: +62 V)
– voltage setting range (–Vo limit)	–117 V to –7 V (initial value: –62 V)
Setting resolution	0.1 V
Setting accuracy	±1 V (DC)

Remark: The difference between the + voltage setting and the – voltage setting is restricted to 24 V or higher and 124 V or lower.
The output voltage and output current supply ranges are determined by the output voltage limiter settings.
Depending on the operation conditions, the output voltage may be limited to a narrower range than the voltage limiter settings.
(☞ Refer to “8.19 Output Voltage and Output Current Supply Ranges”.)

■ **Output current limiters**

Item	Description
+ current setting range (+Io limit)	+3 A to +78 A
– current setting range (–Io limit)	–78 A to –3 A
Setting resolution	0.1 A
Setting accuracy (DC) *1	±3 A

Remark: The source current is considered to be positive.
Depending on the operation conditions, the output current may be limited to a narrower range than the current limiter settings.
(☞ Refer to “8.19 Output Voltage and Output Current Supply Ranges”.)

*1: For DC current within the following current value.

Item	Description
Current	±30 A

1.4 Signal Sources

The signal source can be selected from among internal signal source, external signal source, and internal signal source + external signal source.

1.4.1 Internal signal source

■ **CV mode**

Item		Description
DC voltage	Setting range	–115 V to +115 V
	Setting resolution	0.01 V
	Setting accuracy *1	±(|0.5 % of setting value| + 0.2 V)
AC voltage	Amplitude setting range	0 Vp-p～120 Vp-p
	Amplitude setting resolution	0.1 Vp-p
	Amplitude setting accuracy *2	±(0.5 % of setting value + 0.2 Vp-p)
	Waveform	Sine, square, arbitrary (16 types)
	Frequency setting range	1 Hz to 100 kHz
	Frequency setting resolution	0.1 Hz
	Frequency setting accuracy	±100 ppm

*1: AC 0 V, DC only, 23 ±5 °C, and for the following load.

Item	Description
Resistance load	7.7 Ω

*2: DC 0 V, AC only, 500 Hz sine wave, 23 ±5 °C.

■ CC mode

Item		Description
DC current	Setting range	–30 A to +30 A
	Setting resolution	0.01 A
	Setting accuracy *1	± (|0.5 % of setting value| + 0.09 A)
AC current	Amplitude setting range	0 Ap-p to 90 Ap-p
	Amplitude setting resolution	0.1 Ap-p
	Amplitude setting accuracy *2	±(0.5 % of setting value + 0.09 Ap-p)
	Waveform	Sine, square, arbitrary (16 types)
	Frequency setting range	1 Hz to 100 kHz
	Frequency setting resolution	0.1 Hz
	Frequency setting accuracy	±100 ppm

*1: AC 0 A, DC only, 23 ±5 °C.

*2: DC 0 A, AC only, 500 Hz sine wave, 23 ±5 °C, and for the following load.

Item	Description
Resistance load	1.3 Ω

1.4.2 External signal input

■ Common to CV and CC mode

Item	Description
Phase	In phase
Gain accuracy	±5 % (1 kHz)
Input impedance	10 kΩ
Non-destructive max. input voltage	±5 V
Input terminal	BNC connector (front panel)
Frequency range	DC to 200 kHz

■ CV mode

Item	Description
Gain	100
Input voltage range	±1.15 V

■ CC mode

Item	Description
Gain	30 A/V
Input voltage range	±1.5 V

1.5 Monitor Output

■ Output voltage monitor output

Item		Description
Monitor ratio		1/100
Phase		In phase
Monitor accuracy *1		±1.2 V
Frequency characteristics *2	DC to 40 kHz	±0.5 dB
	40 kHz to 400 kHz	+1 dB, –3 dB
Output impedance		50 Ω
Output terminal		BNC connector (front panel)

*1: Difference between DC output voltage and conversion voltage obtained from monitor voltage, 1 MΩ monitor output load impedance.

*2: 1 kHz reference, 1 MΩ monitor output load impedance

■ Output current monitor output

Item		Description
Monitor ratio *1		1/30
Phase		In phase
Monitor accuracy *2		±0.6 A
Frequency characteristics *3	DC to 20 kHz	±0.5 dB
	20 kHz to 200 kHz	+1 dB, –3 dB
Output impedance		50 Ω
Output terminal		BNC connector (front panel)

*1: Output voltage multiplied by monitor ratio against output current. (V/A)

*2: Difference between DC output current and conversion current obtained from monitor voltage, 1 MΩ monitor output load impedance.

*3: 1 kHz reference, 1 MΩ monitor output load impedance

1.6 Measurement Functions

■ DC output voltage measurement

Item	Description
Full scale	±200 V
Resolution	0.1 V
Measurement accuracy	±0.5 V (within DC ±115 V, AC 0 V)

Remark: Measures AC + DC average. However, AC + DC must be within full scale.

■ DC output current measurement

Item	Description
Full scale	±60 A
Resolution	0.1 A
Measurement accuracy *1	±0.3 A

Remark: Measures AC + DC average. However, AC + DC must be within full scale.

*1: Within max. DC output current, AC 0 A.

■ AC output voltage measurement

Item	Description
Full scale	±400 Vp-p
Resolution	1 Vp-p
Measurement accuracy	±2 Vp-p (DC 0 V, 120 Vp-p, 500 Hz)
Measurement frequency band	10 kHz/–3 dB

Remark: Measures max. value of AC+DC – min. value of AC + DC. However, AC + DC must be within full scale of DC output voltage measurement.

■ AC output current measurement

Item	Description
Full scale	120 Ap-p
Resolution	0.1 Ap-p
Measurement accuracy *1	±3 Ap-p
Measurement frequency band	10 kHz/–3 dB

Remark: Measures max. value of AC + DC – min. value of AC + DC. However, AC + DC must be within full scale of DC output current measurement.

*1: Within max. output current, DC 0 A, 500Hz.

1.7 Sequence Function

The output parameters can be rapidly changed sequentially or swept.

The signal source is limited to internal signal or internal signal + external signal input.

The sequence function settings are saved to battery backed up memory.

Item		Description
Number of sequences		1 sequence for each of the CV mode and CC mode
Number of steps		1 to 255 (within 1 sequence)
Step time	Setting range	0.1 ms to 999.9999 s
	Setting resolution	0.1 ms
Operation within step		Constant or linear sweep
Parameters *1	CV mode	DC voltage, superimposed AC voltage, frequency, waveform Step sync output, 2 bits
	CC mode	DC current, superimposed AC current, frequency, waveform Step sync output, 2 bits
Jump count		1 to 999, or continuous
Sequence control	Start	Starts sequence.
	Stop	Stops sequence.
	Hold	Maintains settings at that point in time. The operation resumes at sequence start.
	Branch	Branches to the specified step.

*1: If a sine wave or square wave is selected as the waveform, the waveform cannot be changed during the sequence. If arbitrary waveform is selected, an arbitrary wave can be specified for each step.

1.8 Arbitrary Waveform Memory

The arbitrary waveform memory is memory for the superimposed AC of the internal signal source. It is battery backed up.

Write to arbitrary waveform memory from the operation panel is not possible. Write is performed via the USB interface.

Item	Description
Number of waveform memories	16
Waveform length	1024 words
Waveform data	16 bit

1.9 Setting Memory

Settings are backed up and the settings that were applied the previous time this product was powered off can be restored the next time is powered on. However, the selected response characteristics are not saved. Moreover, among the various settings, the basic settings (operation mode, DC, superimposed AC, output limiters) can be saved to store/recall memories No. 1 to No. 30, and the saved settings can be called and used.

The store/recall memory call operation is possible only when the output is off.

1.10 Protective Functions

Item	Description
Output overload	If output voltage over, output current over, or internal output loss over is detected, overload is displayed on the panel screen, and the output voltage or current is reduced. If the overload status continues 10 or more seconds, the output is switched off.
Power supply anomaly	Upon anomaly detection, the output and power are both switched off.
Internal overheating	Upon anomaly detection, the output and power are both switched off.
Operation panel anomaly	Upon detection of an operation panel anomaly such as the operation panel being disconnected from the main unit, the output and power are both switched off.

1.11 General

Item		Description
LCD display settings	Contrast	Adjustable
	Display color	Blue or white
Beep		On or off If on, a beep is emitted during key operation and malfunction. A warning sound is emitted upon overload detection, regardless of this setting.
Keylock		On or off In the on status, only keylock off operation and output off operation are possible.
Output setting at power-on		On or off When on, the output is automatically switched on at power-on.
Response characteristics setting at power-on		On or off When on, the response characteristics are automatically set to adjusted characteristics at power-on.
Reset function		Returns the basic settings to the factory default settings.
Self-diagnosis function		Performs check of each memory at power-on.

1.12 External Control I/O

Item		Description	
External control operation mode		Enabled or disabled (Status output is always on.)	
Control input	Input level	High level:+4.0 V or higher, Low level: +1.0 V or lower	
	Non-destructive max. input	+10 V/–5 V	
	Input impedance	Pulled up to +5 V with 47 kΩ	
	Detection cycle	2 ms	
	Control items	Output OFF	Output off at fall
		Output ON	Output on at fall
		Sequence start	Sequence start at fall
		Sequence stop	Sequence stop at fall
		Hold input	Hold at fall
		Branch input 0, 1	Branch start at fall
Status output	Output level	0/+5 V (open)	
	Output impedance	100 Ω	
	Switching cycle	0.1 ms	
	Status items	Power on/off status	0-OFF, 1-ON
		Output on/off status	0-OFF, 1-ON
		Overload	0-Normal, 1-Overload
		Software busy	0-Normal, 1-Busy
		Sequence operation step sync output	0, 1 (selectable)
Terminal		D-sub 25-pin multi connector (rear panel, female, M2.6 screw)	

1.13 USB Interface

A USB interface is provided for performing control from an external computer.

Item		Description
Interface standard		USB 1.1, USBTMC / USB488
USB ID	USBTMC	USB ID has been assigned to each instrument
	USB488	1 to 65534

1.14 Power Input

Item	Description
Power input voltage range	AC 200 V to AC 230 V ±10 % (250 V or lower)
Power supply frequency range	50/60 Hz ±2 Hz
Power supply input phase	Single phase 2 wire
Power supply input terminal	M6 screw
Power factor *1	Approximately 0.93
Power consumption *1	3.6 kVA
Overvoltage category	II

*1: AC 200 V, CV mode, only DC ±60 V output

1.15 Withstand Voltage, Insulation Resistance

Item	Description
Withstand voltage	AC 1500 V
Insulation resistance	10 MΩ or higher (DC 500 V)

Power supply input terminals in batch vs. Other terminals and chassis in batch

1.16 Ambient Temperature Range and Ambient Humidity Range

Item	Description
Operating environment	Indoor use
Altitude	Up to 2,000 m
Performance guarantee *1	+5 to +35 °C/5 to 85 %RH
Storage conditions *2	−10 to +50 °C/5 to 95 %RH
Pollution degree	2

*1: However, the absolute humidity must be 1 to 25 g/m^3, with no condensation

*2: However, the absolute humidity must be 1 to 29 g/m^3, with no condensation

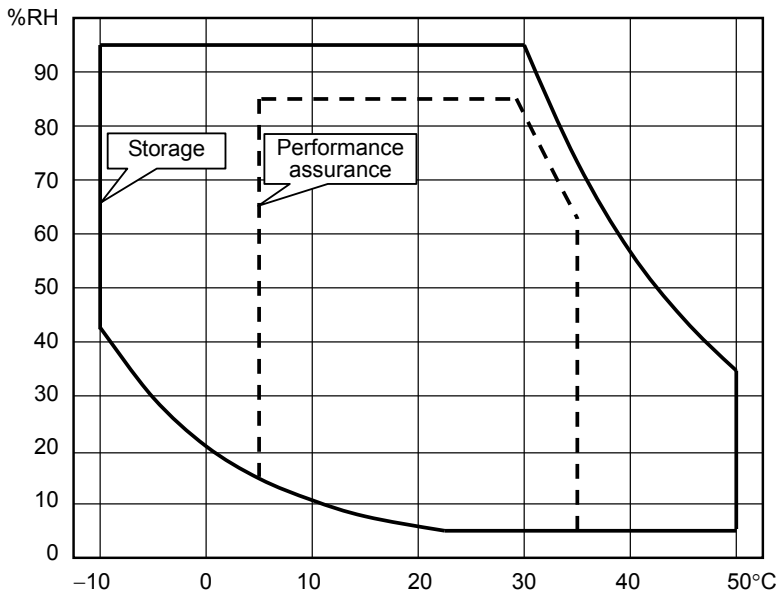


Figure 1-1. Ambient Temperature and Humidity Ranges

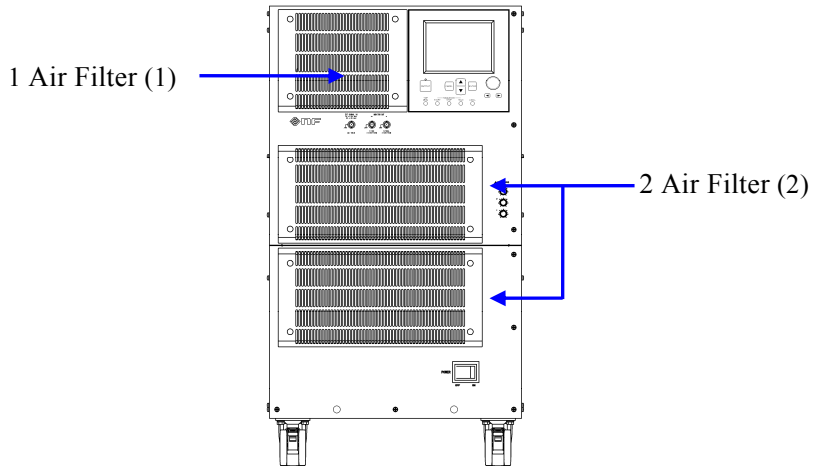
1.17 External Dimensions and Weight

Item	Description
External dimensions (Width × Height × Depth, not including projections)	430 mm × 177 mm × 551 mm
Weight	Approximately 97 kg

1.18 Option

Option name	Description	Remarks
Rack Mount Bracket PA-001-3019 (EIA) PA-001-3020 (JIS)	The rack mount bracket is a set of brackets used to mount the product on the EIA or JIS standard compliant rack.	On order and after purchase
Replacement Air Filter PA-001-3021 (1) PA-001-3022 (2)	A replacement air filter. The quantity required per product is 1 and 2 in order from top to bottom.	On order and after purchase
Fixing Bracket (BP4630) PA-001-3026	The fixing bracket is a set of brackets used to fix the product on floors.	On order and after purchase

(Reference) The type and use of air filters are following.



1.19 Output Voltage and Output Current Supply Ranges

The supply range differs depending on the positive and negative output voltage limiter settings (+Vo limit, –Vo limit).

The DC output range figures (Figures 8-2 to 8-5) show the relationship between the ouputtable voltage and current for DC. These figures also show the outputtable ranges for the voltage and current including DC offset for AC of 500 Hz and lower.

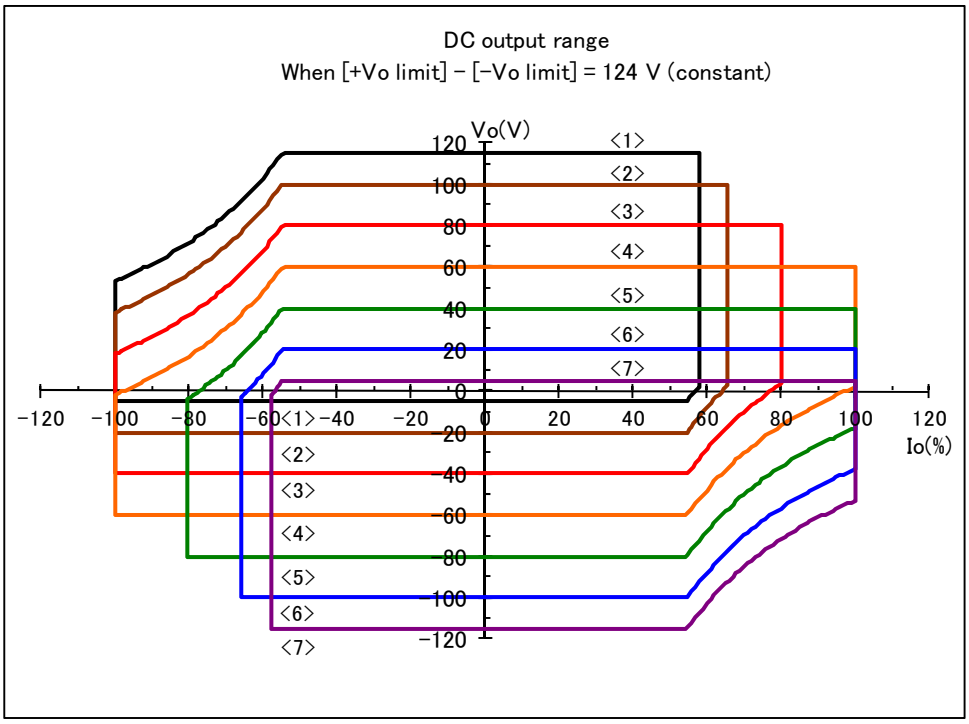
The AC output range figures (Figures 8-6 to 8-9) show the relationship between the outputtable DC voltage and peak current. However, the maximum time interval during which the peak current can be output is 4 ms.

All values in these figures are for reference only.

The horizontal axes of the figures of DC and AC output range is the ratio (%) to the following current value.

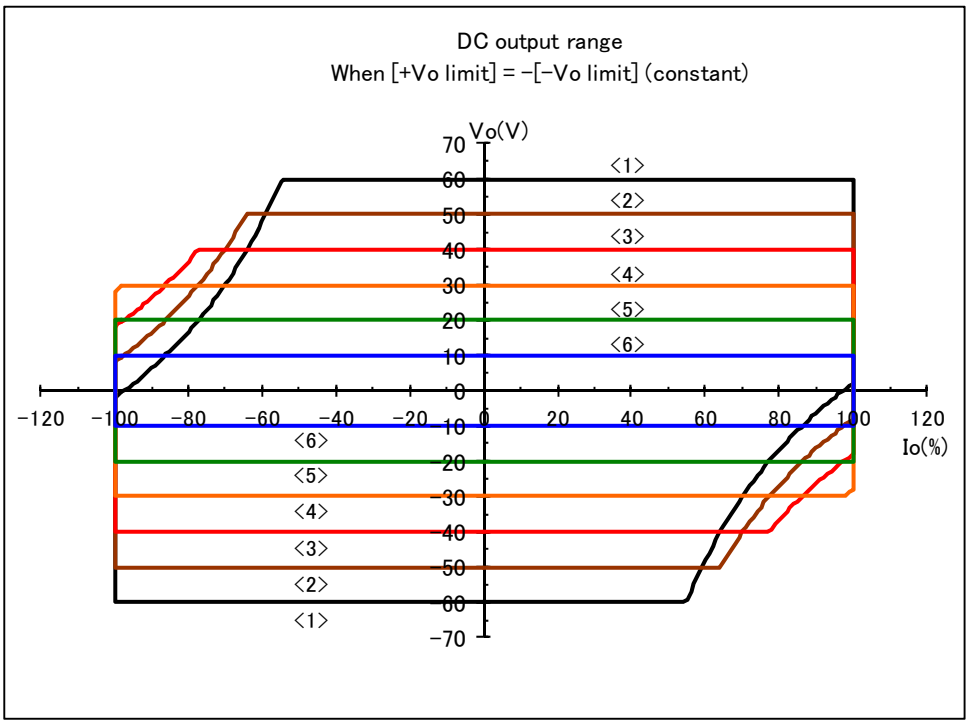
Current I_O (at 100 %)

Item	Description
Current I_O	30 A



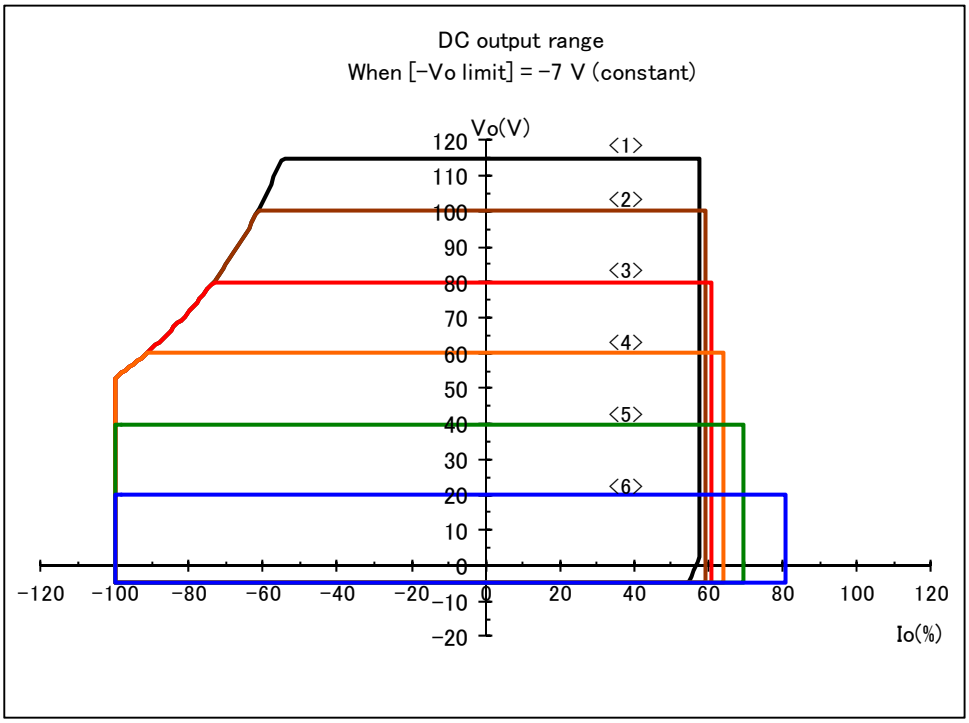
	+Vo limit (V)	−Vo limit (V)
<1>	+117	−7
<2>	+102	−22
<3>	+82	−42
<4>	+62	−62
<5>	+42	−82
<6>	+22	−102
<7>	+7	−117

Figure 1-2. DC Output Range (When Positive/Negative Voltage Limiter Setting Difference Is Fixed to 124 V)



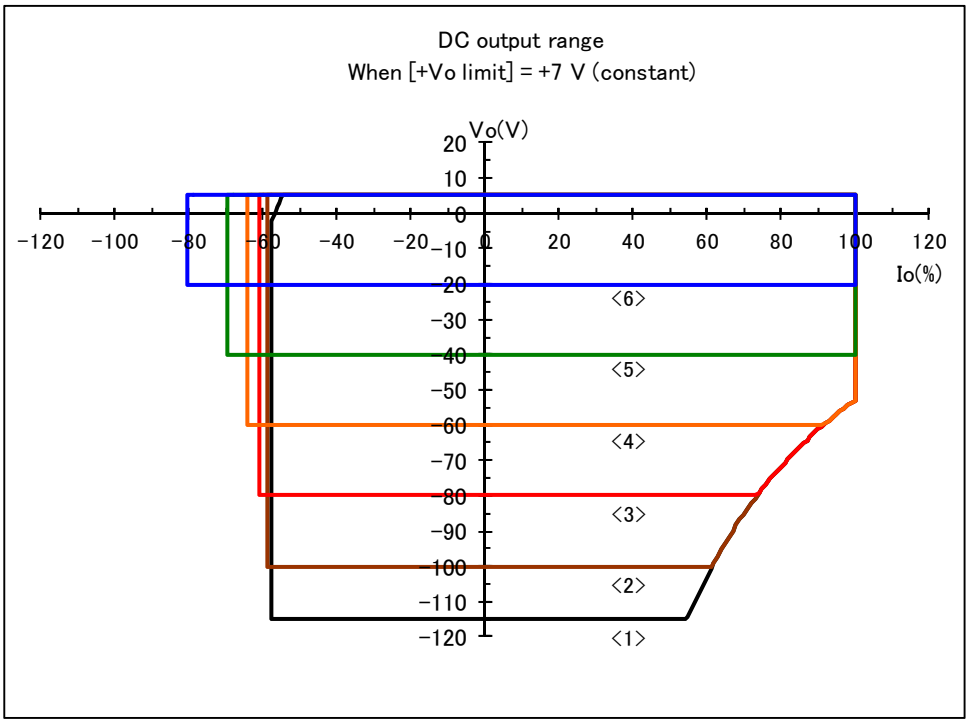
	+Vo limit (V)	−Vo limit (V)
<1>	+62	−62
<2>	+52	−52
<3>	+42	−42
<4>	+32	−32
<5>	+22	−22
<6>	+12	−12

Figure 1-3. DC Output Range (When Positive/Negative Voltage Limiter Settings Are Symmetric)



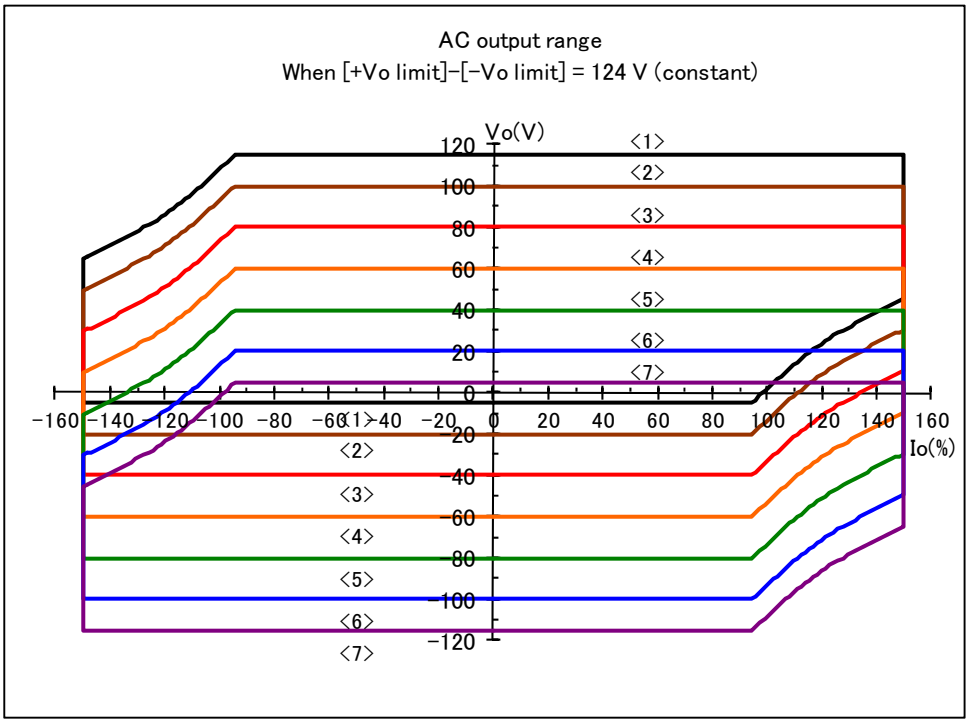
	+Vo limit (V)	−Vo limit (V)
<1>	+117	−7
<2>	+102	−7
<3>	+82	−7
<4>	+62	−7
<5>	+42	−7
<6>	+22	−7

Figure 1-4. DC Output Range (When Negative Voltage Limiter Setting Is Fixed to –7 V)



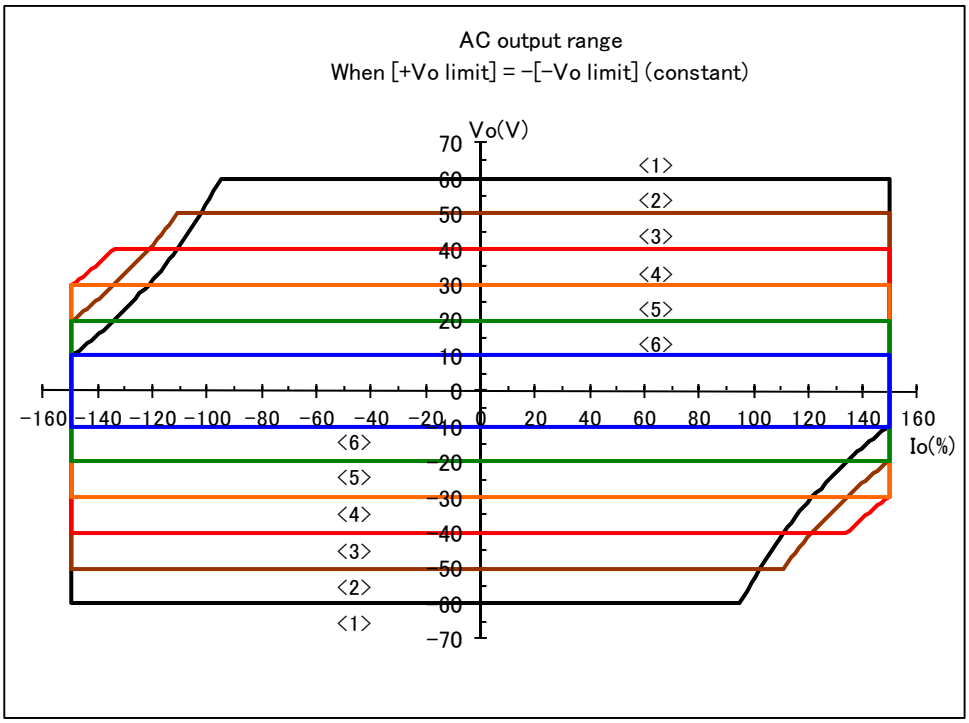
	+Vo limit (V)	−Vo limit (V)
<1>	+7	−117
<2>	+7	−102
<3>	+7	−82
<4>	+7	−62
<5>	+7	−42
<6>	+7	−22

Figure 1-5. DC Output Voltage (When Positive Voltage Limiter Setting Is Fixed to +7 V)



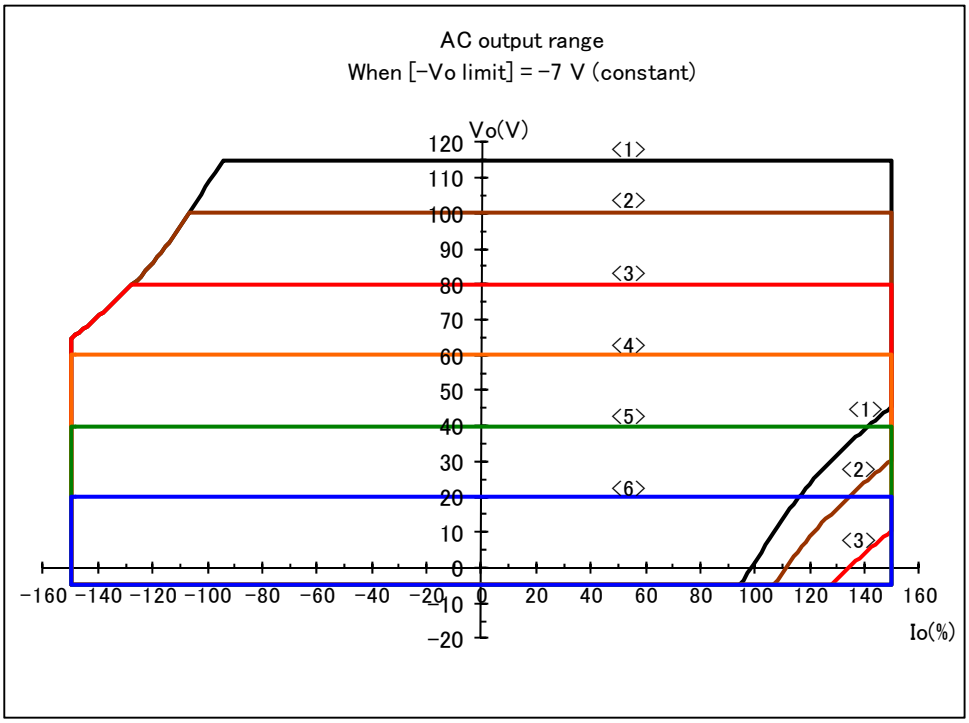
	+Vo limit (V)	−Vo limit (V)
<1>	+117	−7
<2>	+102	−22
<3>	+82	−42
<4>	+62	−62
<5>	+42	−82
<6>	+22	−102
<7>	+7	−117

Figure 1-6. AC Output Range (When Positive/Negative Voltage Limiter Setting Difference Is Fixed to 124 V)



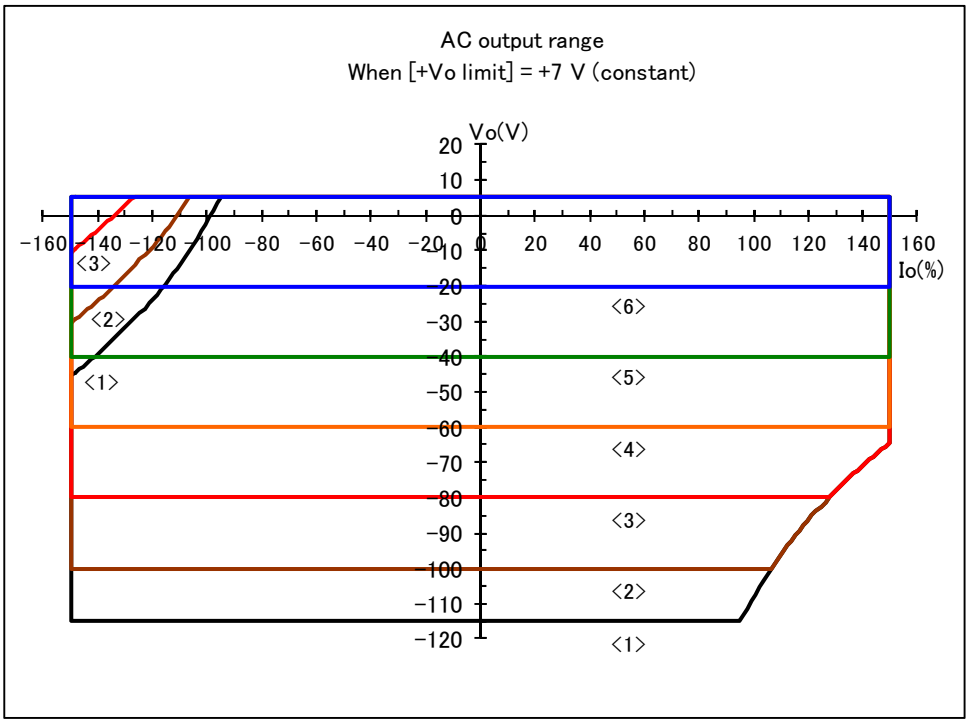
	+Vo limit (V)	−Vo limit (V)
<1>	+62	−62
<2>	+52	−52
<3>	+42	−42
<4>	+32	−32
<5>	+22	−22
<6>	+12	−12

Figure 1-7. AC Output Range (When Positive/Negative Voltage Limiter Settings Are Symmetrical)



	+Vo limit (V)	−Vo limit (V)
<1>	+117	−7
<2>	+102	−7
<3>	+82	−7
<4>	+62	−7
<5>	+42	−7
<6>	+22	−7

Figure 1-8. AC Output Range (When Negative Voltage Limiter Setting Is Fixed to –7 V)



	+Vo limit (V)	−Vo limit (V)
<1>	+7	−117
<2>	+7	−102
<3>	+7	−82
<4>	+7	−62
<5>	+7	−42
<6>	+7	−22

Figure 1-9. AC Output Range (When Positive Voltage Limiter Setting Is Fixed to +7 V)

1.20 Drawing of External Dimensions

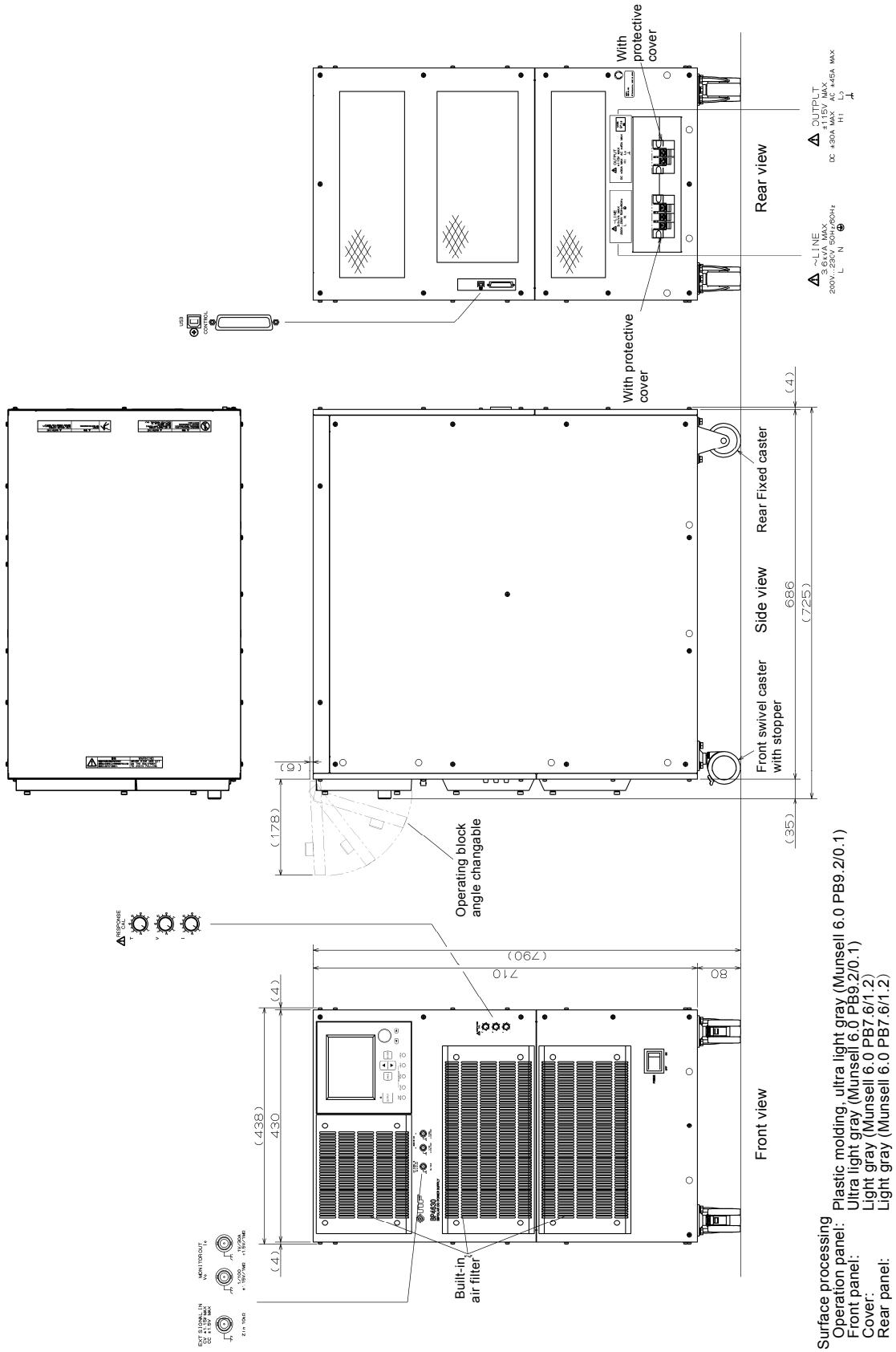


Figure 1-10. Drawing of External Dimension