# 1. BP4610 SPECIFICATIONS



**Values that indicate accuracy are guaranteed values, but values that do not indicate accuracy are for reference only.**

# 1.1 Specification Conditions

Unless otherwise specified, the following conditions apply.

| | |
|---|---|
| Power input: | 100 V AC ±10 V, 50 Hz |
| Output frequency: | 1 kHz |
| Signal: | External input signal |
| Output waveform: | Sine wave (DC = 0 V) |
| Output voltage, current: | ±60 V, ±10 A |
| Load: | 6 Ω resistance |
| Response characteristics: | Fixed characteristics |
| Output voltage limiter setting: | ±62 V |
| Output current limiter setting: | ±26 A |

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

### ■ Fixed characteristics

These characteristics are fixed when the BP4610 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 ±5% of the P-P amplitude.

# 1.2 Output

## ■ Operation mode

Constant voltage (CV) or constant current (CC)

## ■ Maximum output voltage (CV)

| | |
|---|---|
| DC: | +115 V (+Vo limit +117 V, –Vo limit –7 V setting, 23 Ω load resistance) |
| | –115 V (+Vo limit +7 V, –Vo limit –117 V setting, 23 Ω load resistance) |
| Condition: | Adjustment characteristics, external signal input |
| DC to 0.5 kHz: | ±60 V (6 Ω load resistance) |
| 0.5 kHz to 70 kHz: | ±60 V (4 Ω load resistance) |
| 70 kHz to 150 kHz: | ±50 V (6 Ω load resistance) |
| Condition: | Fixed characteristics, external signal input |
| DC to 0.5 kHz: | ±60 V (6 Ω load resistance) |
| 0.5 kHz to 40 kHz: | ±60 V (4 Ω load resistance) |

## ■ Maximum output current (CC)

| | |
|---|---|
| Condition: | Adjusted characteristics, external signal input |
| DC to 0.5 kHz: | ±10 A (6 Ω load resistance) |
| 0.5 kHz to 30 kHz: | ±15 A (4 Ω load resistance) |
| 30 kHz to 70 kHz: | ±8.3 A (6 Ω load resistance) |
| Condition: | Fixed characteristics, external signal input |
| DC to 0.5 kHz: | ±10A (6 Ω load resistance) |
| 0.5 kHz to 3 kHz: | ±15A (4 Ω load resistance) |
| 3 kHz to to 10 kHz: | ±13A (4 Ω load resistance) |

## ■ Output voltage, current supply range

☞ Refer to “1.19 Output Voltage and Output Current Supply Ranges”.

## ■ Small amplitude frequency characteristics

| | |
|---|---|
| Condition: | Output amplitude 12 Vp-p, 500 Hz reference, adjusted characteristics |
| CV mode: | DC to 20 kHz, ±0.5 dB |
| | 20 kHz to 200 kHz, +1, –3 dB |
| CC mode: | DC to 20 kHz, ±0.5 dB |
| | 20 kHz to 70 kHz, +1, –3dB |
| Condition: | Output amplitude 12 Vp-p, 500 Hz reference, fixed characteristics |
| CV mode: | DC to 10 kHz、±0.5 dB |
| | 10 kHz to 35 kHz, +1, –3 dB |
| CC mode: | DC to 2 kHz, ±0.5 dB |
| | 2 kHz to 8 kHz, +1, –3 dB |

### ■ 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.

### ■ Harmonic distortion

1% or less (CV/CC, 10 Hz to 10 kHz)

### ■ Rise/fall time

CV mode: 2.5 $\mu$s (adjusted characteristics, square wave ±60 V)

CC mode: 4 $\mu$s (adjusted characteristics, square wave ±10 A)

### ■ Output impedance

CV mode: 7 mΩ + 1.3 $\mu$H (adjusted characteristics)

CC mode: 10 kΩ//0.45 $\mu$F (adjusted characteristics)

### ■ Line regulation

0.1% or less (CV/CC, power supply voltage of 90 V to 250 V)

### ■ Output DC offset

Condition: Input terminal short

CV mode: ±0.1 V

CC mode: ±0.05 A

### ■ Residual noise

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

CV mode: 50 mVrms or less

CC mode: 8 mArms or less

### ■ Output terminal

M4 terminal block (rear panel)

The Lo side is grounded to the chassis.

# 1.3 Output Limiters

## ■ Output voltage limiters

| | |
|---|---|
| + voltage setting range: | +7 V to +117 V (0.1 V resolution) (+Vo limit) |
| – voltage setting range: | –7 V to –117 V (0.1 V resolution) (–Vo limit) |
| Restrictions: | The difference between the + voltage setting and the – voltage setting is restricted to 24 V or higher and 124 or lower. |
| Setting accuracy: | ±1 V (DC) |
| Remark: | The output voltage and output current supply ranges are determined by the output voltage limiter settings. (☞ Refer to "1.19 Output Voltage and Output Current Supply Ranges".) |
| | Depending on the operation conditions, the output voltage may be limited to a narrower range than the voltage limiter settings. (☞ Refer to "1.19 Output Voltage and Output Current Supply Ranges".) |

## ■ Output current limiters

| | |
|---|---|
| + current setting range: | +1 A to +26 A (0.1 A resolution) (+Io limit) |
| – current setting range: | –1 A to –26 A (0.1 A resolution) (–Io limit) |
| Setting accuracy: | ±1 A (for DC within ±10 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 "1.19 Output Voltage and Output Current Supply Ranges".) |

# 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.

## ■ Internal signal source

- Current

| | | | |
|---|---|---|---|
| Amplitude setting range: | ±115 V | (0.01 V resolution) | (CV mode) |
| | ±10 A | (0.001 A resolution) | (CC mode) |
| Amplitude setting accuracy: | ±(\|0.5% of setting value\| + 0.2 V) | | (CV mode, AC 0 V, 23 Ω resistance load, DC only, 23 ±5°C) |
| | ±(\|0.5% of setting value\| + 0.03 A) | | (CC mode, AC 0 A, DC only, 23 ±5°C) |

- Superimposed AC

| | | | |
|---|---|---|---|
| Waveform: | Sine, square, arbitrary (16 types) | | |
| Frequency setting range: | 1 Hz to 100 kHz (0.1 Hz resolution) | | |
| Frequency accuracy: | ±100 ppm | | |
| Amplitude setting range: | 0 to 120 Vp-p | (0.1 Vp-p resolution) | (CV mode) |
| | 0 to 30 Ap-p | (0.01 Ap-p resolution) | (CC mode) |
| Amplitude setting accuracy: | ±(0.5% of setting value + 0.2 Vp-p) | | (CV mode, DC 0 V, AC only 500 Hz sine wave, 23 ±5°C) |
| | ±(0.5% of setting value + 0.03 Ap-p) | | (CC mode, DC 0 A, AC only 500 Hz sine wave, 4 Ω resistance load, 23 ±5°C) |

## ■ External signal input

| | | | |
|---|---|---|---|
| Gain: | 100× | (100 V/1 V), in phase | (CV mode) |
| | 10× | (10 A/1 V), in phase | (CC mode) |
| 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 | | |

# 1.5 Monitor Output

■ **Output voltage monitor output**

| | |
|---|---|
| Monitor ratio: | 1/100 of output voltage (1 V/100 V), in phase |
| Monitor accuracy: | ±1.2 V (difference between DC output voltage and conversion voltage obtained from monitor voltage, 1 MΩ monitor output load impedance) |
| Frequency characteristics: | DC to 40 kHz ±0.5 dB<br>40 kHz to 400 kHz +1 dB, –3 dB<br>(1 kHz reference, 1 MΩ monitor output load impedance) |
| Output impedance: | 50 Ω |
| Output terminal: | BNC connector (front panel) |

■ **Output current monitor output**

| | |
|---|---|
| Monitor ratio: | 1/10 of output current (1 V/10 A), in phase |
| Monitor accuracy: | ±0.2 A (difference between DC output current and conversion current obtained from monitor voltage, 1 MΩ monitor output load impedance) |
| Frequency characteristics: | DC to 20 kHz ±0.5 dB<br>20 kHz to 200 kHz +1 dB, –3 dB<br>(1 MΩ monitor output load impedance) |
| Output impedance: | 50 Ω |
| Output terminal: | BNC connector (front panel) |

# 1.6 Measurement Functions

■ **DC output voltage measurement (Measures AC + DC average. However, AC + DC must be within ±200 V.)**

| | |
|---|---|
| Full scale: | ±200 V (0.1 V resolution) |
| Measurement accuracy: | ±0.5 V (within DC ±115 V, 0 V AC) |

■ **DC output current measurement (Measures AC + DC average. However, AC + DC must be within ±20 A.)**

| | |
|---|---|
| Full scale: | ±20 A (0.01 A resolution) |
| Measurement accuracy: | ±0.1 A (within DC ±10 A, 0 A AC) |

■ **AC output voltage measurement (Measures max. value of ACTDC – Min. value of AC + DC. However, AC + DC must be within ±200 V.)**

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

■ **AC output current measurement (Measures max. value of AC + DC – Min. value of AC + DC. However, AC + DC must be within ±20 A.)**

| | |
|---|---|
| Full scale: | 40 Ap-p (0.1 Ap-p resolution) |
| Measurement accuracy: | ±1 Ap-p (0 A DC, 30 Ap-p, 500 Hz) |
| Measurement frequency band: | 10 kHz/–3 dB |

# 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.

| | |
|---|---|
| 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: | 0.1 ms to 999.9999 s (0.1 ms resolution) |
| Operation within step: | Constant or linear sweep |
| Parameters | |
| 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 |
| Remark: | If a sine wave or square wave is selected as the waveform, the waveform cannot be changed during the sequence.<br>If arbitrary waveform is selected, an arbitrary wave can be specified for each step. |
| 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. |

# 1.8 Arbitrary Waveform Memory

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

| | |
|---|---|
| Number of waveform memories: | 16 |
| Waveform length: | 1024 words |
| Waveform data: | 16 bits |
| Remark: | Write to arbitrary waveform memory from the operation panel is not possible. Write is performed via the USB interface. |

# 1.9 Setting Memory

Settings are backed up and the settings that were applied the previous time the BP4610 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

| | |
|---|---|
| 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

| | |
|---|---|
| LCD display settings | |
| Contrast: | Adjustable |
| Display color: | Blue or white |
| Beep: | On or off<br>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<br>In the on status, only keylock off operation and output off operation are possible. |
| Output setting at power-on: | On or off<br>When on, the output is automatically switched on at power-on. |
| Response characteristics setting at power-on: | On or off<br>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

## ■ 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 |
| 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 |
| 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 | |

## ■ Terminal

D-sub 25-pin multiconnector (rear panel)

# 1.13 USB Interface

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

| | |
|---|---|
| Interface standard: | USB 1.1 |
| USB ID: | 1 to 65534 |

# 1.14 Power Input

| | |
|---|---|
| Power input voltage range: | 100 V AC to 230 V AC ±10% (250 V or lower) |
| Power supply frequency range: | 50 Hz/60 Hz ±2 Hz (single phase) |
| Power factor: | 0.95 (100 V AC, CV mode, 6 Ω load, DC only ±60 V output) |
| Power consumption: | 1200 VA max. (100 V AC, C mode, 6 Ω load, DC only ±60 V output) |
| Overvoltage category: | II |

# 1.15 Withstand Voltage, Insulation Resistance

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

| | |
|---|---|
| Withstand voltage: | 1500 V AC |
| Insulation resistance: | 10 MΩ or higher (500 V DC) |

# 1.16 Ambient Temperature Range and Ambient Humidity Range

| | |
|---|---|
| Operating environment: | Indoor use |
| Altitude: | Up to 2,000 m |
| Performance guarantee: | +5 to +35°C/5 to 85%RH<br>However, the absolute humidity must be 1 to 25 g/m$^3$, with no condensation |
| Storage conditions: | –10 to +50°C/5 to 95%RH<br>However, the absolute humidity must be 1 to 29 g/m$^3$, with no condensation<br>Figure 1-1 shows the ambient temperature and humidity ranges. |
| Pollution degree: | 2 |

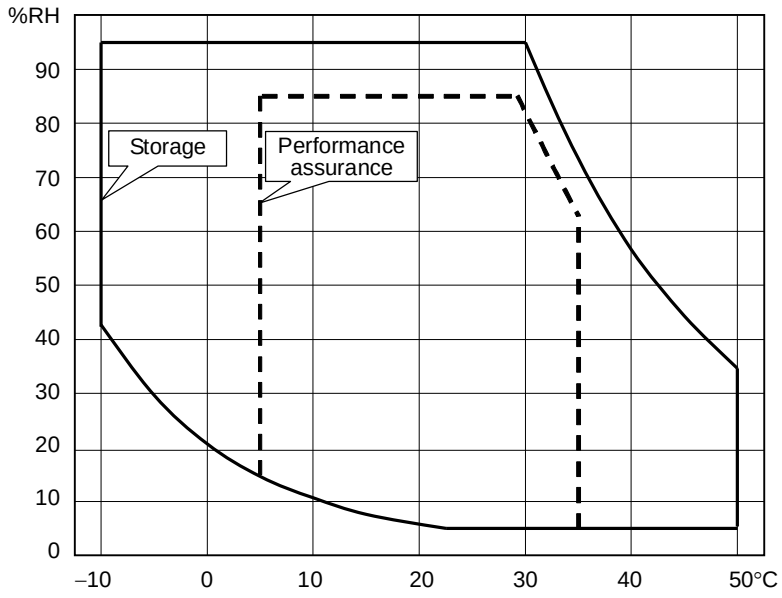



Figure 1-1. Ambient Temperature and Humidity Ranges

# 1.17 External Dimensions and Weight

■ **External dimensions**

Width: 430 mm

Height: 177 mm

Depth: 551 mm

(Not including projections)

■ **Weight**

26 kg or lower

# 1.18 Safety and EMC

■ **Safety standards**

EN61010-1: 2001

■ **EMC**

EN61326: 1997/A1: 1998/A2: 2001/A3: 2003 (Class A)

EN61000-3-2: 2000

EN61000-3-3: 1995/A1: 2001

When in an environment that includes strong radio frequency electromagnetic fields (EMFs), note with caution that output current gauge indications may become temporarily incorrect.

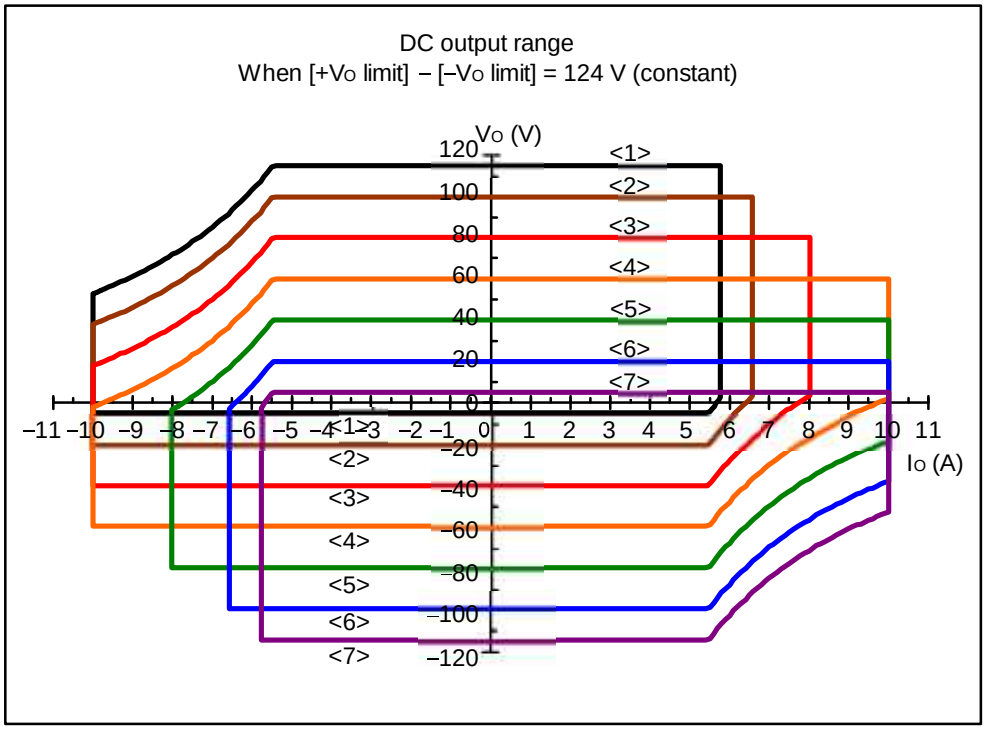
# 1.19 Output Voltage and Output Current Supply Ranges

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

The DC output range figures (Figures 1-2 to 1-5) 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.

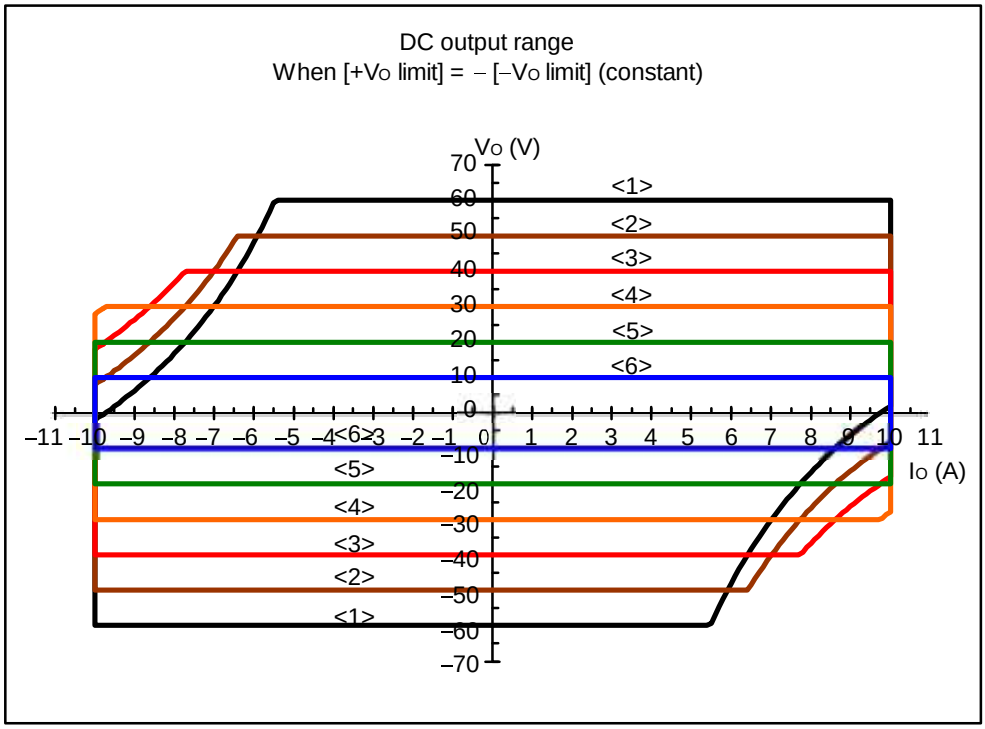
The AC output range figures (Figures 1-6 to 1-9) show the relationship between the outputtable DC voltage and peak current. However, the maximum time interval during which the peak current can be output is 4 ms.

All values in these figures are for reference only.



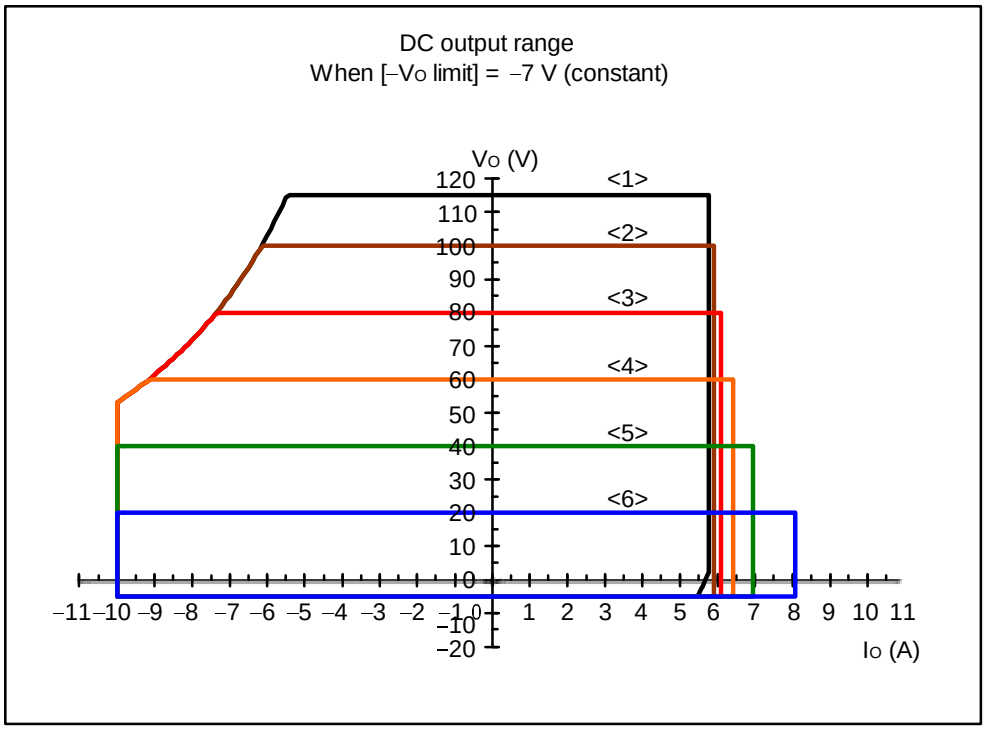

| | +Vo limit (V) | −Vo limit (V) |
|---|---|---|
| <1> | +117 | −7 |
| <2> | +102 | −22 |
| <3> | +82 | −42 |
| <4> | +62 | −62 |
| <5> | +42 | −82 |
| <6> | +22 | −102 |
| <7> | +7 | −117 |

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



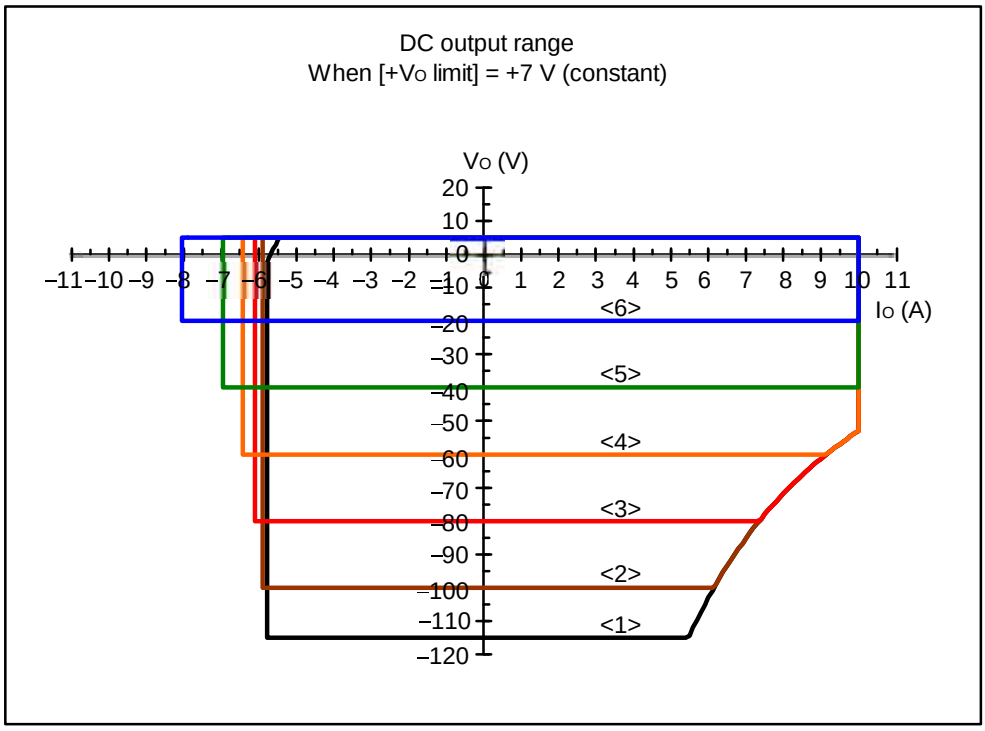

| | +Vo limit (V) | −Vo limit (V) |
|---|---|---|
| <1> | +62 | −62 |
| <2> | +52 | −52 |
| <3> | +42 | −42 |
| <4> | +32 | −32 |
| <5> | +22 | −22 |
| <6> | +12 | −12 |

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



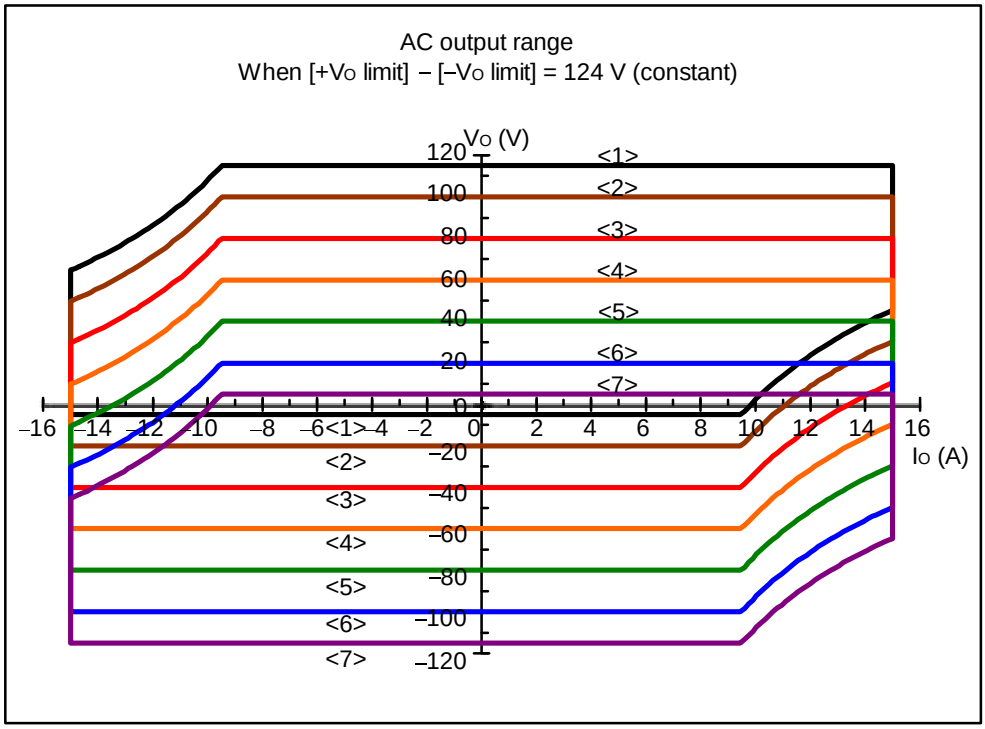

| | +Vo limit (V) | –Vo limit (V) |
|---|---|---|
| <1> | +117 | –7 |
| <2> | +102 | –7 |
| <3> | +82 | –7 |
| <4> | +62 | –7 |
| <5> | +42 | –7 |
| <6> | +22 | –7 |

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



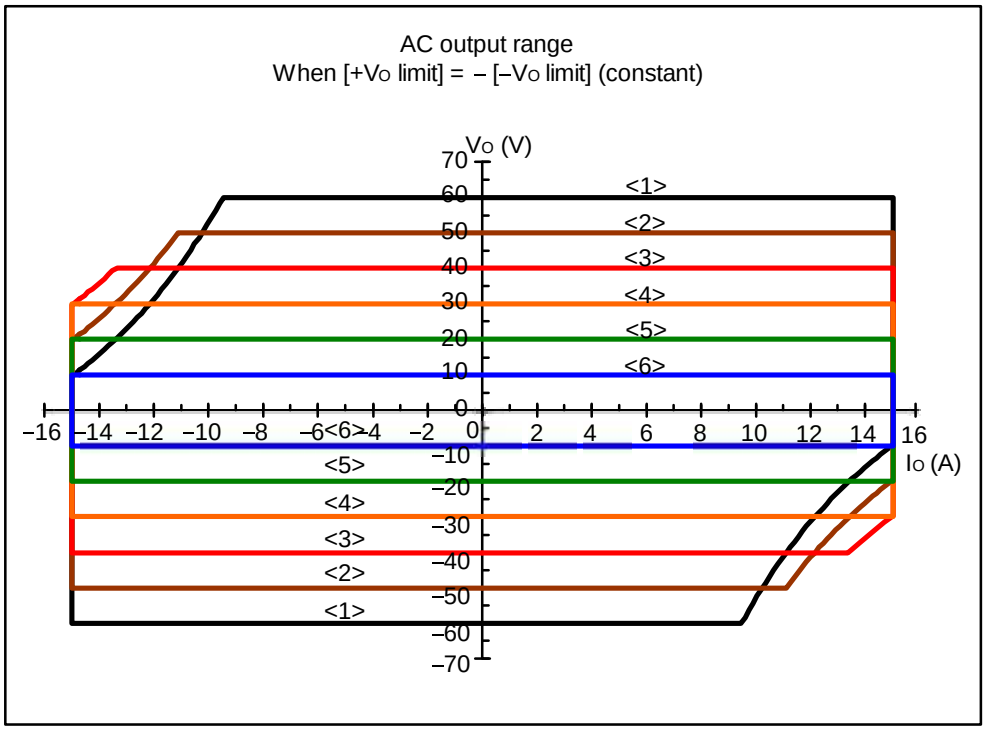

| | +Vo limit (V) | –Vo limit (V) |
|---|---|---|
| <1> | +7 | –117 |
| <2> | +7 | –102 |
| <3> | +7 | –82 |
| <4> | +7 | –62 |
| <5> | +7 | –42 |
| <6> | +7 | –22 |

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



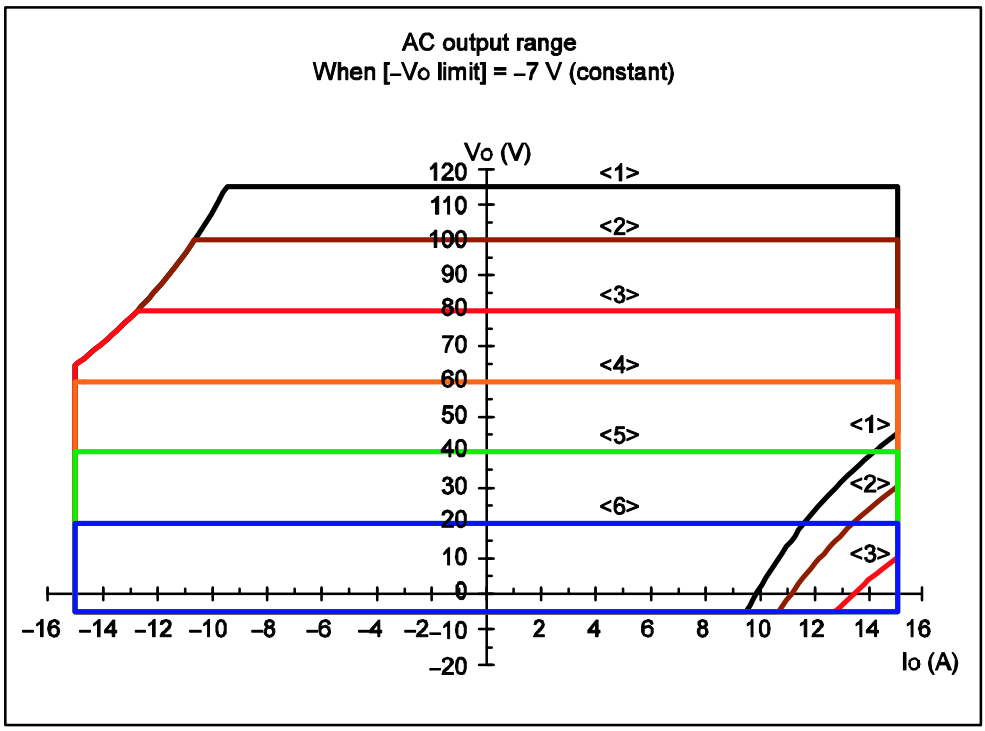

| | +Vo limit (V) | −Vo limit (V) |
|---|---|---|
| <1> | +117 | −7 |
| <2> | +102 | −22 |
| <3> | +82 | −42 |
| <4> | +62 | −62 |
| <5> | +42 | −82 |
| <6> | +22 | −102 |
| <7> | +7 | −117 |

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



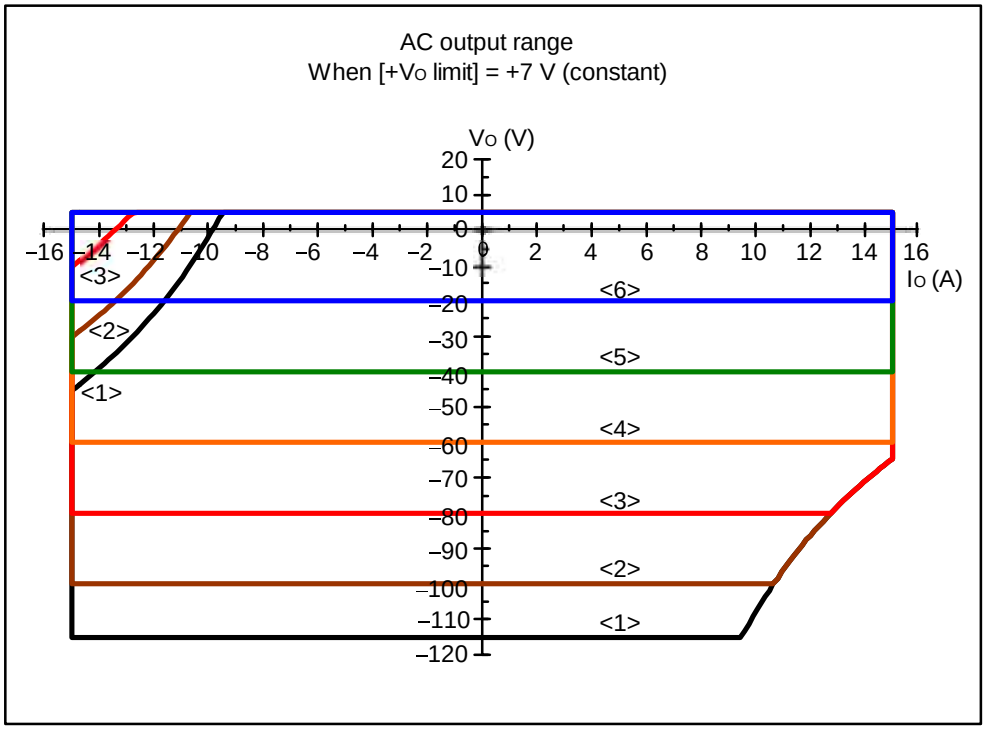

| | +Vo limit (V) | −Vo limit (V) |
|---|---|---|
| <1> | +62 | −62 |
| <2> | +52 | −52 |
| <3> | +42 | −42 |
| <4> | +32 | −32 |
| <5> | +22 | −22 |
| <6> | +12 | −12 |

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

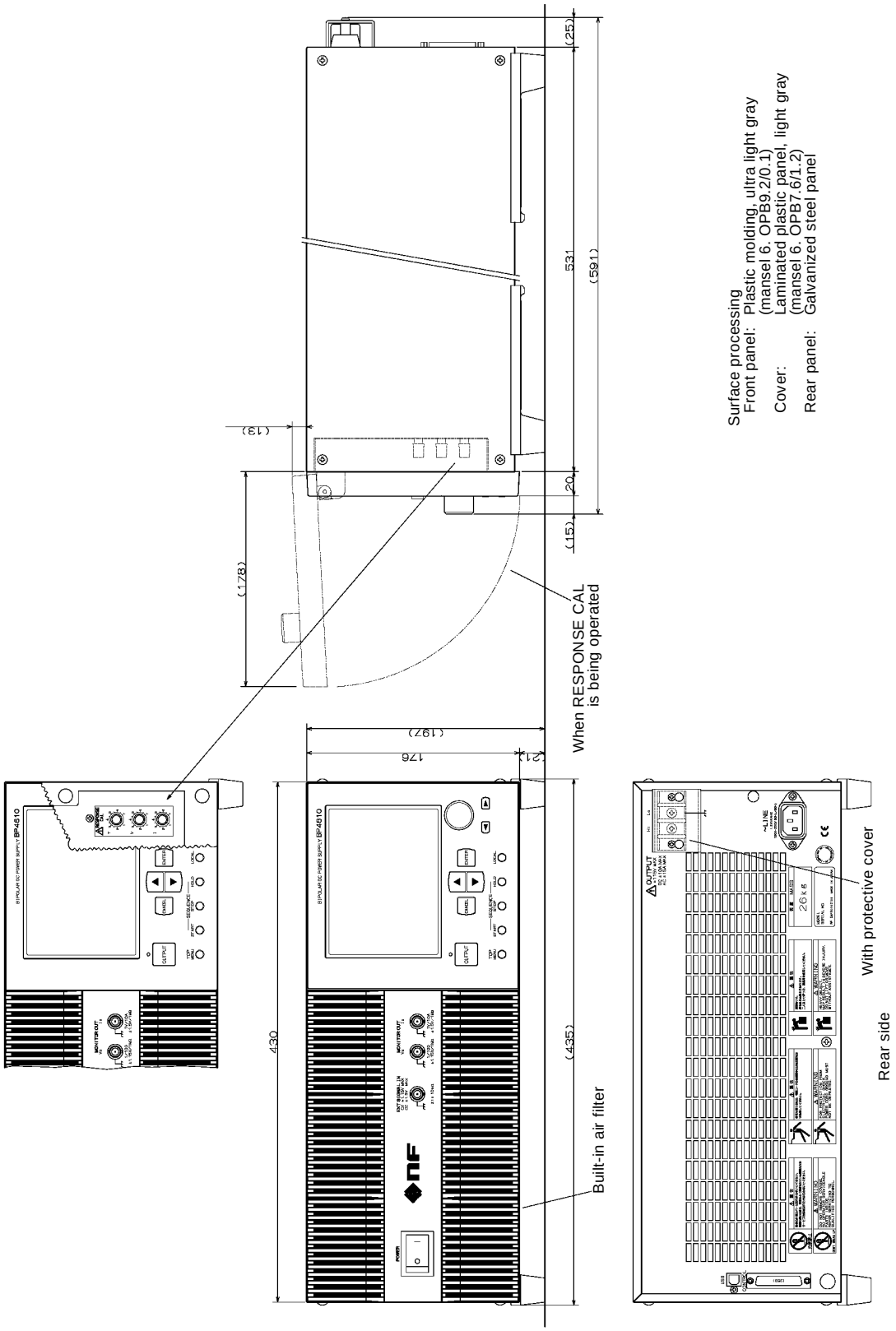



Figure 1-10. Drawing of External Dimensions

# 1. BP4620 SPECIFICATIONS



**Values that indicate accuracy are guaranteed values, but values that do not indicate accuracy are for reference only.**

**All of the adjusted characteristics values are also for reference only.**

# 1.1 Specification Conditions

Unless otherwise specified, the following conditions apply.

| | |
|---|---|
| Power supply input: | 200 V AC ±10 V, 50 Hz |
| Output frequency: | 1 kHz |
| Signal: | External input signal |
| Output waveform: | Sine wave (DC = 0 V) |
| Output voltage, current: | ±60 V, ±20 A |
| Load: | 3 Ω resistance |
| Response characteristics: | Fixed characteristics |
| Output voltage limiter setting: | ±62 V |
| Output current limiter setting: | ±52 A |

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

### ■ Fixed characteristics

These characteristics are fixed when the BP4620 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 ±5% of the P-P amplitude.

# 1.2 Output

## ■ Operation mode

Constant voltage (CV) or constant current (CC)

## ■ Maximum output voltage (CV)

| | |
|---|---|
| DC: | +115 V (+Vo limit +117 V, –Vo limit –7 V setting, 12 Ω load resistance) |
| | –115 V (+Vo limit +7 V, –Vo limit –117 V setting, 12 Ω load resistance) |
| Condition: | Adjustment characteristics, external signal input |
| DC to 0.5 kHz: | ±60 V (3 Ω load resistance) |
| 0.5 kHz to 70 kHz: | ±60 V (2 Ω load resistance) |
| 70 kHz to 150 kHz: | ±50 V (3 Ω load resistance) |
| Condition: | Fixed characteristics, external signal input |
| DC to 0.5 kHz: | ±60 V (3 Ω load resistance) |
| 0.5 kHz to 40 kHz: | ±60 V (2 Ω load resistance) |

## ■ Maximum output current (CC)

| | |
|---|---|
| Condition: | Adjusted characteristics, external signal input |
| DC to 0.5 kHz: | ±20 A (3 Ω load resistance) |
| 0.5 kHz to 30 kHz: | ±30 A (2 Ω load resistance) |
| 30 kHz to 70 kHz: | ±16.6 A (3 Ω load resistance) |
| Condition: | Fixed characteristics, external signal input |
| DC to 0.5 kHz: | ±20A (3 Ω load resistance) |
| 0.5 kHz to 3 kHz: | ±30A (2 Ω load resistance) |
| 3 kHz to to 10 kHz: | ±26A (2 Ω load resistance) |

## ■ Output voltage, current supply range

☞ refer to “1.19 Output Voltage and Output Current Supply Ranges”.

## ■ Small amplitude frequency characteristics

| | |
|---|---|
| Condition: | Output amplitude 12 Vp-p, 500 Hz reference, adjusted characteristics |
| CV mode: | DC to 20 kHz, ±0.5 dB |
| | 20 kHz to 200 kHz, +1, –3 dB |
| CC mode: | DC to 20 kHz, ±0.5 dB |
| | 20 kHz to 70 kHz, +1, –3dB |
| Condition: | Output amplitude 12 Vp-p, 500 Hz reference, fixed characteristics |
| CV mode: | DC to 10 kHz、±0.5 dB |
| | 10 kHz to 35 kHz, +1, –3 dB |
| CC mode: | DC to 2 kHz, ±0.5 dB |
| | 2 kHz to 8 kHz, +1, –3 dB |

### 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 for the time constant, voltage feedback amount, and voltage and current feedback amount, while watching the output current waveform on an external oscilloscope.

### Harmonic distortion

1% or less (CV/CC, 10 Hz to 10 kHz)

### Rise/fall time

CV mode: 2.5 $\mu$s (adjusted characteristics, square wave ±60 V)

CC mode: 4 $\mu$s (adjusted characteristics, square wave ±20 A)

### Output impedance

CV mode: 3.5 mΩ + 0.65 $\mu$H (adjusted characteristics)

CC mode: 5 kΩ//0.90 $\mu$F (adjusted characteristics)

### Line regulation

0.1% or less (CV/CC, power supply voltage of 180 V to 250 V)

### Output DC offset

Condition: Input terminal short

CV mode: ±0.1 V

CC mode: ±0.1 A

### Residual noise

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

CV mode: 50 mVrms or less

CC mode: 8 mArms or less

### Output terminal

M4 terminal block (rear panel)

The Lo side is connected to the chassis.

# 1.3 Output Limiters

## ■ Output voltage limiters

| | |
|---|---|
| + voltage setting range: | +7 V to +117 V (0.1 V resolution) (+Vo limit) |
| – voltage setting range: | –7 V to –117 V (0.1 V resolution) (–Vo limit) |
| Restrictions: | The difference between the + voltage setting and the – voltage setting is restricted to 24 V or higher and 124 or lower. |
| Setting accuracy: | ±1 V (DC) |
| Remark: | The output voltage and output current supply ranges are determined by the output voltage limiter settings. (☞ Refer to "1.19 Output Voltage and Output Current Supply Ranges".) |
| | Depending on the operation conditions, the output voltage may be limited to a narrower range than the voltage limiter settings. (☞ Refer to "1.19 Output Voltage and Output Current Supply Ranges".) |

## ■ Output current limiters

| | |
|---|---|
| + current setting range: | +2 A to +52 A (0.1 A resolution) (+Io limit) |
| – current setting range: | –2 A to –52 A (0.1 A resolution) (–Io limit) |
| Setting accuracy: | ±2 A (for DC within ±20 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 "1.19 Output Voltage and Output Current Supply Ranges".) |

# 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.

## ■ Internal signal source

- DC

| | | | |
|---|---|---|---|
| Amplitude setting range: | ±115 V | (0.01 V resolution) | (CV mode) |
| | ±20 A | (0.001 A resolution) | (CC mode) |
| Amplitude setting accuracy: | ±(\|0.5% of setting value\| + 0.2 V) | | (CV mode, AC 0 V, 12 Ω resistance load, DC only, 23 ±5°C) |
| | ±(\|0.5% of setting value\| + 0.06 A) | | (CC mode, AC 0 A, DC only, 23 ±5°C) |

- Superimposed AC

| | | | |
|---|---|---|---|
| Waveform: | Sine, square, arbitrary (16 types) | | |
| Frequency setting range: | 1 Hz to 100 kHz (0.1 Hz resolution) | | |
| Frequency accuracy: | ±100 ppm | | |
| Amplitude setting range: | 0 to 120 Vp-p | (0.1 Vp-p resolution) | (CV mode) |
| | 0 to 60 Ap-p | (0.01 Ap-p resolution) | (CC mode) |
| Amplitude setting accuracy: | ±(0.5% of setting value + 0.2 Vp-p) | | (CV mode, DC 0 V, AC only 500 Hz sine wave, 23 ±5°C) |
| | ±(0.5% of setting value + 0.06 Ap-p) | | (CC mode, DC 0 A, AC only 500 Hz sine wave, 2 Ω resistance load, 23 ±5°C) |

## ■ External signal input

| | | | |
|---|---|---|---|
| Gain: | 100× | (100 V/1 V), in phase | (CV mode) |
| | 20× | (20 A/1 V), in phase | (CC mode) |
| 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 | | |

# 1.5 Monitor Output

■ **Output voltage monitor output**

| | |
|---|---|
| Monitor ratio: | 1/100 of output voltage (1 V/100 V), in phase |
| Monitor accuracy: | ±1.2 V (difference between DC output voltage and conversion voltage obtained from monitor voltage, 1 MΩ monitor output load impedance) |
| Frequency characteristics: | DC to 40 kHz ±0.5 dB<br>40 kHz to 400 kHz +1 dB, –3 dB<br>(1 kHz reference, 1 MΩ monitor output load impedance) |
| Output impedance: | 50 Ω |
| Output terminal: | BNC connector (front panel) |

■ **Output current monitor output**

| | |
|---|---|
| Monitor ratio: | 1/20 of output current (1 V/20 A), in phase |
| Monitor accuracy: | ±0.4 A (difference between DC output current and conversion current obtained from monitor voltage, 1 MΩ monitor output load impedance) |
| Frequency characteristics: | DC to 20 kHz ±0.5 dB<br>20 kHz to 200 kHz +1 dB, –3 dB<br>(1 MΩ monitor output load impedance) |
| Output impedance: | 50 Ω |
| Output terminal: | BNC connector (front panel) |

# 1.6 Measurement Functions

■ **DC output voltage measurement (Measures AC + DC average. However, AC + DC must be within ±200 V.)**

| | |
|---|---|
| Full scale: | ±200 V (0.1 V resolution) |
| Measurement accuracy: | ±0.5 V (within DC ±115 V, 0 V AC) |

■ **DC output current measurement (Measures AC + DC average. However, AC + DC must be within ±40 A.)**

| | |
|---|---|
| Full scale: | ±40 A (0.01 A resolution) |
| Measurement accuracy: | ±0.2 A (within DC ±20 A, 0 A AC) |

■ **AC output voltage measurement (Measures max. value of ACTDC – Min. value of AC + DC. However, AC + DC must be within ±200 V.)**

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

■ **AC output current measurement (Measures max. value of AC + DC – Min. value of AC + DC. However, AC + DC must be within ±40 A.)**

| | |
|---|---|
| Full scale: | 80 Ap-p (0.1 Ap-p resolution) |
| Measurement accuracy: | ±2 Ap-p (0 A DC, 60 Ap-p, 500 Hz) |
| Measurement frequency band: | 10 kHz/–3 dB |

# 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.

| | |
|---|---|
| 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: | 0.1 ms to 999.9999 s (0.1 ms resolution) |
| Operation within step: | Constant or linear sweep |
| Parameters | |
| 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 |
| Remark: | If a sine wave or square wave is selected as the waveform, the waveform cannot be changed during the sequence.<br>If arbitrary waveform is selected, an arbitrary wave can be specified for each step. |
| 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. |

# 1.8 Arbitrary Waveform Memory

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

| | |
|---|---|
| Number of waveform memories: | 16 |
| Waveform length: | 1024 words |
| Waveform data: | 16 bits |
| Remark: | Write to arbitrary waveform memory from the operation panel is not possible. Write is performed via the USB interface. |

# 1.9 Setting Memory

Settings are backed up and the settings that were applied the previous time the BP4620 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

| | |
|---|---|
| Output overload: | If output voltage over, output current over, or internal power 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

| | |
|---|---|
| LCD settings | |
| Contrast: | Adjustable |
| Display color: | Blue or white |
| Beep: | On or off<br>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<br>In the on status, only keylock off operation and output off operation are possible. |
| Output setting at power-on: | On or off<br>When on, the output is automatically switched on at power-on. |
| Response characteristics setting at power-on: | On or off<br>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

## ■ 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 |
| 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 |
| 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 | |

## ■ Terminal

D-sub 25-pin multiconnector (rear panel)

# 1.13 USB Interface

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

| | |
|---|---|
| Interface standard: | USB 1.1 |
| USB ID: | 1 to 65534 |

# 1.14 Power Input

| | |
|---|---|
| Power input voltage range: | 200 V AC to 230 V AC ±10% (250 V or lower) |
| Power supply frequency range: | 50 Hz/60 Hz ±2 Hz (single phase) |
| Power factor: | Approximately 0.93 (200 V AC, CV mode, 3 Ω load, DC only ±60 V output) |
| Power consumption: | 2400 VA max. (200 V AC, C mode, 3 Ω load, DC only ±60 V output) |
| Overvoltage category: | II |

# 1.15 Withstand Voltage, Insulation Resistance

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

| | |
|---|---|
| Withstand voltage: | 1500 V AC |
| Insulation resistance: | 10 MΩ or higher (500 V DC) |

# 1.16 Ambient Temperature Range and Ambient Humidity Range

| | |
|---|---|
| Operating environment: | Indoor use |
| Altitude | Up to 2,000 m |
| Performance guarantee: | +5 to +35°C/5 to 85%RH<br>However, the absolute humidity must be 1 to 25 g/m$^3$, with no condensation |
| Storage conditions: | –10 to +50°C/5 to 95%RH<br>However, the absolute humidity must be 1 to 29 g/m$^3$, with no condensation<br>Figure 1-1 shows the ambient temperature and humidity ranges. |
| Pollution degree: | 2 |

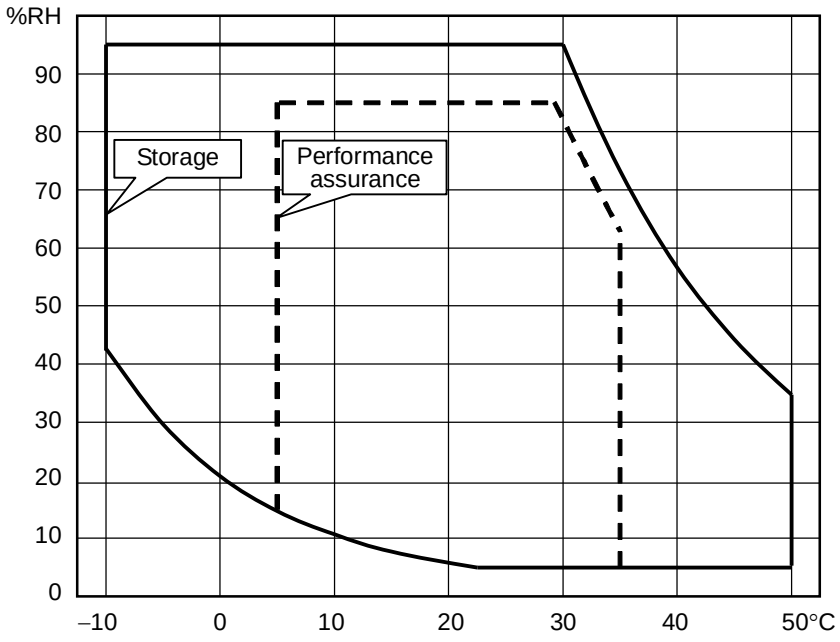



Figure 1-1. Ambient Temperature and Humidity Ranges

## 1.17 External Dimensions and Weight

■ **External dimensions**

Width: 430 mm
Height: 354 mm
Depth: 551 mm
(Not including projections)

■ **Weight**

Approximately 53 kg

## 1.18 Safety and EMC

■ **Safety standards**

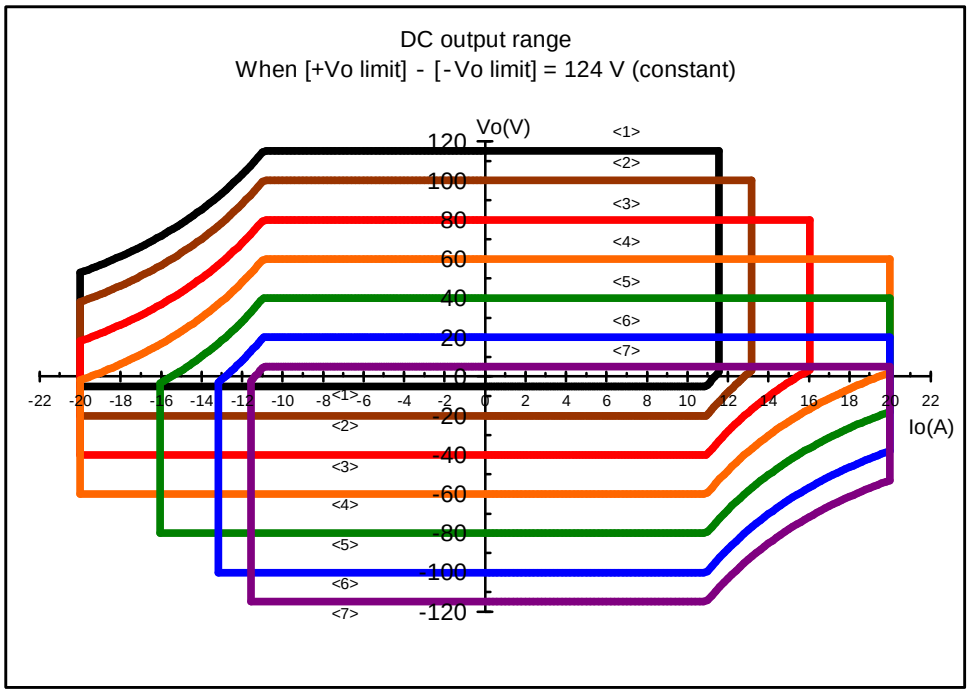
EN61010-1: 2001

■ **EMC**

EN61326: 1997/A1: 1998/A2: 2001/A3: 2003 (class A)
EN61000-3-2: 2000 (professional equipment greater than 1 kW)
EN61000-3-3: 1995/A1: 2001
When in an environment having strong radio frequency electromagnetic fields (EMFs), note with caution that output current gauge readings may become temporarily incorrect or the output may be cut off due to an incorrect overload reading.

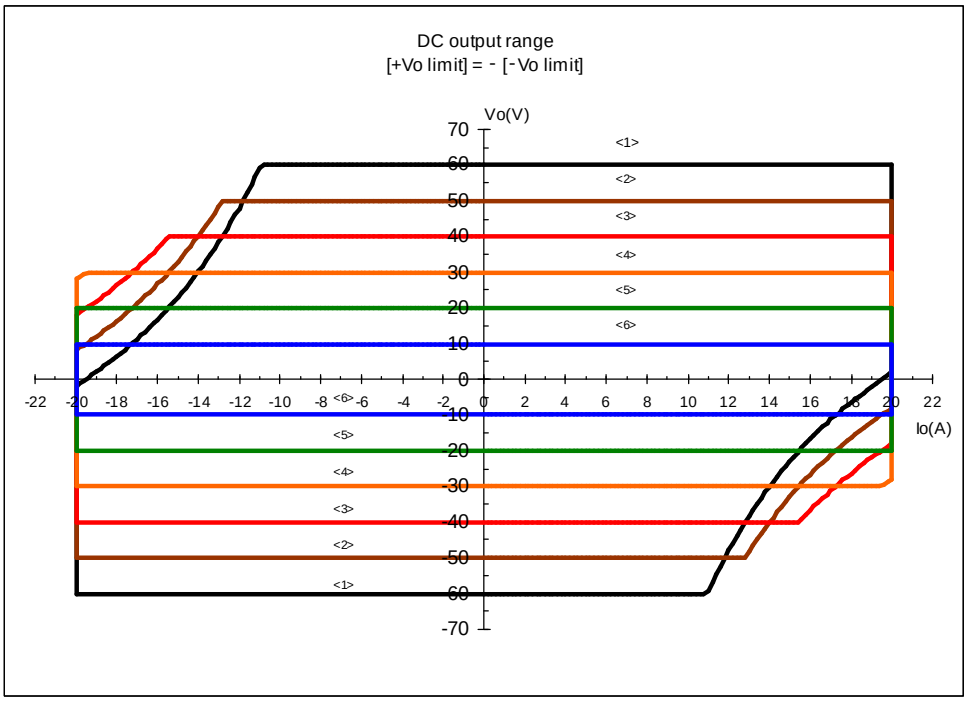
## 1.19 Output Voltage and Output Current Supply Ranges

The supply range differs depending on the positive and negative output voltage limiter settings (+Vo limit, –Vo limit).
The DC output range figures (Figures 1-2 to 1-5) show the relationship between the outputtable 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 1-6 to 1-9) 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.



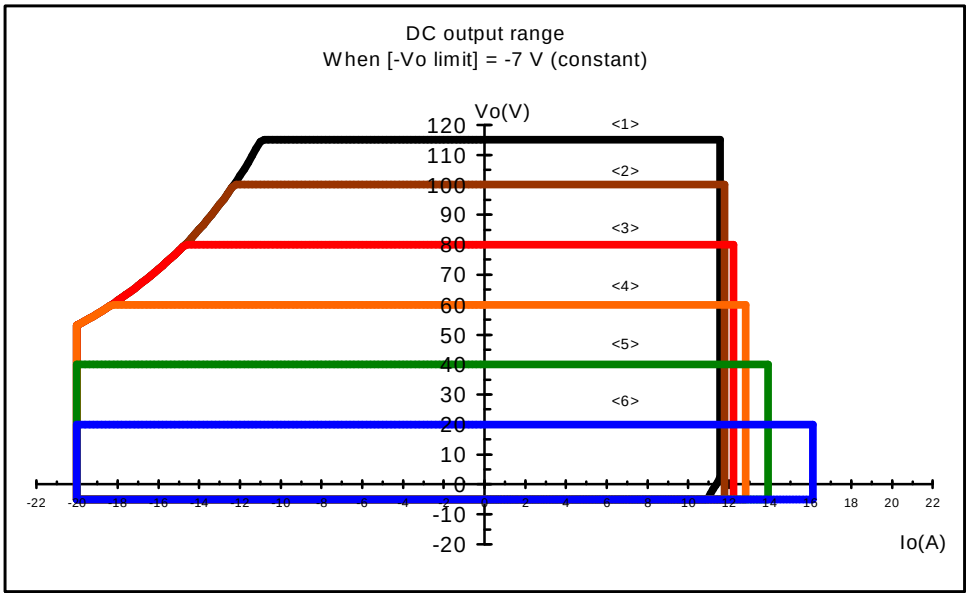

| | +Vo limit (V) | –Vo limit (V) |
|---|---|---|
| <1> | +117 | –7 |
| <2> | +102 | –22 |
| <3> | +82 | –42 |
| <4> | +62 | –62 |
| <5> | +42 | –82 |
| <6> | +22 | –102 |
| <7> | +7 | –117 |

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



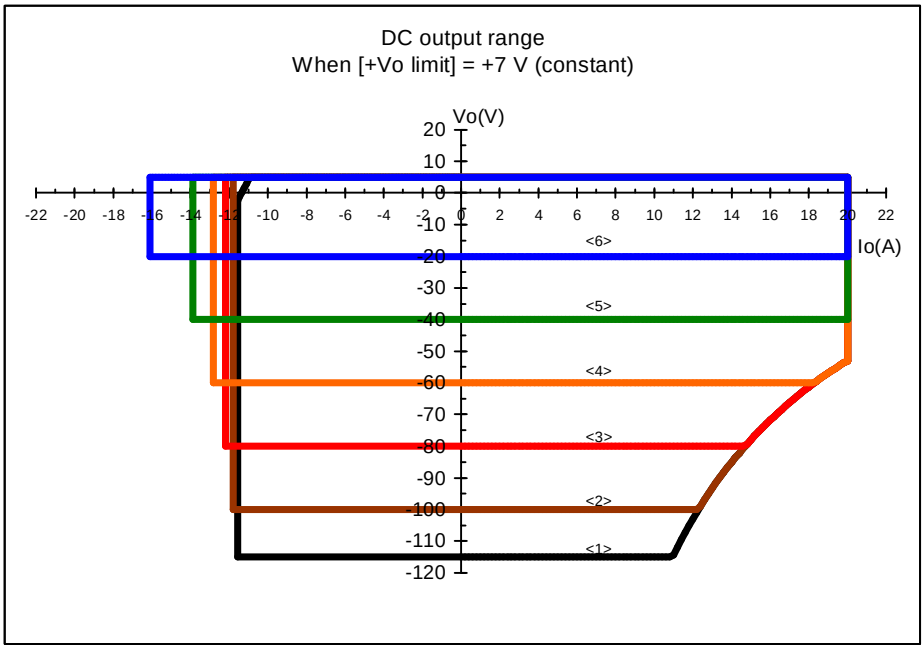

| | +Vo limit (V) | -Vo limit (V) |
|---|---|---|
| <1> | +62 | –62 |
| <2> | +52 | –52 |
| <3> | +42 | –42 |
| <4> | +32 | –32 |
| <5> | +22 | –22 |
| <6> | +12 | –12 |

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



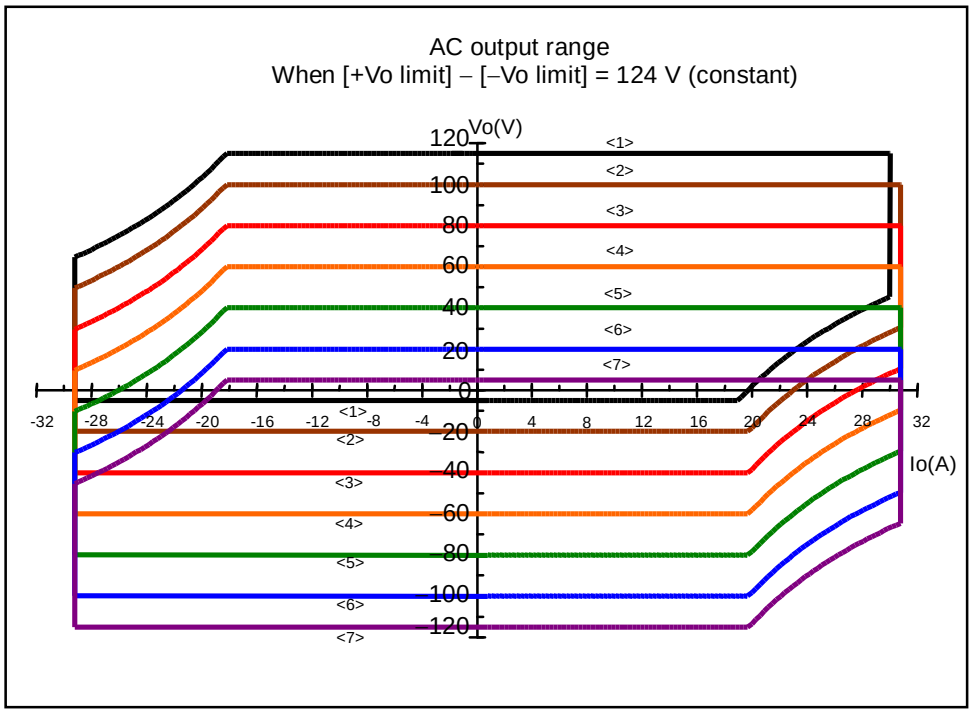

| | +Vo limit (V) | -Vo limit (V) |
|---|---|---|
| <1> | +117 | –7 |
| <2> | +102 | –7 |
| <3> | +82 | –7 |
| <4> | +62 | –7 |
| <5> | +42 | –7 |
| <6> | +22 | –7 |

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



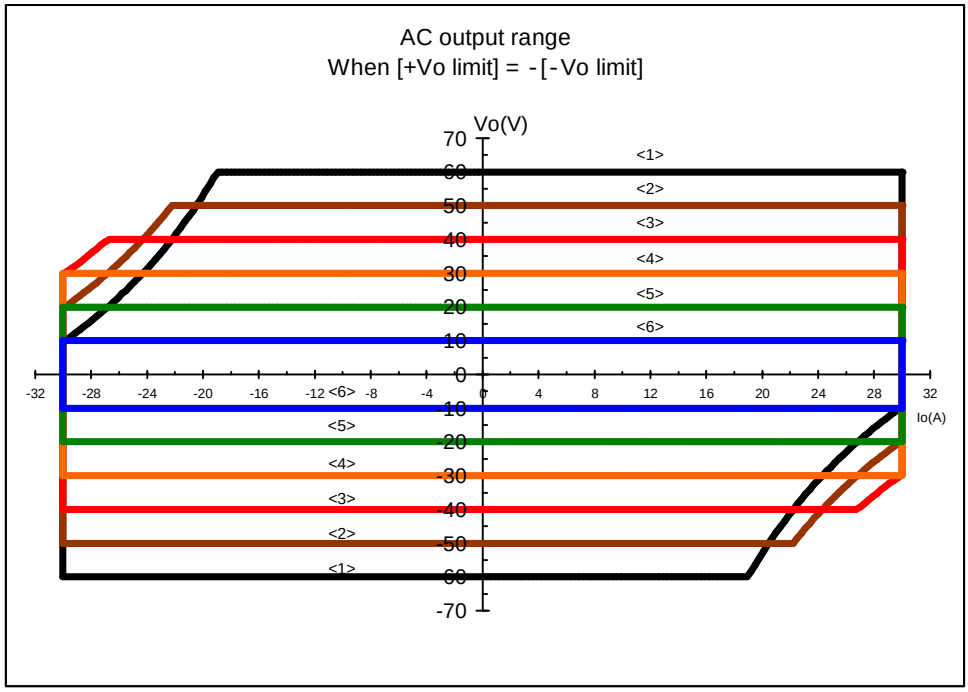

| | +Vo limit (V) | –Vo limit (V) |
|---|---|---|
| <1> | +7 | –117 |
| <2> | +7 | –102 |
| <3> | +7 | –82 |
| <4> | +7 | –62 |
| <5> | +7 | –42 |
| <6> | +7 | –22 |

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



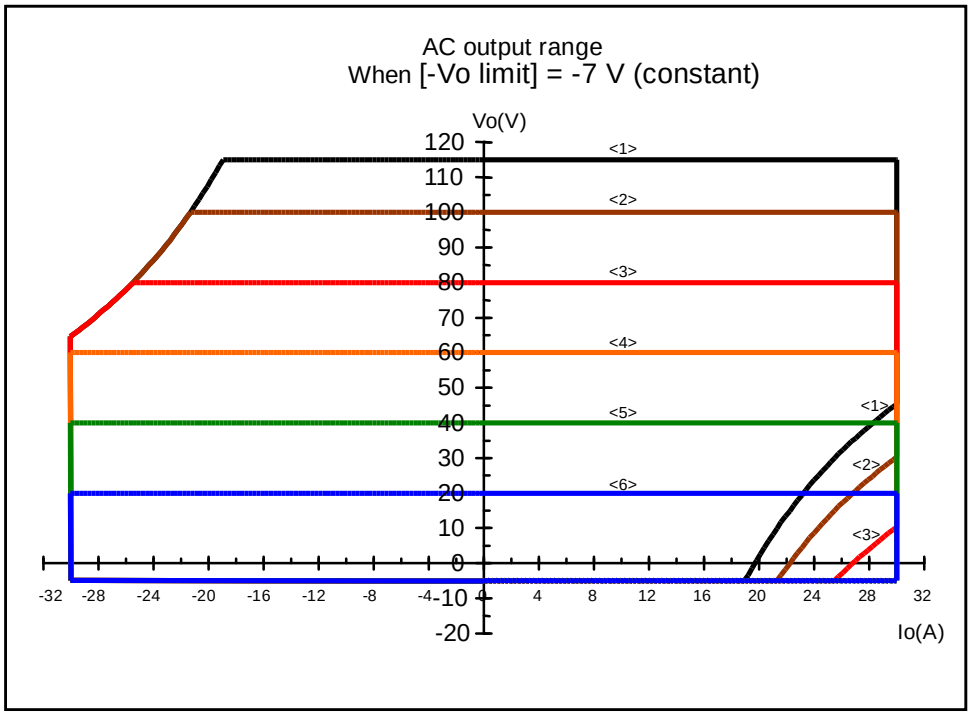

| | +Vo limit (V) | -Vo limit (V) |
|---|---|---|
| <1> | +117 | –7 |
| <2> | +102 | –22 |
| <3> | +82 | –42 |
| <4> | +62 | –62 |
| <5> | +42 | –82 |
| <6> | +22 | –102 |
| <7> | +7 | –117 |

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



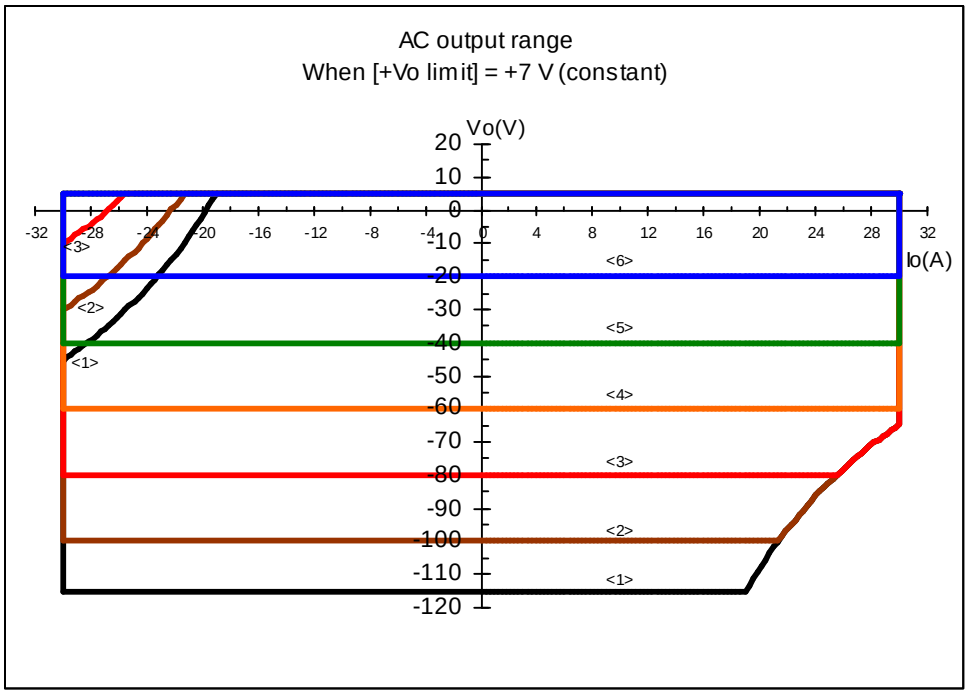

| | +Vo limit (V) | –Vo limit (V) |
|---|---|---|
| <1> | +62 | –62 |
| <2> | +52 | –52 |
| <3> | +42 | –42 |
| <4> | +32 | –32 |
| <5> | +22 | –22 |
| <6> | +12 | –12 |

Figure 1-7. AC Output Range (When Positive/Negative Voltage Limiter Settings Are 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 1-8. 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

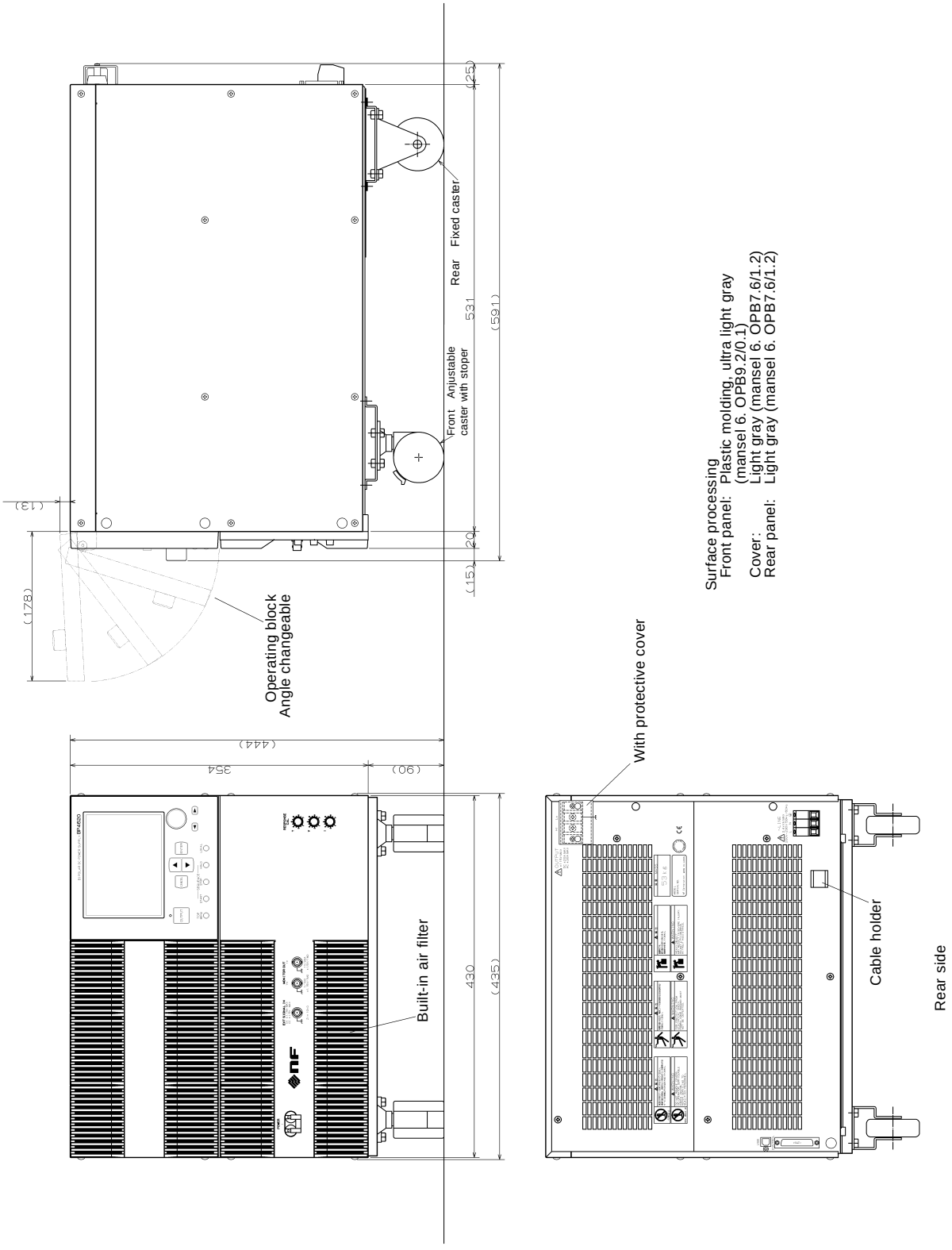



Figure 1-10. Drawing of External Dimensions