SERIES **BOP-HV**

Model BOP 500M

The Kepco Model BOP 500M and BOP 1000M are *high voltage* power sources, up to ±500V or ±1000V, respectively. These combine the capabilities of fast programmable power supplies with a Class A output stage, which can respond bi-directionally from zero. The BOP-HV can be operated in either a "voltage stabilizing" or "current stabilizing" operating mode (selectable by a front panel switch).

The term bipolar means that the voltage and current outputs can be made to vary smoothly and linearly through their entire plus and minus rated ranges, passing through zero with no polarity switching.

They can source or sink up to 100% of their current rating at any voltage setting, depending on the duty cycle. Please refer to the plot of voltage vs. current, Figure 1. The separate bipolar voltage and current control channels are backed by four independently adjustable (and programmable) limits. Four front panel LEDs tell you whether the unit is operating in the voltage or current mode, or against the voltage limit or current limit. A mode switch on the front panel selects the operating channel.

The tabulation of the effective series resistance and inductance in voltage mode, and the effective shunt resistance and shunt capacitance in current mode, is done to allow a calculation of the output impedance versus frequency.

BOP-HV MODEL TABLE

MODEL(3)	d-c OUTPUT RANGE		CLOSE LOOP GAIN		OUTPUT IMPEDANCE			
			VOLTAGE CHANNEL	CURRENT CHANNEL	VOLTAGE MODE		CURRENT MODE	
	E_0 max.	I_0 max.	G_V (V/V)	G_I (mA/V)	SERIES R	SERIES L(1)	SHUNT R	SHUNT C(2)
BOP 500M	±500	±80mA	50	8.0	0.05Ω	5mH	100MΩ	0.3μF
BOP 1000M	±1000	±40mA	100	4.0	0.2Ω	50mH	400MΩ	0.4μF

(1) For determining dynamic impedance in voltage mode.
(2) For determining dynamic impedance in current mode.
(3) To specify digital display, substitute the suffix "D" for "M."

FEATURES

- 40 watts, linear 4-quadrant operation.
- FET output stage.
- Preamplifiers for summing and scaling arbitrary input signals.
- Wide bandwidth.
- Voltage and current stabilization with automatic crossover to current and voltage limits.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

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KEPCO, INC. • 131-38 Sanford Avenue • Flushing, NY 11352 USA • Tel: (718) 461-7000 • Fax: (718) 767-1102
Email: hq@kepcopower.com • www.kepcopower.com/bophv.htm

BOP-HV GENERAL SPECIFICATIONS

SPECIFICATION	RATING/DESCRIPTION	CONDITION
INPUT		
a-c Voltage	105-125, 210-250V a-c	User selectable
Current	3.8A rms	Max load, 115V a-c
Frequency	47-65Hz	Range
OUTPUT		
d-c Output	Bi-direction series pass	MOSFET
Type of Stabilizer	Voltage & current	Automatic crossover
Voltage	0-100% of rating	Adjustment range For temp 0-55°C
Current	0-100% of rating	
Sink	See source/sink plot	Duty cycle
Error Sense	0.5V per load wire	Voltage allowance
Isolation Voltage	500V d-c or peak	Output to ground
Leakage Current	<50 microamperes	rms at 115V a-c 60Hz
Output to Ground	<5 milliamperes	p-p at 115V a-c 60 Hz
Series Connection	500V	Max voltage off grd.
Parallel Connection	—	Not recommended
OVP	—	Not available
CONTROL		
Type Voltage	Variable input, fixed gain	
Current	Differential comparison	
Voltage/Current Local	10-turn zero-center pot	
Remote Analog	-10V to +10V	
Remote Digital	Use SN or SNR interface	12 bit listen-only
Bounding	±Voltage/current local	Four screwdriver trimmers
	±Voltage/current remote	0 to 10 volts
Dynamics	See dynamic spec table	Fast only
User Amplifiers	Uncommitted gain 20K	Two provided
References	±10 volts	Two provided
MECHANICAL		
Input Connection	Detachable IEC type 3-wire	All models
Output Connections	Binding posts	Front signal/output
	30-terminal connector	Rear user port
	Barrier strip	Rear output
Meters	Two 2½" horiz., zero-center	Analog, 2%
	Two 3½" digital LCD	Digital
Indicators	Four LEDs	Voltage/current/bounding
Mounting	Mounting "ears" supplied	Full rack size
Cooling	Convection	Top surface
Dimensions inches (HxWxD) mm	7 x 16½ x 19 15/16 177 x 419.1 x 490.5	Full rack size
Finish: Fed Std 595	Light gray, color 26440	Front panel
Weight	65lb (29.5Kg)	Packed for shipment

For high power bipolar power supplies, see Series BOP High Power, page 44.

For bipolar power supplies, see Series BOP, page 50.

The BOP-HV incorporates two separate control channels, for local (front panel) or remote control of the output current and the output voltage. In addition, bounding currents for bipolar voltage and current limiting are provided which may be adjusted manually (by front panel controls) or can be remotely programmed. All control and bounding channels are connected to the bipolar (Class A) output stage via an "EXCLUSIVE-OR" gate, so that only one circuit is in control of the BOP-HV at any one time.

The amplifier in each channel is controlled via a zeroable preamplifier offering a minimum of 20,000 volts per volt open loop gain. These preamplifiers may be unstrapped and used as uncommitted amplifiers for signal scaling and summing. With their internal input/feedback elements, they function as unity gain inverting amplifiers driven by either the panel-mounted zero center controls, or an external -10V to +10V signal applied through the front panel binding posts. Their terminals are accessible at the rear for operational control with external feedback.

All rear programming and flag connections are made through a 30-terminal plug which can be wired for various control functions.

To realize the full high speed potential of the BOP-HV, the load characteristics should be mainly resistive. Load capacitance and inductance up to 0.01µF and 0.5 mH, respectively, can be tolerated without performance deterioration.

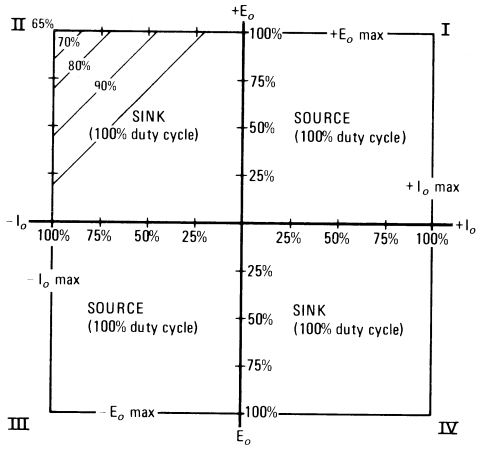


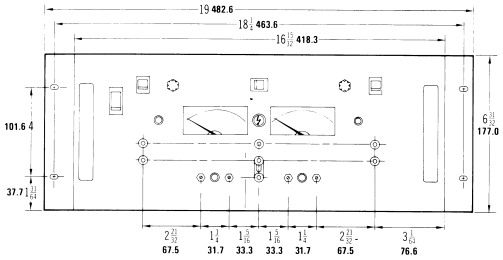
FIGURE 1
Output Source-Sink plot

CE BOP-HV are CE marked per the Low Voltage Directive (LVD), EN61010-1.

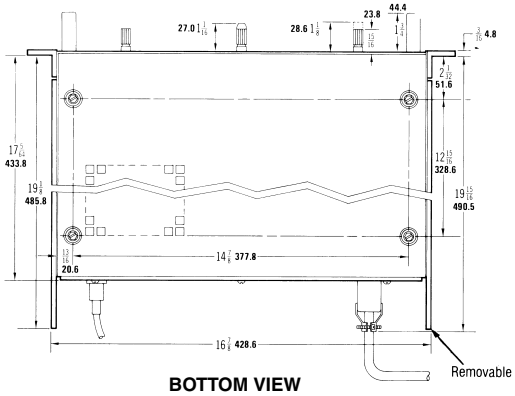
OUTLINE DIMENSIONAL DRAWINGS

Fractional dimensions in light face type are in inches, **dimensions in bold face type are in millimeters.**

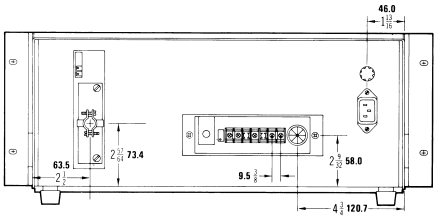
Tolerance: ± 1/64" **(0.4)** between mounting holes
± 1/32" **(0.8)** other dimensions



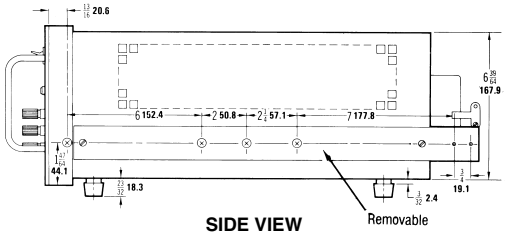
FRONT VIEW



BOTTOM VIEW



REAR VIEW



SIDE VIEW

BOP-HV STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS (1) VOLTAGE MODE	OUTPUT EFFECTS (1) CURRENT MODE	PREAMPLIFIER OFFSETS (6) ΔE_{io}	PREAMPLIFIER OFFSETS (6) ΔI_{io}	REFERENCES
Source (min.-max.)		<0.0005%	<0.0005% (5)	<5µV	<1nA	<0.0005%
Load (no load-full load)		<0.0005%	<0.005%	—	—	<0.0005%
Time (8-hour drift)		<0.01%	<0.01%	<20µV	<1nA	<0.005%
Temperature, per °C		<0.01%	<0.01%	<20µV	<1nA	<0.005%
Ripple and Noise(2)	rms	<10mV	<25µA(4)	—	—	<10µV
	pp	<500mV(3)	<200mV(4)	—	—	<100µV

(1) Specifications are expressed as a percent-of-setting for the output range 10% to 100%. Below 10% output, the specification limit is the rated percentage of the 10% output setting.
(2) One terminal must be grounded, or connected so that the common-mode current does not flow through the load.
(3) Peak-to-peak ripple is measured over a 20Hz to 10MHz bandwidth.
(4) For frequency components in the bandwidth of the current stabilizer. Beyond cutoff, noise will appear as a voltage component equal to the rated voltage mode noise.
(5) Or 0.2µA, whichever is greater.
(6) The output effect can be calculated by the relationship:
$\Delta E_o = \pm\Delta E_r\ (R_f/R_i) \pm\Delta E_{io}\ (1 + R_f/R_i) \pm \Delta I_{io}\ (R_f)$ where R_f is the feedback resistor, and R_i is the input resistor from the reference, E_r.

The tabulated offsets, more particularly their change as a function of source, time and temperature, allow a user to calculate performance of the uncommitted amplifier(s) with user specified input and feedback components. The formula for this is given in the static specifications table footnote.

BOP-HV DYNAMIC SPECIFICATIONS

	VOLTAGE CHANNEL BOP 500M	VOLTAGE CHANNEL BOP 1000M	CURRENT CHANNEL BOP 500M	CURRENT CHANNEL BOP 1000M
Closed Loop Gain	50V/V	100V/V	8mA/V	4mA/V
Bandwidth –3db	5.3KHz	1.8KHz	2.0KHz	1.5KHz
Programming Time Constant	30µsec	88µsec	80µsec	106µsec
Large Signal Frequency Response	6KHz	1.9KHz	2.5KHz	1.6KHz
Slew Rate	18V/µsec	12V/µsec	1.25mA/µsec	0.4mA/µsec
Load Recovery Time Constant	25µsec	75µsec	25µsec	50µsec

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Email: hq@kepcopower.com • www.kepcopower.com/bophv.htm