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## Test & Measurement

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## Complimentary Reference Material

This PDF has been made available as a complimentary service for you to assist in evaluating this model for your testing requirements.

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The 1000 watt HSP have a wide range a-c input (90-277V a-c). The 1500 watt models operate from 180-277V a-c mains. Both feature an active power factor correction (PFC) front end to suppress harmonic generation per EN61000-3-2.

HSP have optional built-in “or-ing” diodes for redundancy paralleling and a “hot swap” capability. These are specified by appending the suffix “R” to the model number.

HSP may be controlled by an external voltage or current over the range 20% to 110% of rated voltage. Metered versions are also available. See page 69.



The Kepco HSP series comprises a group of ten models, seven 1000 watt power supplies with outputs from 3.3 volts to 48 volts and three 1500 watt power supplies with outputs from 24 volts to 48 volts. All models feature current-sharing for parallel redundant N+1 operation. Models with the or-ing diode (option R), are capable of hot swapping when plugged into Kepco’s RA 60 series rack adapter. A mechanical keying scheme allows the user to define which power supply will plug into a specified slot in the housing. Output voltage and current limit settings are adjustable from the panel and may be remotely adjusted.

## HSP MODEL TABLE

SPECIFICATION	OUTPUT VOLTAGE		OVP SETTING	RATED OUTPUT CURRENT			RIPPLE		NOISE	EFFICIENCY
Unit	Volts		Volts	Amps			mV p-p		mV p-p	Percent
Condition	Factory Set	Adjustment Range	Factory Setpoint	50°C	60°C	71°C	Source max	Switching max	(Spike) 20MHz	100% Load Nominal input
<b>1000 WATT MODELS</b>										
HSP 3.3-230	3.3	2.3-3.6	4.29	230	173	105	20	30	100	71
HSP 5-200	5	3.5-5.5	6.5	200	150	95	20	30	100	72
HSP 12-84	12	8.4-13.2	15.6	84	63	40	20	40	120	73
HSP 15-66	15	10.5-16.5	19.5	66	49.5	31.4	20	40	150	76
HSP 24-42	24	16.8-26.4	31.2	42	31.5	20	20	60	240	77
HSP 28-36	28	19.6-30.8	36.4	36	27	17	20	60	280	78
HSP 48-21	48	33.3-59.2	62.4	21	16	10	20	60	480	80
<b>1500 WATT MODELS</b>										
HSP 24-60	24	16.8-26.4	31.2	60	45	28.6	20	60	120	77
HSP 28-53	28	19.6-30.8	36.4	53	39.8	25.2	20	60	140	78
HSP 48-30	48	33.3-59.2	62.4	30	22.5	14.3	20	60	240	80

Add suffix “M” to the model number, e.g. HSP 24-42M, to designate factory installed voltmeter/ammeter. See page 69.

## FEATURES

- Remote sensing (0.5V for 3.3 and 5V models, 0.8V for all others).
- Control/programming of the voltage channel, current limit, overvoltage set point. The output voltage is remotely trimmable by resistance. Both the output voltage and current limit are adjustable over the range 20%-100% by a 2-10V analog voltage.
- Set point monitors for voltage and current permit online adjustment of output limits.
- Switch selectable Bellcore-type current "walk-in" characteristic for battery charger applications.
- Front panel status indicators, duplicated by form C relay contact status flags at rear panel connector: POWER, DC FAIL, OVERTEMP, FAN FAIL.
- Safety Agency Approvals: Recognized component with SELV output per UL 60950, CSA 950, VDE IEC 950/EN60950 for a-c mains operation.
- HSP are capable of sustaining full load operation through the loss of one full mains cycle at any source voltage without indication of failure. If mains power is lost for more than one cycle, HSP provides a flag a minimum of 5 milliseconds before the output loses regulation. Total effective hold-up time exceeds 27 milliseconds.
- 5" x 5" crosssection plug-ins meet EIA standard for 3U height. Fit three abreast in EIA standard 19" equipment racks (four abreast in 24" racks).
- HSP are fully protected for any overload including a short circuit. Normal overload protection is continuous current limiting. A switch selectable option will latch the power off after 20 seconds to avoid damage to load wires. An overvoltage protector latches the power off whenever the output exceeds a user-set limit.
- Remote control of HSP is provided via one of two isolated TTL-level signals, one normally high and the other normally low. An internal 5V supply powers this circuit and provides the auxiliary 5V, 100mA output. This voltage is available whenever source power is applied, whether or not the main output is inhibited. The main output is normally ON if no remote logic is applied.
- HSP meet all EN50082-2 (heavy industrial) immunity levels including mains lightning surge. See also ANSI C62.41.

## HSP INPUT CHARACTERISTICS

SPECIFICATIONS		RATING/DESCRIPTION	CONDITION
a-c Voltage 1000W models	nominal	100-250V a-c	Single phase
	range	90-277V a-c	Wide range
a-c Voltage 1500W models	nominal	200-250V a-c	Single phase
	range	180-277V a-c	Wide range
d-c Voltage <sup>(1)</sup>	1000W	125-420V d-c <sup>(1)</sup>	Polarity insensitive
	1500W	250-420V d-c <sup>(1)</sup>	Polarity insensitive
Brownout Voltage	1000W	75V a-c	
	1500W	150V a-c	
Source Frequency		47-440Hz	>63Hz, input leakage current exceeds tabulated value
Source Current	120V a-c	1000W: 11.0A rms	Typical
	240V a-c	1000W: 5.5A rms 1500W: 8.0A rms	
Power Factor	Typical	0.99	Any source 25% to 100% load
	Minimum	0.96	

(1) Safety approval is for a-c operation only.

## HSP CURRENT HARMONICS, SOURCE TRANSIENTS AND EMI SPECIFICATIONS

PARAMETER	DOCUMENT	SPECIFICATION
<b>IMMUNITY<sup>(1)</sup></b>		
Radiated RF (Ampl. mod.)	EN61000-4-3	10V/m, 80-1000MHz
Radiated RF (Pulse mod.)	EN61000-4-3	10V/m, 900MHz
Magnetic Field	EN61000-4-8	30A/M, 50Hz
Electrostatic Discharge	EN61000-4-2	4KV (contact) 8KV (air)
Conducted RFI	EN61000-4-6	10Vrms, 0.15-80MHz
Electrical Fast Transient	EN61000-4-4	2KV, Tr/Th = 5/50ns
Surge (CM, DM)	EN61000-4-5	4KV (CM) Tr/Th = 8/20µs 2KV (DM) Tr/Th = 8/20µs
<b>EMISSIONS</b>		
Conducted RF	FCC, Class A CISPR 22, Class A	0.45-30MHz 0.15-30MHz
Current Harmonics	EN61000-3-2	0-2KHz

(1) All immunity levels meet the requirements for heavy industrial applications per EN50082-2 using Criteria A (no operational effect).



HSP are CE marked per the Low Voltage Directive (LVD), EN60950.





## HSP OUTPUT CHARACTERISTICS

SPECIFICATIONS		RATING/DESCRIPTION	CONDITION
Output Setting Range		70% - 110% (1)	Of nominal output
		70% - 125% (1)	48V Models only
Source Effect	typ	0.05%	Nominal $\pm 15\%$
	max	0.1%	
Load Effect	typ	0.05%	5%-100% load operation between 0-5% load results in increased ripple and degraded transient response
	max	0.1%	
Temperature Effect	typ	0.01%	Per degree C (0 to 50°C)
	max	0.02%	
Combined Effect (source, load temperature & time)	typ	0.15%	
	max	0.3%	
Time Effect (drift)	typ	0.05%	0.5-8.5 hours
	max	0.1%	
Start up Time	max	1 second	Any source/load
Recovery Characteristics	Excursion	<3% of nominal output	50-100% load
	Recovery	1000W: 100 $\mu$ sec 1500W: 300 $\mu$ sec	Return to 1% of setting
Ride Through	min	21.5 Milliseconds	From loss of source to flag signal
Hold-up Time	min	5 Milliseconds	After signal flag
Overshoot	turn on	+3% max	Any source
	turn off	none	5%-100% load
Error Sense	3.3 & 5V	0.25V	Voltage allowance per wire
	All others	0.4V	
Series Connection (output floats)		500V	Maximum voltage off ground
Parallel Connection (for redundancy)		Current shares within 5% of rated load	5-100% load, hot-swappable
Selective Overvoltage Shutdown		Adjustable 100-140% of nominal; factory set to 130%	Latched, reset by cycling source power off
Current Limiting		Constant current mode Factory set 110% of I <sub>Q</sub> max	Optional shutdown mode with 20 second delay
Remote On/off	RC-1	Normally high	Isolated form C or TTL
Remote On/off	RC-2	Normally low	Isolated form C or TTL
Overtemperature		Thermostat, Auto re-start	With hysteresis

(1) When remotely controlled by voltage or resistance, the HSP may be controlled over a range of 20% to 110% of rated output. 20% to 125% for 48V models.

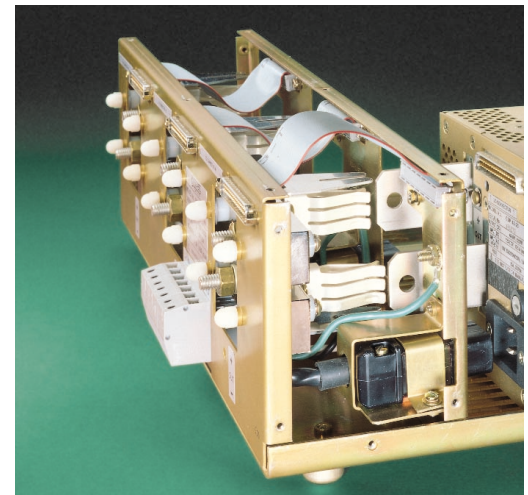
HSP power supplies are available with a meter option. Add the suffix "M" to the model number for this option. The metered models offer a 3 1/2 digit LED display on the front panel to provide both voltmeter and ammeter functions. An illuminated rocker switch selects either volts or amps as the normally displayed parameter. A second momentary-action switch, causes the meter to toggle between either the programmed value of the voltage and current setpoints or the actual output.

Voltmeter accuracy is  $\pm 3\%$ . Ammeter accuracy is  $\pm 10\%$  for loads between 25% and 100% of rated output current. For load currents less than 25% of rated output, ammeter accuracy degrades significantly.

The display function is operational when HSP-M is used singly as a stand-alone power supply or as part of a redundant array. When the power supply is part of a parallel-redundant array, the voltmeter displays the BUS voltage, not the individual module's output. (The setpoint display does indicate the individual setting of the module). The ammeter displays the actual current of the individual module and its setpoint.



Front view of the HSP plug-in module



Rear view, cover removed, of the rack housing showing the heavy-duty bus-bar connections that make HSP's "Hot Swap" practical

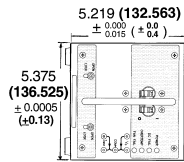


Metered Version HSP  
(Add suffix "-M" to the model number)

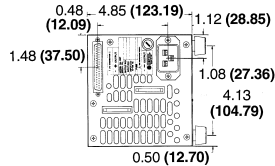
AN ISO 9001 COMPANY  
 **KEPCO**  
 THE POWER SUPPLIER™  
 SINCE 1946

## OUTLINE DIMENSIONAL DRAWINGS

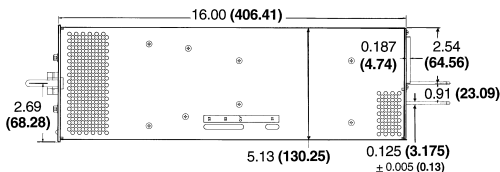
Fractional dimensions in light face type are in inches.  
**dimensions in bold face type are in millimeters.**  
 Tolerance:  $\pm 1/64"$  (**0.4**) between mounting holes  
 $\pm 1/32"$  (**0.8**) other dimensions



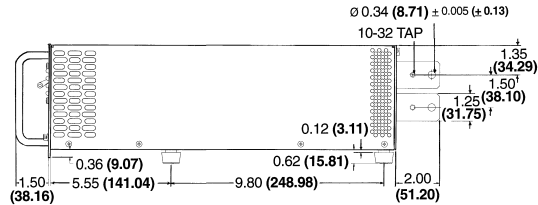
FRONT VIEW



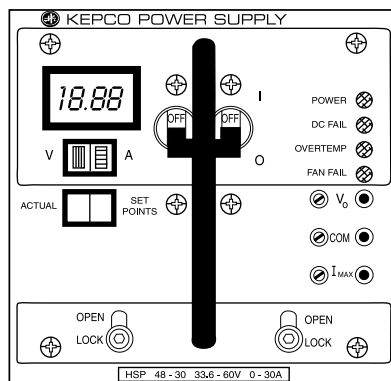
REAR VIEW



TOP VIEW



SIDE VIEW



FRONT VIEW - HSP Metered Version

## HSP SIGNALS AND FLAGS

SPECIFICATIONS	RATING/DESCRIPTION		CONDITION
Status Flags (Form C dry relay contacts)	Power	Indicates low source voltage; signal asserted 5 msec prior to loss of output voltage	Both NO and NC available
	Output	Indicates normal operation	
	Overtemp	Overtemperature shutdown	
	Fan fail	Failure of internal fan	
Status Indicators front panel LEDs	Power	Green	Lit when a-c is sufficient
	DC fail	Red	Lit when output failure is detected
	Overtemp	Yellow	Lit when thermostat activates
	Fan fail	Red	Lit when fan failure is detected
Test Points	Voltage	Monitor setpoint	0.1 x E out
	Current	Monitor setpoint	0-5 Volts full scale
Auxiliary Voltage (isolated)	4.5-5.5V d-c isolated 0-100 milliamperes		Present whenever housekeeping supply is operating

## HSP CONTROL

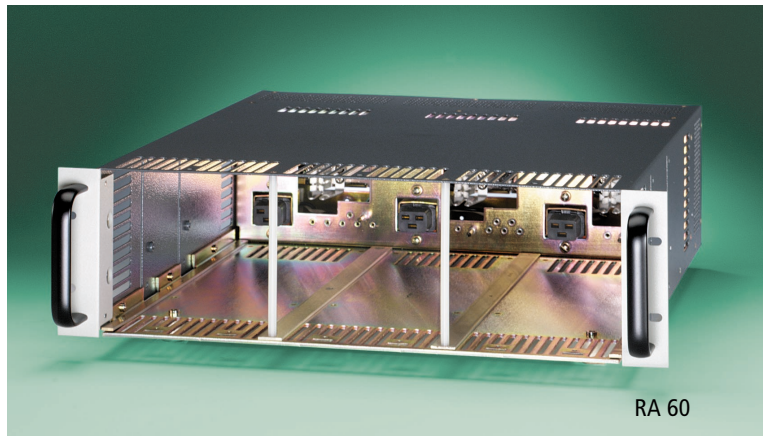
SPECIFICATIONS	RATING/DESCRIPTION		CONDITION
Voltage set programming (mode selected by internal switches) (isolated)	Internal	Multiturn potentiometer	The DCOK/DCFAIL fault detect window tracks the programmed output voltage, OVP trip unaffected
	External 1	Resistance, 0-10K = 100-50%	
	External 2	Voltage, 2-11V = 20-110% of rated output voltage, 20-125% for 48V models	
Current limit programming (mode selected by internal switches)	Internal	Multiturn potentiometer	
	External	Voltage, 2-11V = 20-110% of rated output current	
Remote ON/OFF	Normal H	TTL level	Isolated 5V, 100mA internal pull up supply
	Normal L	TTL level	
Forced load share	Single wire connection between modules		0-5.5V signal indicates each module's current

## HSP PHYSICAL CHARACTERISTICS

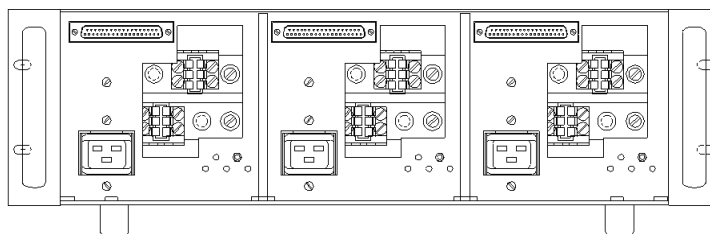
SPECIFICATIONS	RATING/DESCRIPTION		CONDITION
Dimensions	English	5.38" x 5.22" x 16"	Excluding front latch, circuit breaker, handle and rear connections
	Metric	137 x 133 x 406 mm	
Weight	English	19lbs	
	Metric	8.6Kg	
Source Connection	3 pin IEC Connector		Compatible with molded line cord
Load Connection	Two bus bars 1.25" x 0.125" x 2.5"		Keyed for plug-in housing
Signal Connection	37 Pin D-subminiature connector		

## HSP GENERAL SPECIFICATIONS

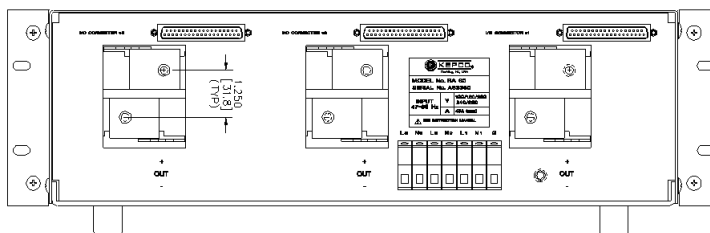
SPECIFICATIONS	RATING/DESCRIPTION	CONDITION
Temperature	-20° to +71°C (see model table)	Operating
	-40° to +85°C	Storage
Humidity	0 to 95% RH	Non condensing operating & storage
Shock	20g 11msec ±50% half sine	Non-operating 3-axes 3 shocks each axis
Vibration	5-10Hz 10 mm double amplitude	Non operating 1 hour each axis
	10-55Hz 2g	
Altitude	operating Sea level to 10,000 ft	
	storage Sea level to 160,000 ft	
Isolation	Output-case 500V d-c	25°C, 65% RH
Withstand Voltage	Input-output 3000V a-c rms	25°C, 65% RH
	Input-case 1500V a-c rms	
Safety	UL 1950; VDE EN 60950; CSA 122.2 No. 234-M90 level 5	Information Technology Equipment
Type of Construction	Enclosed, plug-in style includes status LEDs, circuit breaker, handle, voltage/current trimmers, monitor test points	Rack mountable. See listing of available housings
Cooling	Internal d-c fan	Exhaust to rear



RA 60



INTERIOR VIEW - Front of RA 60



REAR VIEW - RA 60

## Accessory Housings for HSP Models

**RA 60** (3) HSP Modules  
3 slots wired in parallel for redundancy, hot swap connectors

English 19"W x 5.25"H x 21"D

Metric 483 x 133 x 533 mm

**RA 62** (3) HSP Modules  
2 slots wired in parallel, 1 independent, hot swap connectors

English 19"W x 5.25"H x 21"D

Metric 483 x 133 x 533 mm

**RA 63** (3) HSP Modules  
independent slots, hot swap connectors

English 19"W x 5.25"H x 21"D

Metric 483 x 133 x 533 mm

**RA 58** (3) HSP Modules  
independent slots, hardwire

English 19"W x 5.25"H x 16.4"D

Metric 483 x 133 x 417 mm

*To configure the above rack housings for 23" or 24" wide rack cabinets, add suffix -23E or -24E respectively*

**RA 59** (4) HSP Modules  
4 slots prewired for independent operation. User configurable for parallel operation.

English 24"W x 5.25"H x 21"D

Metric 610 x 133 x 533 mm

**RA 61** (4) HSP Modules  
independent slots, hardwire

English 24"W x 5.25"H x 16.4"D

Metric 610 x 133 x 417 mm

## Accessories for HSP Models

**118-0776** line cord set with NEMA 5-20P termination (125V/20A)

**142-0381** source power entry mating connector

**142-0422** I/O mating connector

**108-0203** I/O connector jackposts (set of two)

**108-0294** I/O connector shell

**101-0159** screw for mounting