

1.5kW Fan cooled



The HPA1K5 series offers users both output voltage and output current programming, via voltage, I²C PMBus, RS485 and CANopen in a very high efficiency, high power density 1.5kW chassis mount package. Options are available for RS232 or UART.

Measuring just 279.4 x 106.6 x 41.6mm, the HPA1K5 also features active current sharing, remote on/off, remote sense and a power OK signal. The 5V/2A standby output is available whenever the mains supply is present.





Features

- Programmable output voltage (0-105%)
- Programmable output current (0-110%)
- High efficiency up to 93%
- ITE and medical approvals
- Parallel operation
- Analog and digital interfaces
- Multiple digital protocols PMBus, CANopen, MODBUS and SCPI
- Fully featured signals and controls
- Graphical user interface (GUI)
- 5V/2A standby supply
- SEMI F47 compliant
- 3 year warranty

Applications







Industrial Electronics



Semiconductor Manufacturing



Technology

Dimensions

279.4 x 106.6 x 41.6 mm (11.0" x 4.20" x 1.64"in)

More resources

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Models & ratings

Model number(1)	Мах		Output voltage V1		Output	F45 siam and (2)	
	output power	Minimum	Nominal	Maximum	Minimum	Maximum	Efficiency ⁽²⁾
HPA1K5PS24	1.5kW	0VDC	24VDC	25.2VDC	0.0A 62.50A		91%
HPA1K5PS36	1.5kW	0VDC	36VDC	37.8VDC	0.0A	41.70A	92%
HPA1K5PS48	1.5kW	0VDC	48VDC	50.4VDC	0.0A	31.25A	93%
HPA1K5PS60	1.5kW	0VDC	0VDC 60VDC		0.0A 25.00A		92%

- 1. Standard models include PMBus, CANopen and RS485 interfaces. RS485 default is full duplex. RS485 half duplex can be configured via I2C or factory configured on request. To replace RS485 with RS232 or UART, contact sales.
- 2. Measured with 230VAC input and full load.
- 3. USB interface available to enable RS485 and RS232 communication with GUI. Part number XP PS MANAGER INT.



Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
land to the man	180		264		1.5kW
Input voltage (see application notes)	100		180	VAC	1.4kW max
(See application notes)	90		100		1.2kW max
Input frequency	47		63	Hz	
Power factor		0.96			Complies with EN61000-3-2 for Class A
Input current			16	А	100VAC, 1400W
Inrush current			40	А	264VAC, 25°C cold start
Earth leakage current			450	μΑ	264VAC, 60Hz
Input protection	F20A / 250V fuse fitted in line and neutral				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions	
Output voltage	0		63	VDC	See Models and Ratings table	
Output set tolerance		±0.5		%	Nominal voltage irrespective of set voltage	
+5V standby tolerance		±3		%	5V/2A Standby	
Output voltage program	0		105	%	Of nominal, slew rate <40ms 10-105% & 105-10%. Max frequency of voltage program is 0.5 Hz 0-5% load, 0.67Hz 5-10% load, 1Hz 10-20% load, 3 Hz 20-100% load	
Output voltage adjust	±10			%	Of set output via potentiometer 105% of nominal max.	
Output current program	0		110	%	Of nominal	
Minimum load	0			А	No minimum load required	
Start up delay		1.3	2	s	Under all load and line conditions	
Start up rise time			40	ms		
	10	14			230VAC at 1.5kW and 25°C	
Hold up time	10	17		ms	100VAC at 1.4kW and 25°C	
			±0.5	0/	Of nominal voltage	
Line regulation			±0.5	- %	5V Standby	
			1	0.4	0-100% or 100-0% load	
Load regulation			2	- %	5V Standby	
Transient response			3	%	Deviation with a 50-75-50% load change. Output returns to within 1% less than 500µs	
Ripple & noise			1/2.5	%	Of nominal voltage/5V Standby. Measured with 20MHz bandwidth limited oscilloscope 0-50°C	
Overshoot			5	%	Turn on & turn off	
Overvoltage protection	110		120	%	Of nominal voltage, latching. Cycle AC to reset. No protection for 5V Standby	
Overtemperature protection	Auto resetting	g thermal prote	ection			
Overload protection			±3	% of max load	Set current limit point. Constant current characteristics. Max current limit is 108/112% ±3% (24V/48V models) of maximum rated current. For low line (80-115VAC), constant power characteristic set at 1.4kW until curren limit point is reached. 5V Standby: <5A max	
Temperature coefficient			0.03	%/°C	Of max load	
Short circuit protection	Constant cur	rent character	istics. 5V Standl	y: Foldback ch	aracteristic < 5A max	
Remote sense	Compensate	s for 1% max	of nominal voltag	ge per lead, 2%	of total nominal voltage drop.	





General

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions
Efficiency		92		%	230VAC, 1.5kW, 5V Standby at full load
Isolation: Input to output	4000			VDC	2 x MOPP
Input to ground	2500			VDC	1 x MOPP
Output to ground	500			VDC	
Switching frequency	60	65	70	kHz	Fixed frequency PFC
	40		250	kHz	Variable frequency main converter
Power density			50.2	W/cm³	
Signals and controls	V Program, I	Program, AC O	K, DC OK, Fan	Fail/Temperature	Warning, Sync, PMBus, Inhibit, Current Share
MTBF		580		khrs	Telecordia 332, +25°C
Weight		1900 (4.2)		g (lb)	

Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & conditions		
Operating temperature	-20		+70	°C	Derate linearly from 50°C to 50% rated power at +70°C		
Storage temperature	-40		+85	°C			
Cooling	Force-cooled with intelligent fan speed control						
Humidity	5		95	%RH	Non-condensing		
On averting alkitude			4000		Medical		
Operating altitude			5000	m m	IT		
Shock	±3 x 30g shocks in each plane, total 18 shocks. 30g = 11ms (±0.5ms) half sine. Conforms to EN60068-2-27 & EN60068-2-47						
Vibration	Single axis 1	Single axis 10-500Hz at 2g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6					

Signals & controls

	Function			
V program ⁽¹⁾⁽²⁾	0V to 5V signal will program Vout from 0-105%. VProg accuracy ±3% of nominal output voltage. When left open, supply will go into its default operating mode			
I program ⁽¹⁾⁽²⁾ 0V to 5V signal will program the current limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%. When this signal is left open, supply will go into its default limit from 0-110%.				
AC OK LOW = Input Voltage is within operating range, HIGH = Input Voltage is outside of operating range or there is a loss of phase. Uncommitted opto-transistor, 2ms war				
DC OK	When the supply is used as a variable output supply, this signal is disabled. When the supply is programmed as a fixed output supply, LOW = Vout > 95% of Vnominal. This level is programmable by the user through the PMBus. Uncommitted opto-transistor			
Fan fail/Temp warning	High = Fan FAIL and/or overtemperature, Low = Fan OK and temperature OK (3.3V Logic), unit switches off 10 s after Fan Fail/Temp Warning alarm, auto recovery. XP Power GUI available for download, contact sales			
Sync.	Connect parallel units to synchronise output turn on			
PMBus, CANopen and RS485 Optional: RS485 can be replaced with RS232 or UART	The interface specification is detailed in a separate document "HPA1K5 Communication, Control and Status Specification". XP GUI available for download, contact sales. Vout monitor accuracy is ±1% of nominal voltage, Vout setting accuracy is ±1% of nominal voltage, lout monitor accuracy is ±3% of full load, lout setting accuracy is ±3% of full load			
Current share	Connecting pin 23 on one unit to pin 23 on a like voltage unit will force the current to be shared. Up to 5 units can be paralleled. Current share accuracy ±3% of full system load			
Inhibit	Uncommitted opto diode. See Signals & Controls			

⁽¹⁾ In analog mode, the default Vout and lout settings are 0% when open circuit.



⁽²⁾ To activate analog mode, PMBus_EN (pin 24) must be pulled down to SGND. Default when open is digital programming.



EMC: emissions

Phenomenon	Standard	Test level	Notes & conditions
Conducted	EN55011/EN55032	Class B	Class A <80% nominal output voltage
Radiated	EN55011/EN55032	Class A	
Harmonic currents	EN61000-3-2	Class A	
Voltage flicker	EN61000-3-3		

EMC: immunity

Phenomenon	Standard	Test level	Criteria	Notes & conditions
ESD immunity	EN61000-4-2	4	Α	±8kV contact / ±15kV air discharge
Radiated immunity	EN61000-4-3	3	А	
EFT/Burst	EN61000-4-4	3	А	
Surge	EN61000-4-5	Installation class 3	А	
Conducted	EN61000-4-6	3	А	
Magnetic field	EN61000-4-8	4	А	
		Dip 100%, 8.4ms	А	
		Dip 100%, 16.7ms	В	Criteria A derate to 1.1kW
	EN61000-4-11	Dip 60%, 200ms	В	Criteria A derate to 315W
	(100VAC)	Dip 30%, 500ms	А	
		Dip 20%, 5000ms	В	
		Int 100%, 5000ms	В	
	EN61000-4-11 (240VAC)	Dip 100%, 10ms	А	Criteria B >1440W
		Dip 100%, 20ms	В	Criteria A derate to 1kW
		Dip 60%, 200ms	В	Criteria A derate to 1.3W
		Dip 30%, 500ms	А	
		Dip 20%, 5000ms	А	
Dips and interruptions		Int 100%, 5000ms	В	
		Dip 100%, 10ms	А	Criteria B derate to >1.2kW
		Dip 100%, 20ms	В	Criteria A derate to 1kW
	EN60601-1-2 (100VAC)	Dip 60%, 100ms	В	Criteria A derate to 325W
	(1007/10)	Dip 30% , 500ms	А	
		Int 100%, 5000ms	В	
		Dip 100%, 10ms	А	
		Dip 100%, 20ms	В	Criteria A derate to 1kW
	EN60601-1-2 (240VAC)	Dip 60%), 100ms	А	
	(2 10 17 10)	Dip 30%, 500ms	А	
		Int 100%, 5000ms	В	
	SEMI F47-0706	>200VAC input	А	

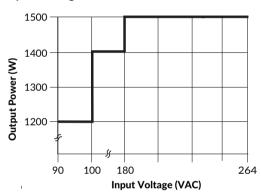


Safety approvals

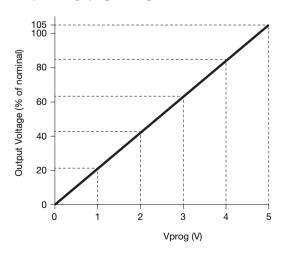
Certification	Safety standard	Notes & conditions		
CP remark	IEC62368-1 Ed 2	Information technology		
CB report	IEC60601-1 Ed 3 Including risk management	Medical		
	UL62368-1, CSA 22.2 No.62368-1, UL60950-1	Information technology		
UL	ANSI/AAMI ES60601-1:2005 & CSA C22.2, No.60601-1:08	Medical		
FN	EN62368-1	Information technology		
EN	EN60601-1/2006	Medical		
CE	Meets all applicable directives			
UKCA	Meets all applicable legislation			
Equipment protection class	Class I	See safety agency conditions of acceptability for details		
Isolation	Means of protection	Notes & conditions		
Primary to secondary	2 x MOPP (Means of patient protection)			
Primary to earth	1 x MOPP (Means of patient protection)	IEC60601-1 Ed 3		
Secondary to earth	N/A			

Application notes

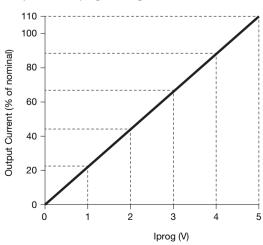
Input derating



Output voltage programming



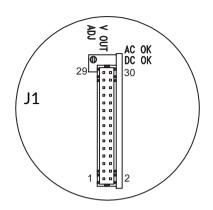
Output current programming





Signals & controls

Signal connections



	J1 signal connections									
Pin	Function	Opto-isolator	Description							
1	DCOK	Collector	See circuit diagram on page 7.							
2	DCOK return	Emitter	Uncommited opto-isolator. Circuit conducting means Vout is within range.							
3	Remote inhibit	Anode	See circuit diagram on page 7.							
4	Remote inhibit return	Cathode	Uncommited opto-diode. Diode conducting means output OFF.							
5	A0		I ² C Device Address Bit (Internal 10kΩ pull-up to 3.3V)							
6	A1		I ² C Device Address Bit (Internal 10kΩ pull-up to 3.3V)							
7	A2		I ² C Device Address Bit (Internal 10kΩ pull-up to 3.3V)							
8	CANH		CAN Bus Communication using CANopen protocol							
9	RS485_Y		RS485 Differential Serial Bus Communication							
10	CANL		CAN Bus Communication using CANopen protocol							
11	RS485_Z		RS485 Differential Serial Bus Communication							
12	SGND		Signal Return							
13	UART_RX / RS232_RX/RS485_A		RS485 Differential Serial Bus Communication or RS232 Serial Bus Communication or UART							
14	I ² C SDA		l²C (Internal 10kΩ pull-up to 3.3V)							
15	UART_TX / RS232_TX/RS485_B		RS485 Differential Serial Bus Communication or RS232 Serial Bus Communication or UART							
16	I ² C SCL		I ² C Bus Clock (Internal 10kΩ pull-up to 3.3V)							
17	FAN_FAIL/TEMP WARNING		Fan Failure/Temp Warning Reporting (High means fan fails and/or overtemperature rating; 10k Ω pull up to 3.3V) See circuit diagram on page 7.							
18	SYNC		Connect parallel units to synchronise output turn on							
19	VPROG		0 to 5V to set Vout from 0 to 105% ⁽¹⁾ (50.8kΩ internal resistance between Vprog and SGND ⁽²⁾)							
20	RS+		Postive Remote Sense							
21	RS-		Negative Remote Sense							
22	IPROG		0 to 5V to set Current Limit from 0 to110% of rated current ⁽¹⁾ (50.8kΩ internal resistance between Iprog and SGND)							
23	ISHARE		0 to 2.6V for current sharing of units in parallel							
24	PMBUS_EN		Selecting Digital (open) or Analog (low) mode for VPROG & IPROG (Internal 10kΩ pull up to 3.3V)							
25	ACOK	Collector	See circuit diagram on page 7.							
26	ACOK Return	Emitter	Uncommitted opto-isolator. Circuit conducting means AC is within range.							
27	5VSBY		5V/2A Standby							
28	5VSBY		5V/2A Standby							
29	5VSBY_RTN		5V/2A Standby Return							
30	5VSBY_RTN		5V/2A Standby Return							

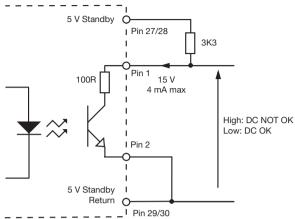
- 1. In analog mode, the default Vout & lout settings are 0% when Vprog & Iprog are open circuit.
- $2. \ To \ activate \ analog \ mode, PMBus_EN \ must \ be \ pulled \ down \ to \ SGND. \ Default \ if \ left \ open \ is \ digital \ programming.$



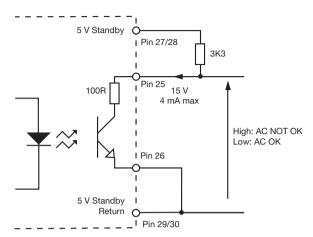


Signals & controls

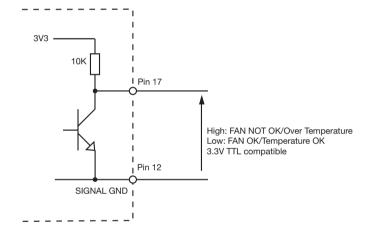




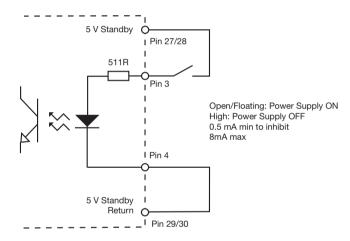
AC OK



Fan fail/Temperature warning



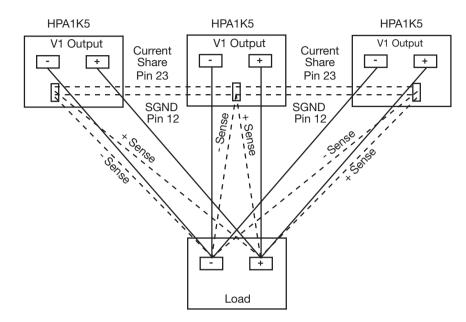
Inhibit





Signals & controls

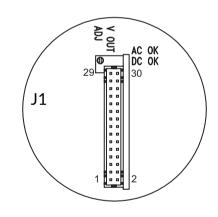
Current share



Up to 5 x HPA1K5 units

To synchronise output turn on from application of AC input, connect SYNC (pin 18) of parallel units together.

LED signals

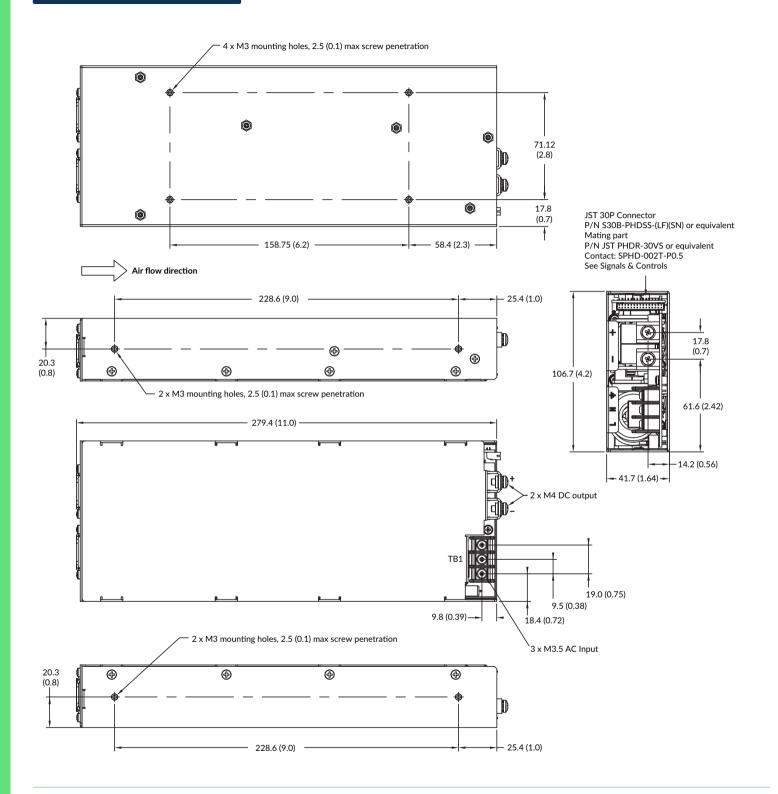


C 1111	LI	ED state		S	Signals			
Conditions	AC OK	DC OK	AC OK	рс ок	FAN_FAIL/ TEMP	Remote inhibit		
AC input OK	ON	ON ⁽³⁾	LOW	LOW	LOW	LOW		
AC not present or too low	OFF	OFF	HIGH	HIGH	LOW	X ⁽²⁾		
AC present but out of range or PFC failure or no primary to secondary communication	Blink (0.2s ON, 0.2s OFF)	OFF	HIGH	HIGH	LOW	X ⁽²⁾		
Output over voltage	ON	OFF	LOW	HIGH	LOW	LOW		
Current limit (Constant current response)	ON	Blink (0.2s ON, 0.2s OFF)	LOW	LOW or HIGH(3)	LOW	LOW		
Fan failure/Thermal shutdown	ON	OFF	LOW	HIGH	HIGH ⁽¹⁾	LOW		
Remote OFF	ON	Blink (1.0s ON, 1.0s OFF)	LOW	HIGH	LOW	HIGH		
PMBus operation OFF	ON	Blink (1.0s ON, 1.0s OFF)	LOW	HIGH	LOW	LOW		

- 1. In case of fan failure, and/or overtemperature, FAN_FAIL/Temp Warning signal will be set 10s before output shutdown.
- 2. Don't care / not applicable.
- 3. DC_OK LED is ON if Output Voltage >= VOUT_UV_FAULT_LIMIT, if Output Voltage < VOUT_UV_FAULT_LIMIT, the DC_OK LED will be OFF



Mechanical details



- 1. In case of fan failure, and/or overtemperature, FAN_FAIL/Temp Warning signal will be set 10s before output shutdown.
- 2. Don't care / not applicable
- $3.\ DC_OK\ LED\ is\ ON\ if\ Output\ Voltage >= VOUT_UV_FAULT_LIMIT,\ if\ Output\ Voltage < VOUT_UV_FAULT_LIMIT,\ the\ DC_OK\ LED\ will\ be\ OFF$