

5000W FAN COOLED

AC-DC POWER SUPPLIES

The HPT5K0 series offers ultimate flexibility with both output voltage and output current programming and user defined signals, warnings and alarms. Programming is via voltage, I²C PMBus, RS485 and CANopen in a very high efficiency, high power density 5 kW chassis mount package. Options are available for RS232 or UART. The HPT5K0 can be used in both constant voltage and constant current operation.

Measuring just 13.0" x 5.0" x 5.0", the HPT5K0 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

- 3 phase 180 to 528 VAC input - 3 wire & earth
- High efficiency - up to 94%
- Programmable output voltage (0-105%)
- Programmable output current (0-110%)
- Parallel operation
- Analog & digital interfaces
- Multiple digital protocols - PMBus, CANopen, MODBUS & SCPI
- Fully featured signals & controls
- 5V/2A standby output
- Graphical User Interface (GUI)
- 3 Year Warranty

Models & Ratings

Model Number ^(2,3)	Max Output Power	Output Voltage V1			Output Current		Efficiency ⁽¹⁾
		Minimum	Nominal	Maximum	Minimum	Maximum	
HPT5K0TS048	5000W	0VDC	48VDC	50.4VDC	0.0A	104.0A	93%
HPT5K0TS060	5000W	0VDC	60VDC	63VDC	0.0A	83.3A	93%
HPT5K0TS100	5000W	0VDC	100VDC	105VDC	0.0A	50.0A	93%
HPT5K0TS200	5000W	0VDC	200VDC	210VDC	0.0A	25.0A	93%

Notes:

1. Measured with 480 VAC input and full load.
2. 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.
3. For medical applications with 4000 VAC isolation test add suffix -M. Installation Class 3 surge only.
4. USB interface available to enable RS485 and RS232 communication with GUI, part number XP PS MANAGER INT.

Applications



Industrial Electronics



Healthcare



Technology



Semiconductor Manufacturing

Dimensions

HPT5K0:

13.00 x 5.00 x 5.00 in (330.2 x 127.0 x 127.0 mm)

Input

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage	180		264	VAC	3 kW output power max, 3 wire & earth
	342		528		5 kW output power max, 3 wire & earth
			580		For 5 s
Input Frequency	47		63	Hz	
Power Factor		0.96			Complies with EN61000-3-2 for Class A
Input Current			10/11	A	Per phase, 342 VAC (5 kW)/180 VAC (3 kW)
Inrush Current			60	A	Per phase, 528 VAC (5 kW)
Earth Leakage Current			1.0	mA	528 VAC/60 Hz
			3.3		528 VAC/60 Hz, single fault
Input Protection	F16A / 500V fuse fitted in each phase				
Loss of Phase	Shut down after 0.5s, auto-recovery				

Output

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage	0		210	VDC	See Models and Ratings table
Output Set Tolerance		±0.5		%	Nominal voltage irrespective of set voltage.
+5 V Standby Tolerance		±3		%	5V/2A Standby
Output Voltage Program	0		105	%	Of nominal, slew rate <40 ms 10-105% & 105-10%. Max frequency of voltage program is 0.5 Hz 0-5% load, 0.67 Hz 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			A	No minimum load required
Start Up Delay		1.8	2	s	Under all load and line conditions
Start Up Rise Time			40	ms	
Hold Up Time	20	22		ms	380 VAC at 5000 W and 25 °C
	40	44			180 VAC at 3000 W and 25 °C
Line Regulation			±0.5	%	Of nominal voltage
			±0.5		5V Standby
Load Regulation			1	%	0-100% or 100-0% load
			2		5V Standby
Transient Response			3	%	Deviation with a 50-75-50% load change. Output returns to within 1% in less than 500 µs
Ripple & Noise			1/2.5	%	Of nominal voltage/5V Standby. Measured with 20 MHz 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 thermal protection				
Overload Protection			±3	% of max load	Set current limit point. Constant current characteristics. Max current limit is 108% ±3% of maximum rated current. For low line (180-264 VAC), constant power characteristic set at 3.4 kW until current limit point is reached. 5V Standby: <5 A max
Temperature Coefficient			0.03 of max load	%/°C	
Short Circuit Protection	Constant current characteristics. 5V Standby: Foldback characteristic < 5 A max.				
Remote Sense	Compensates for 1% max of nominal voltage per lead, 2% of total nominal voltage drop. Not fitted on HPT5K0TS200				

General

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	93	94		%	Measured from 342 to 528 VAC, 5V Standby at full load.
Isolation: Input to Output	4000			VAC	2 x MOPP. Barrier only(1)
Input to Ground	1500			VAC	1 x MOPP
Output to Ground	500			VDC	
Switching Frequency	55	60	65	kHz	Fixed frequency PFC
	40		250	kHz	Variable frequency main converter
Power Density			15.38	W/in ³	
Signals and Controls	V Program, I Program, AC OK, DC OK, Fan Fail/Temperature Warning, Sync, PMBus, Inhibit, Current Share.				
MTBF		450		kHrs	Telecordia 332, 25°C
Weight		12.5 (5.7)		lb (kg)	

1. For test at 4000 VAC, GDTs must be removed. -M versions available with installation Class 3 surge only. See models and ratings table..

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
Operating Altitude			3000	m	Medical
			5000		ITE
Transport Altitude			10000	m	
Shock	±3 x 30 g shocks in each plane, total 18 shocks. 30 g = 11 ms (±0.5 ms) half sine. Conforms to EN60068-2-27 & EN60068-2-47				
Vibration	Single axis 10-500 Hz at 2 g sweep and endurance at resonance in all 3 planes. Conforms to EN60068-2-6				
Acoustic Noise	< 70 db(A) Lw				

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 operating mode. IProg accuracy ±3% of maximum rating.
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, 2 ms warning time
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 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 "HPT5K0 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, Iout monitor accuracy is ±3% of full load, Iout 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 Iout settings are 0% when open circuit.

(2) To activate analog mode, PMBus_EN (pin 24) must be pulled down to SGND or 5VSBY return. Default when open is digital programming.

EMC: Emissions

Phenomenon	Standard	Test Level	Notes & Conditions
Conducted	EN55011/EN55032	Class B	
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	A	±8 kV contact / ±15 kV air discharge
Radiated Immunity	EN61000-4-3	3	A	
EFT/Burst	EN61000-4-4	3	A	
Surge	EN61000-4-5	Installation class 4	A	
Conducted	EN61000-4-6	3	A	
Magnetic Field	EN61000-4-8	4	A	
Dips and Interruptions	EN61000-4-11 (200/380 VAC)	Dip 100% (0 VAC), 8.4ms	A	
		Dip 100% (0 VAC), 16.7ms	A	
		Dip 60% (80/152 VAC), 200ms	A	
		Dip 30% (140/266 VAC), 500ms	A	
		Dip 20% (160/304 VAC), 5000ms	B	
		Int 100% (0 VAC), 5000ms	B	
	EN61000-4-11 (240/480 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (96/192 VAC), 200ms	A	
		Dip 30% (168/336 VAC), 500ms	A	
		Dip 20% (192/384 VAC), 5000ms	B	
		Int 100% (0 VAC), 5000ms	B	
	EN60601-1-2 (200/380 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (80/152 VAC), 100ms	A	
		Dip 30% (140/266 VAC), 500ms	A	
		Int 100% (0 VAC), 5000ms	B	
	EN60601-1-2 (240/480 VAC)	Dip 100% (0 VAC), 10ms	A	
		Dip 100% (0 VAC), 20ms	A	
		Dip 60% (96/192 VAC), 100ms	A	
Dip 30% (168/336 VAC), 500ms		A		
Int 100% (0 VAC), 5000ms		B		
SEMI F47 (200/380 VAC)	Dip 22% (156/296 VAC), 1000ms	A		
	Dip 33% (134/254 VAC), 500ms	A		
	Dip 55% (90/171 VAC), 200ms	A		

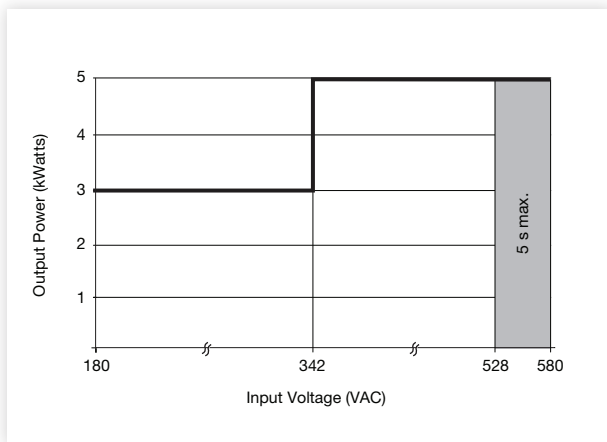
Safety Approvals

Safety Agency	Safety Standard	Notes & Conditions
CB Report	IEC62368-1 Ed 2	Information Technology
	IEC60601-1 Ed 3 Including Risk Management	Medical
UL	UL62368-1, CSA 22.2 No.62368-1, UL60950-1	Information Technology
	ANSI/AAMI ES60601-1:2005 & CSA C22.2, No.60601-1:08	Medical
TUV	EN62368-1	Information Technology
	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

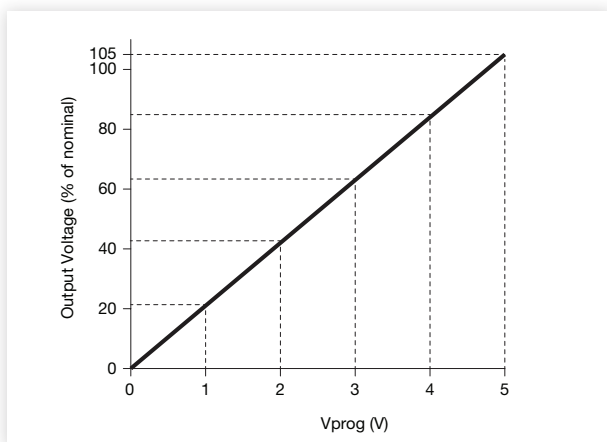
Means of Protection		Notes & Conditions
Primary to Secondary	2 x MOPP (Means of Patient Protection)	IEC60601-1 Ed 3
Primary to Earth	1 x MOPP (Means of Patient Protection)	
Secondary to Earth	N/A	

Applications Notes

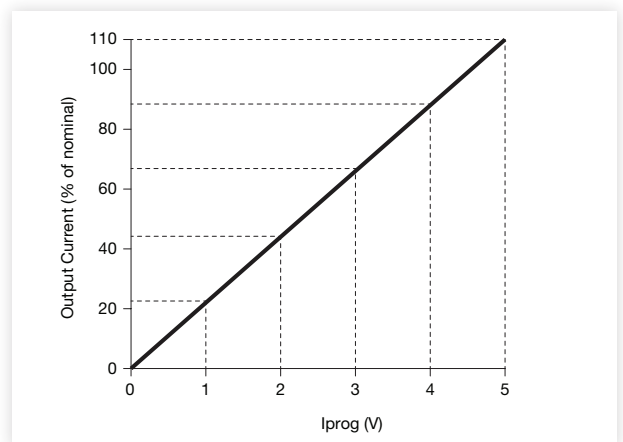
Input Derating



Output Voltage Programming

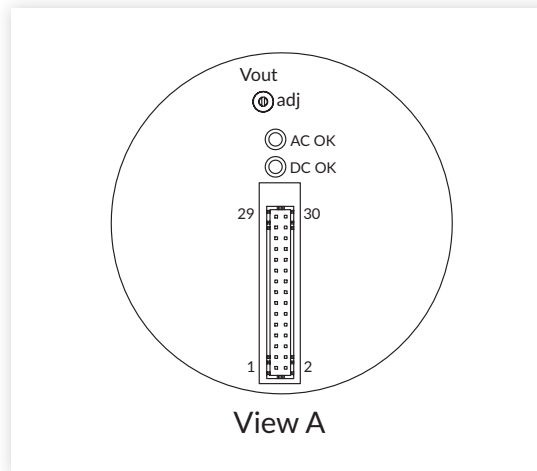


Output Current Programming



Signals & Controls

Signal Connections



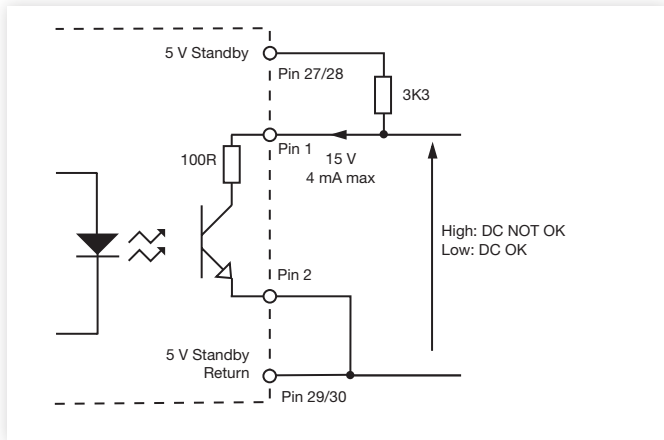
J1 Signal Connector Connections		
Pin	Function	Description
1	DCOK	Low means Vout is within range (Opto Isolated; Open Collector)
2	DCOK Return	Return for DCOK (Opto Isolated)
3	Remote Inhibit	High to Inhibit - uncommitted opto diode
4	Remote Inhibit Return	Return for Inhibit - uncommitted opto diode
5	A0	I ² C Device Address Bit (10k Ω pull up to 3.3V)
6	A1	I ² C Device Address Bit (10k Ω pull up to 3.3V)
7	A2	I ² C Device Address Bit (10k Ω 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	I ² C (10k Ω 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 (10k Ω 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)
18	SYNC	Connect parallel units to synchronise output turn on
19	VPROG	0 - 5V to set Vout from 0 to 105%(1) (50.8k Ω discharge resistor to SGND (2))
20	RS+	Postive Remote Sense (HPT5K0TS048, HPT5K0TS060 and HPT5K0TS100 only)
21	RS-	Negative Remote Sense (HPT5K0TS048, HPT5K0TS060 and HPT5K0TS100 only)
22	IPROG	0 - 5V to set Current Limit from 0 - 110% of rated current(1) (50.8k Ω discharge resistor to SGND (2))
23	ISHARE	0 - 2.6V for current sharing of units in parallel
24	PMBUS_EN	Selecting Digital (open) or Analog (low) mode for VPROG & IPROG (10k Ω pull up to 3.3V)
25	ACOK	Low means AC is within range operating range (Opto Isolated; Open Collector)
26	ACOK Return	Return for ACOK (Opto isolated)
27	5VSBY	5V/2A Standby
28	5VSBY	5V/2A Standby
29	5VSBY_RTN	5V/2A Standby
30	5VSBY_RTN	5V/2A Standby

Notes:

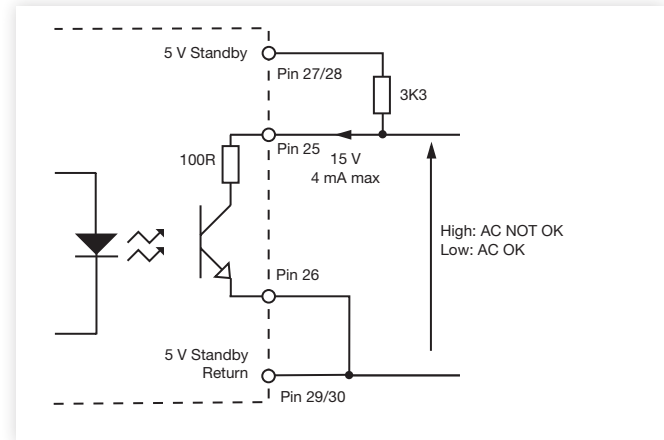
1. In analog mode, the default Vout & Iout settings are 0% when Vprog & Iprog are open circuit.
2. To activate analog mode, PMBus_EN must be pulled down to SGND or 5VSBY return. Default if left open is digital programming.

Signals & Controls

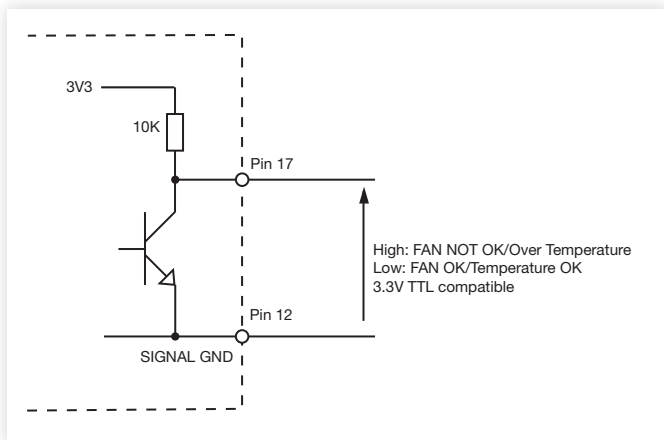
DC OK



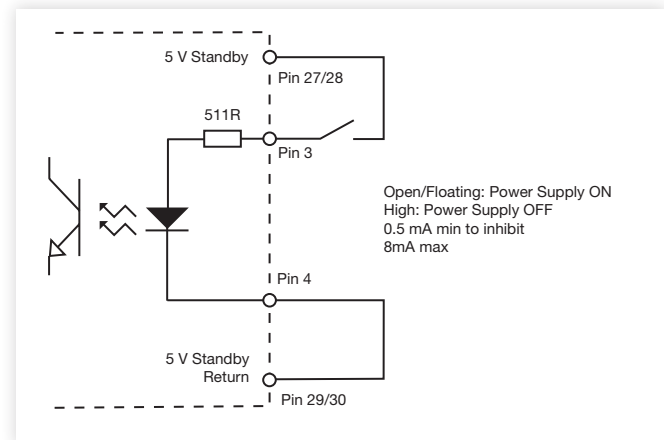
AC OK



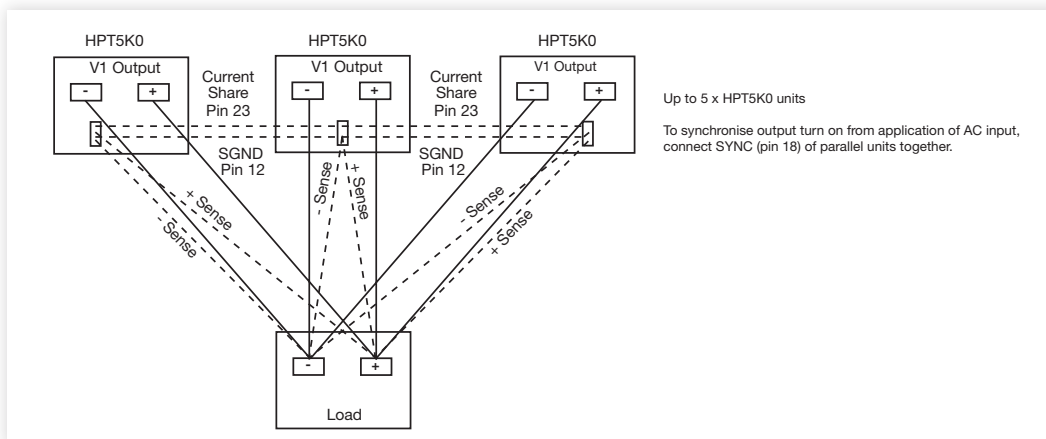
Fan Fail/Temperature Warning



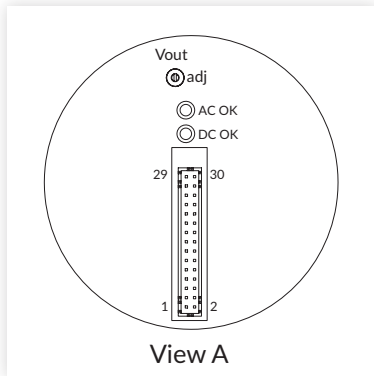
Inhibit



Current Share



LED Signals

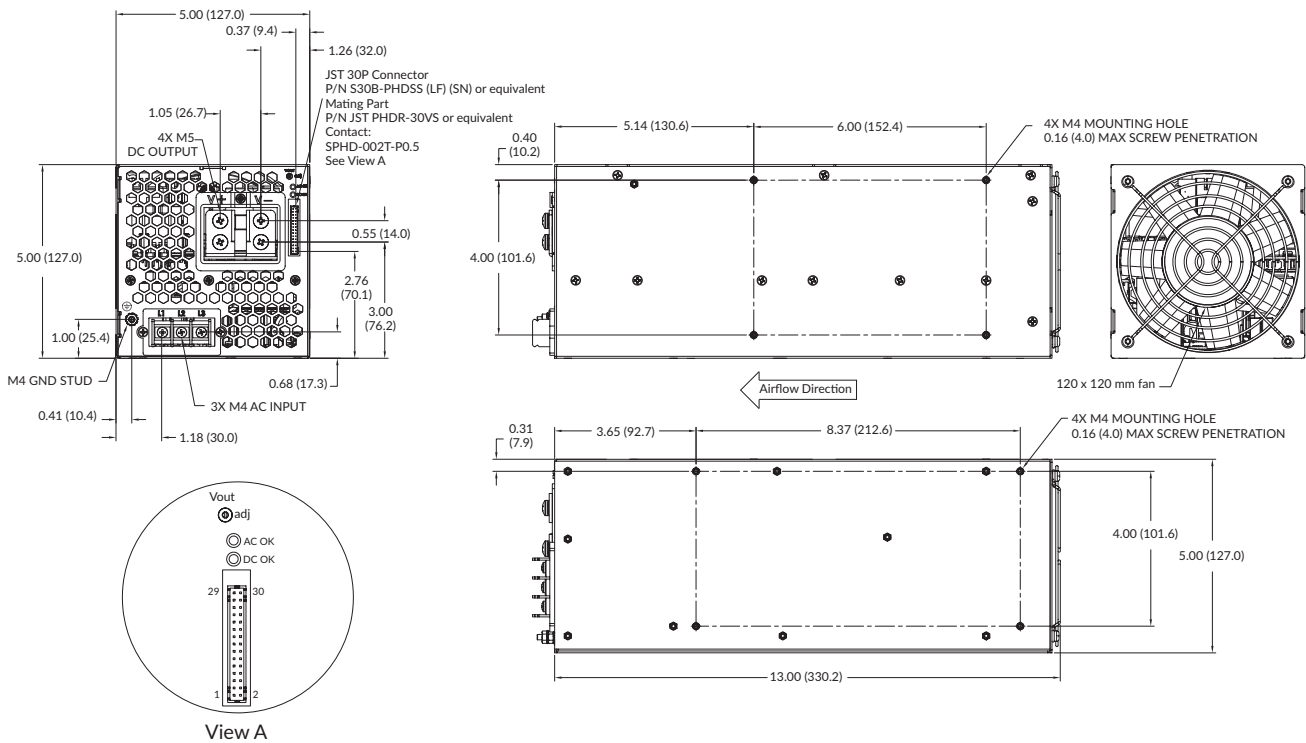


Conditions	LED State		Signals			
	AC OK	DC OK	AC OK	DC OK	FAN_FAIL/TEMP	Remote Inhibit
AC input OK	ON	ON ⁽²⁾	LOW	LOW	LOW	LOW
AC not present or too low	OFF	OFF	HIGH	HIGH	LOW	X ⁽²⁾
AC Present but out of range or PFC failure or no Primary to secondary communication	Blink (0.2s ON, 0.2s OFF)	OFF	HIGH	HIGH	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 ⁽²⁾	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

Notes:

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

Mechanical Details



Notes:

- All dimensions are in inches (mm).
- Weight 12.5 lb (5.7 kg)
- Signal Connector: P/N JST S30B-PHDSS (LF) (SN) or equivalent
Mates with P/N JST PHDR-30VS or equivalent
Contact: SPHD-002T-P0.5