PowerDirect 3000
5.5kW Power Supply Unit (PSU)

User Manual

Specification Number: 1R505500V3
Model Number: R50-5500V3

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/support/ for additional assistance.

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Admonishments Used in this Document

DANGER! Warns of a hazard the reader ***will*** be exposed to that will ***likely*** result in death or serious injury if not avoided. (ANSI, OSHA)

WARNING! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)

CAUTION! Warns of a potential hazard the reader ***may*** be exposed to that ***could*** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)

ALERT! Alerts the reader to an action that ***must be avoided*** in order to protect equipment, software, data, or service. (ISO)

ALERT! Alerts the reader to an action that ***must be performed*** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)

FIRE SAFETY! Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)

SAFETY! Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

Important Safety Instructions

Safety Admonishments Definitions

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page iv.

General Safety

DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.
Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

a) The tasks should be performed in the order indicated.

b) Remove watches, rings, and other metal objects.

c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present. Check for voltage with both DC voltmeters prior to making contact.

d) Wear eye protection.

e) Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed.

Voltages

AC Input Voltages

DANGER! This system operates from AC input voltage capable of producing fatal electrical shock.

DC Output and Battery Voltages

DANGER! This system produces DC power. Although the DC voltage is not hazardously high, the Power Supply Units can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or exposed wire connected to an output terminal. NEVER allow a metal object, such as a tool, to contact more than one terminal at a time, or to simultaneously contact a terminal and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.

Hazardous Voltage

DANGER! HAZARD OF ELECTRICAL SHOCK.
More than one disconnect may be required to de-energize the system before servicing.

Handling Equipment Containing Static Sensitive Components

ALERT! Installation or removal of equipment containing static sensitive components requires careful handling. Before handling any equipment containing static sensitive components, read and follow the instructions contained on the Static Warning Page.

Static Warning

This equipment contains static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any equipment containing static sensitive components, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch traces or components on equipment containing static sensitive components. Handle equipment containing static sensitive components only by the edges that do not have connector pads.
4. After removing equipment containing static sensitive components, place the equipment only on static dissipative surfaces such as conductive foam or ESD bag. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship equipment containing static sensitive components only in static shielding containers.
6. If necessary to repair equipment containing static sensitive components, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

1 Introduction

1.1 Overview

The R50-5500V3 Power Supply Unit provides load power during normal operating conditions. The Power Supply Unit is rated at its maximum output power 5500W. This means that, within the normal operating ambient temperature range and input voltage range, the maximum available output power is 5500W. If ambient temperature rises above or input voltage falls below specified values, the Power Supply Unit continues to operate but at derated output power levels.

The default DC output voltage of the Power Supply Unit is fixed at 50V @NL and 49V@FL while in normal operation. It supplies rated power for the entire range of DC output voltage.

1.2 Specifications

1.2.1 AC input Ratings

- AC input: 180Vac~305Vac.

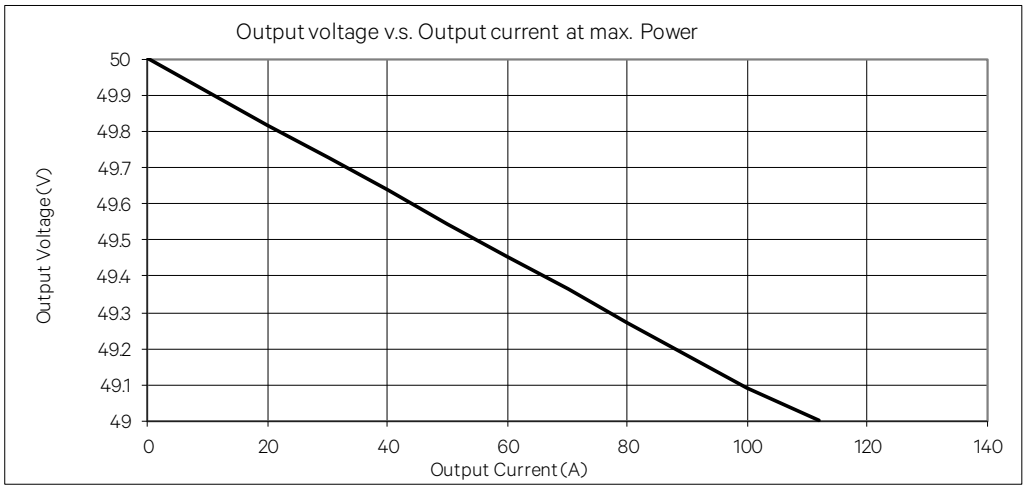
1.2.2 DC Output Ratings

- Voltage: The default DC output voltage of the Power Supply Unit is fixed at 50 V @NL and 49 V@FL while in normal operation., negative ground. The Power Supply Unit output voltage set point is adjustable from 48 V to 51 V.
- Output Power and Current: 5500W 180 Vac~ 305Vac nominal input and +49VDC output.

  Output voltage 50V@ rated current 112.25A and 12Vsb @ rated current 1/A.

  Output Characteristics: Refer to **Figure 1.1** for a graph of output voltage vs. output current.

Figure 1.1 Output Voltage vs. Output Current



- The Power Supply Unit is capable of supplying full rated output power over a single-phase input voltage range of 180V AC -305V AC, frequency of 47 Hz -63 Hz. The relationship between the output power and input voltage is illustrated in **Figure 1.2.**

Figure 1.2 Power Based on Input Voltage at Temp≤45°C and Vo =50V from 180Vac to 305Vac

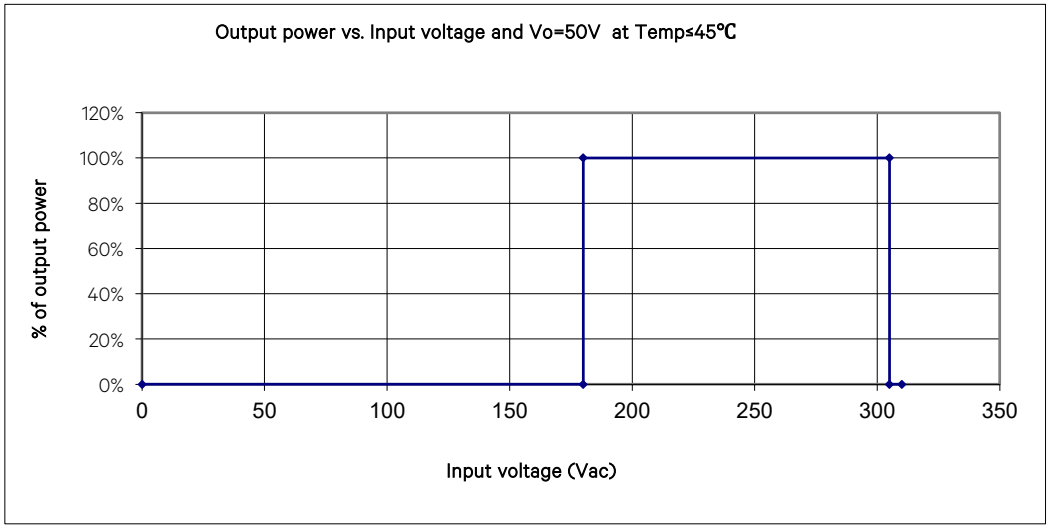
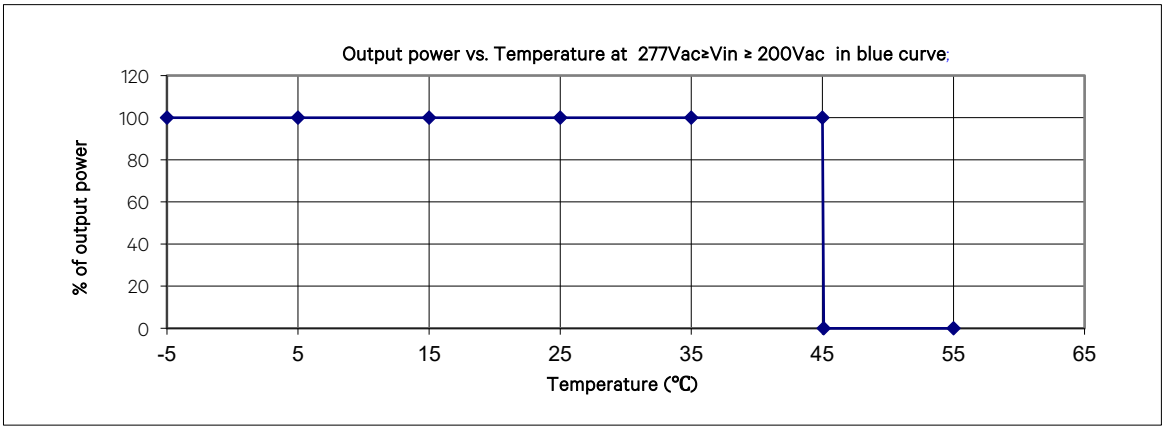


Table 1.1 Input Characteristics

Parameter	Notes	Description			Units
		Min	Nominal	Max	
Vin Operating Range	5500W	180	200~277	305	Vac
Frequency Operating Range		47	50,60	63	Hz
UVLO Brown In Threshold			176±3		Vac
UVLO Brown Out Threshold	10s delay		167 ±3		Vac
UVLO Brown Out Threshold	1.6s delay		150 ±3		Vac
OVLO Brown In Threshold			309 ±3		Vac
OVLO Brown Out Threshold	50 ms		313 ±3		Vac

The PSU includes a soft-start that promptly resets at any input AC loss > 20 ms, or after any protection conditions.
For brown-in/brown-out functionality, the power supply includes input-voltage hysteresis to prevent output-voltage chatter during startup or shutdown.

Figure 1.3 Power Derating Based on Temperature



NOTE! *5500W @ +45°C (+113°F) and 180Vac < Vin <305Vac*

- Regulation:

  a) Static: The Power Supply Unit droop voltage (0%-100%) shall be 1V by default (with the tolerance of ± 0.125V). That means output voltage is 49V at 100% load and 50V at no-load.

  b) Dynamic: 50V output Under the testing conditions in the DC output voltage shall not vary by more than specified deviation for undershoot and overshoot with a 3 ms settling time.

Table 1.2 Dynamic Response

Step load increase or decrease	Frequency	Transient load rate	Max undershoot and overshoot
50% step load (10% min. load)	Up to 10kHz	1 A/uSec	0.5V
90% step load (10% min. load)	Up to 10kHz	1 A/uSec	1V
140% step load (10% min. load)	Up to 10kHz	1 A/uSec	1.5V
50% step load(10% min. load)	Up to 10kHz	6 A/uSec	0.5V
90% step load (10% min. load)	Up to 10kHz	6 A/uSec	1V
140% step load(10% min. load)	Up to 10kHz	6 A/uSec	1.5V

  c) EDPP: The power supply unit (PSU) is capable of supporting the following peak loads while maintaining output within the defined output regulation and without triggering overcurrent protection. This sequence of loading can occur repeatedly, provided the average power over 1 second does not exceed the rated output power.

NOTE! *The below peak power ratings can repeat in any possible timing interval that still gives a 1-second average of 100% loading.*

≤180%, ≤0.5 ms;

≤150%, ≤50 ms;

100%, continuous

d) Filtering:

The DC output voltage +50V ripple and noise is ≤ 500 mV peak to peak; the DC output voltage +12Vsb ripple and noise is ≤ 120 mV peak to peak; the rated input voltage range: Minimum load - maximum load. Operating temperature range. Measurements is made with a 20 MHz oscilloscope bandwidth setting and a 0.1 μF ceramic capacitor and 10 μF solid-state capacitor across the busbar connector as the point of measurement.

1.2.3 AC Input Ratings

- Voltage:

  Operating range of 180 Vac to 305 Vac, single phase, 50/60 Hz. Acceptable input frequency range is 47 Hz to 63 Hz.

- Harmonic Content (iTHD): 15% for 5% to 10% load, ≤10% for 10% to 30% load, ≤5% for 30% to 100% load at input voltage of 208~277V for 50Hz,60Hz and at 25°C.

- Inrush Current: Maximum AC inrush current from cold power-on shall be limited to no greater than 80A peak at any AC operating voltage and a temperature of 25 °C. This specified inrush current shall not include the X-Capacitors charging. Under the above conditions, standard AC distribution circuit breakers will not trip.

- Typical Input Data:

  e) Refer to **Table 1.3**.

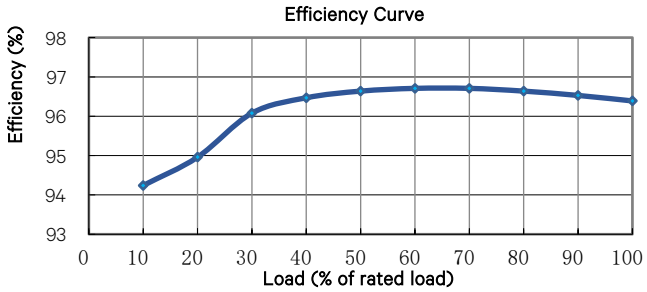
  f) Typical Input Current: Refer to **Table 1.3**.

Table 1.3 Typical Input Data in 208Vac / 230Vac / 240Vac/ 277Vac Input at 50HZ

NOMINAL INPUT VOLTAGE	PERCENT OF FULL LOAD	INPUT CURRENT (AMPERES)	INPUT POWER (WATTS)	EFFICIENCY %	POWER FACTOR	HEAT DISSIPATION (BTU/HR)
208 Vac	10%	2.86	591.3	93.84%	0.993	124.27
	20%	5.58	1156.2	94.73%	0.997	207.89
	30%	8.29	1723.4	95.78%	0.999	248.13
	40%	11.02	2289.6	96.09%	0.999	305.44
	50%	13.73	2852.5	96.29%	0.999	361.06
	60%	16.48	3424.6	96.30%	0.999	432.31
	70%	19.22	3993.0	96.23%	0.999	513.60
	80%	21.96	4563.6	96.09%	0.999	608.79
	90%	24.71	5135.4	95.90%	0.999	718.36
	100%	27.48	5710.5	95.64%	0.999	849.46
230 Vac	10%	2.59	590.9	94.09%	0.993	119.15
	20%	5.03	1154.0	94.73%	0.997	207.49
	30%	7.50	1721.1	95.85%	0.998	243.69
	40%	9.95	2286.6	96.20%	0.999	296.45
	50%	12.42	2853.2	96.61%	0.999	330.00
	60%	14.88	3418.8	96.46%	0.999	412.92
	70%	17.34	3984.7	96.42%	0.999	486.70
	80%	19.81	4551.7	96.36%	0.999	565.27
	90%	22.35	5134.6	96.17%	0.999	670.95
	100%	24.78	5693.4	95.97%	0.999	782.82
240 Vac	10%	2.48	592.1	94.15%	0.993	118.18
	20%	4.83	1154.8	94.81%	0.997	204.48
	30%	7.19	1721.4	95.93%	0.998	239.03
	40%	9.53	2285.7	96.30%	0.999	288.54
	50%	11.90	2852.4	96.68%	0.999	323.10
	60%	14.25	3417.7	96.52%	0.999	405.79
	70%	16.61	3983.3	96.49%	0.999	477.02
	80%	18.98	4549.8	96.41%	0.999	557.28
	90%	21.40	5131.9	96.28%	0.999	651.34
	100%	23.73	5689.3	96.09%	0.999	758.96
277 Vac	10%	2.16	590.5	94.24%	0.987	116.05
	20%	4.18	1153.1	94.96%	0.995	198.28
	30%	6.22	1719.5	96.08%	0.998	229.97
	40%	8.25	2282.5	96.47%	0.999	274.90
	50%	10.29	2847.6	96.64%	0.999	326.44
	60%	12.32	3409.1	96.71%	0.999	382.67
	70%	14.36	3974.2	96.71%	0.999	446.10
	80%	16.41	4539.8	96.64%	0.999	520.43
	90%	18.51	5121.0	96.53%	0.999	606.27
	100%	20.51	5676.4	96.39%	0.999	699.14

- Efficiency Curve: (Refer to **Figure 1.4**)

Figure 1.4 Efficiency Curve (277Vac Input at 50HZ)



1.2.4 Environmental Ratings:

- Operating Ambient Temperature Range:

  -5°C (23°F) to +45°C (+113°F) with full power performance.

  The Ambient Temperature above +45°C (+113°F), the PSU will shut down.

- Storage Ambient Temperature Range: -40°C (-40°F) to +85°C (+185°F).

- Relative Humidity:

  Operational: 0-85% RH non-condensing

  Non-operational: 0-95% RH non-condensing

- Altitude: 3080 m (10000 ft) at full power (power limited for heights above 3080m).

- Ventilation Requirements: The Power Supply Units are fan-cooled and utilize front-to-back forced ventilation. A Power Supply Unit must be mounted so that ventilating openings are not blocked and the temperature of the air entering the Power Supply Unit does not exceed the Operating Ambient Temperature Range stated above.

- Single Power Supply Unit Audible Noise: ≤85dBA when fan modules are running at full speed and operating within the defined environmental envelope.

- High Voltage Category: II.

- Power Distribution System: TN/TT/IT.

NOTE! *The Power Supply Unit module is recommended to be used in an environment with Pollution of Degree 2 or less. Pollution Degree 2 applies where there is only non-conductive pollution that might temporarily become conductive due to occasional condensation (such as the office environment).*

EMI/RFI Suppression: Power Supply Units operating in an approved Power Supply Unit mounting shelf conform to the requirements of European Norm, EN55032, Class A for Radiated and Conducted emissions limits.

1.2.5 Compliance Information

- EMC: The power shelf shall have minimum 6dB margin from the EN 55032 FCC Class A limit for the radiated and conducted emissions.

- Surge Protection: Compliance with EN61000-4-5 , Criteria A (AC Power Line: >2kV (Line-to-line), >4kV (Line-to-earth); Signal Port: >1kV). Common mode voltage 2.0KV/differential mode voltage 1.0KV.

NOTE! *This level of protection is a widely used standard for power equipment. As with all such equipment, it is the end user's responsibility to provide an adequately sized Surge Suppression Device at the commercial power service entrance of the building that reduces all incoming surges to levels below the classes/categories stated for the equipment.*

- Safety: UL 62368-1 C22.2 NO. 62368-1, EN 62368-1, IEC 62368-1.

1.2.6 Transition and Synchronization Requirements

- Start-up (0V to 50V) Transition procedure

  Each PSU has a small circuit to output a SYNC_START signal and all PSUs' SYNC_START signals are connected together on the power shelf backplane.

  1)Each PSU sets its SYNC_START signal to high when the PSU is ready to turn on the output.

  2)Only PSU in SLOT #1 generates a random timer and set SYNC_START to high when ready and the random timer is finished.

  3)The PSUs will turn on the output when the SYNC_START signal is high.

  4)If the SYNC_START signal is kept low for 3s more than the max random timer limit (which is 2s without BBU and 5.5s with BBU), the PSU shall turn on immediately.

  5)If PSU1 is not installed or its SYNC_START signal is low, the other PSUs shall turn on within 10s. In this case a random timer doesn't exist.

1.2.7 Hold-up Time

Hold-up time at different voltages is given in the table below.

Table 1.4 On-off sequence and holdup time

Load Power	Hold-up Time (ms)	Min.	Max.	Unit
T_vstby_holdup	Time the +12VSB output voltage remains within regulation after AC loss.	1000		ms
T_Vout_holdup	Time from AC loss to the output voltage reaching 45V.	23		ms

1.2.8 AC_Loss

The AC_Loss signal is an output signal that is driven high by the power supply to indicate that the AC input voltage is within the normal operating range. Assert the signal to a low level within 5 milliseconds after the loss of input voltage.

It can drive the output below 0.4V with a load of 4 mA. See AC_LOSS_N Signal Characteristics Table below.

Table 1.5 AC_LOSS_N Signal Characteristics

AC_LOSS_N Signal Characteristics		
Signal Type: Output signal from the power supply	Pull-up 10kΩ to 3.3V located in the power supply	
AC_LOSS_N = Low	AC Low (Not OK)	
	MIN	MAX
Logic level low voltage, Isink = 4mA	0V	0.4V
Logic level high voltage, Isource = 200μA	2.4V	3.4V
Input Sink current, AC_LOSS_N = Low	4mA	
Output Source current, AC_LOSS_N = High		80μA
AC_LOSS_N rise and fall time (w/o decoupling cap)		100μS

1.2.9 Forced Discharge Mode

The rack monitor can send PMbus commands to Power Supply Units (PSUs) to toggle the AC_Loss_N signal. This action ensures that the Battery Backup Unit (BBU) will discharge even when AC power is present.

1.2.10 Power Supply Unit Physical Addressing

Three Power Supply Unit signal pins are used for the slot physical addressing. There are digital signals that have internal pull up resistors inside the Power Supply Unit. On the power shelf, these pins are grounded (0) or left open (1) to determine Power Supply Unit location as below:

Power Supply Unit slot location PSU0: 000

Power Supply Unit slot location PSU1: 001

Power Supply Unit slot location PSU2: 010

Power Supply Unit slot location PSU3: 011

Power Supply Unit slot location PSU4: 100

Power Supply Unit slot location PSU5: 101

1.2.11 Black Box Function

The black box function stores important data when a fault occurs:

- The black box stores data in memory and be able to withstand several read/write cycles.
- The PSU is able to store failure data before the PSU turns off/fails even in catastrophic failure events both on primary and secondary side. Hold up time of the Blackbox microcontroller is able to store all the information and then shutdown.
- Last 4 events stored in memory.
- AC input current, AC input voltage, Input Power, Power factor, iTHD, DC output voltage, DC output current,
- Temperature readings, fan Speed, input voltage, output voltage, bulk voltage, various error codes from all the different converters (OTP, OVP, OCP, UVP), and warnings.
- Total run time of PSU
- Run time since last turn on
- Real time stamping
- Number of AC power cycles
- Number of AC outages (can be determined by going into backup without counting the battery test conditions)

Power supply event data is saved to the Black Box for the following events:

Any events that caused the Main Output to shut down:

- Main Output over voltage fault
- Main Output under voltage fault
- Main Output over current fault
- Main Output short circuit fault
- Fan failure
- Over temperature fault

Any events that caused the AC input to be bad:

- AC Input under voltage fault

- AC Input over voltage fault
- AC Input out of range frequency fault

1.2.12 Signal Detection and Accuracy Requirements

- Sensor Accuracy

  For discrete and critical sensors (such as ambient temperature), an accuracy of ±2 °C is required (≤±1 °C is preferred). If a component does not have an integrated temperature sensor and uses a proxy, it needs to target an accuracy of ≤±5 °C (≤±2 °C is preferred). If this component is temperature sensitive, the thermal margin requirements defined above should account for sensor inaccuracy.

Table 1.6 Reporting Accuracy Table

Parameter	Load	Accuracy
AC Input Power	<10%	±25W
	10% to 20%	±5%
	20% to 100%	±3%
AC Input Current	<15%	±0.5A or ±5%
	15% to 30%	±5%
	30% to 100%	±3%
AC Input Voltage	0-100%	±2%
DC Output Voltage	0-100%	±2%
DC Output Current	10-20%	±10%
	20-50%	±5%
	50-100%	±2%
DC Output Power	<10%	±25W
	10-20%	±3%
	20-100%	±2%
Inlet Temperatures		±2°C
Internal Temperatures		±5°C
Busbar Temperatures		±5°C
Fan Speed		±500 rpm

1.2.13 Standard Features

- Type of Power Conversion Circuit: High frequency.
- Working Mode:

  The default DC output voltage of the Power Supply Unit is fixed at 50 V @NL and 49 V @FL during normal operation. The Power Supply Unit is rated at its maximum output power. This means that, within the normal operating ambient temperature range and input voltage range, the rated output power is 5500 W for long-time continuous operation.

- Input Protection:

  Input Over/Under Voltage Protection: The Power Supply Unit will shut down at low or high voltage input voltage, based on the following table:

  Table 1.7 Input Over& Under-Voltage Protection

Parameter	Notes	Description		
		Min	Nominal	Max
Vin Operating Range	5500W	180Vac	200~277Vac	305Vac
Frequency Operating Range		47Hz	50,60Hz	63Hz
UVLO Brown In		173 Vac	176 Vac	179 Vac
UVLO Brown Out	10s delay	164 Vac	167 Vac	171 Vac
UVLO Brown Out	1.6s delay	147 Vac	150 Vac	153Vac
OVLO Brown In		306 Vac	309 Vac	312 Vac
OVLO Brown Out	50 ms	310 Vac	313 Vac	316 Vac

- Output Protection:

  Output overcurrent protection: If a Power Supply Unit is overloaded beyond the values listed below:

  Table 1.8 Output Overcurrent Protection

Parameter	Min	Type	Max	Unit	Notes
Output Current-limit Warning(50V)	102	107	112	%full load	
Output Current-Limit Inception(50V)	115	120	125	%full load	Delay >10s; Hiccup 5 times and latch off
Output Current-Limit Inception(50V)	125	130	135	%full load	Delay >100ms; Hiccup 5 times and latch off
Output Current-Limit Inception(50V)	150	155	160	%full load	Delay >50ms; Hiccup 5 times and latch off
Output Current-Limit Inception(50V)	160	165	170	%full load	Delay >6ms; Hiccup 5 times and latch off
Output Current-Limit Inception (12V)		1.5	1.7	A	Hiccup restart

  Output Short-circuit Protection: The Power Supply Unit employs short-circuit protection to protect the Power Supply Unit and attached load in the case of an output short-circuit or other output overload condition. The Power Supply Unit branch voltage is 50V (short-circuit condition), and the Power Supply Unit shuts down immediately and latch. The output branch voltage is +12Vsb (short-circuit condition), and the Power Supply Unit will recover.

  Output Over Voltage Protection:

  For Output Voltage Limit Inception (50) V, the Power Supply Unit shall immediately shut down and latch if the DC output voltage exceeds 52.5V. For DC output voltage shall never exceed 55V (fast OVP).

For Output Voltage Limit Inception (12 V), the Power Supply Unit shall hiccup-restart if the DC output voltage exceeds 14.5V.

Output Under Voltage Protection:

For Output Under-Voltage protection (50) V, the Power Supply Unit shall immediately shut down and latch if the DC output voltage is below 40 V.

Over-Temperature Protection:

The Power Supply Unit employs over-temperature protection for both ambient over temperature and internal thermal temperature to protect the Power Supply Unit. The Power Supply Unit shuts down due to an over temperature condition and recovers after a certain period after the over temperature condition is removed. The OTP circuit incorporates built in hysteresis such that the power supply does not oscillate on and off due to temperature recovering condition. The OTP event is reported as a fault.

- Active Load Sharing: The Power Supply Units have a dedicated analog bus with slow bandwidth for active current sharing. With the maximum number of Power Supply Units connected in the system, the current sharing accuracy shall be ± 2% @100% and ± 5% @ 20%.
- Hot Swappable: The Power Supply Unit is designed to be plug-and-play. The Power Supply Unit can be inserted or removed from a live DC power system with no damage. When the Power Supply Unit is plugged into the system, the system output voltage will not be affected.
- Cooling: Each Power Supply Unit module contains a fan for front-to-back force air-cooling.

  g) Fan Fault Protection: The Power Supply Unit module shuts down if a fan fails, the rectifier indicates the failure with a signal that is reported via software as well as an LED indicator on the front panel. The rectifier does not need to shut down because of a failed fan and only shuts down if there is a fault, i.e. over-temperature fault. The fan is field replaceable.

  h) Fan Control: Fan speed is continuously variable. When input voltage is within normal range, the built-in processor adjusts fan speed according to the Power Supply Unit module's internal temperature and output power. For example, a higher temperature or output power increases the fan speed. This feature can be disabled via the controller, allowing the fan to run at full speed regardless of temperature.

- Paralleling: Up to 6 Power Supply Units can be connected in parallel in one system.
- Monitoring Function: The Power Supply Unit has a built-in advanced DSP that monitors and controls the operation of the Power Supply Unit. The DSP also communicates with the PMC.
- Up to eight power shelves can be connected in one rack.

1.2.14 Mechanical Specifications

- Dimensions:

  i) Millimeters: 40(Height) X 68 (Width) X 640 (Depth)

  j) Inches: 1.6 (Height) X 2.7 (Width) X 25.2 (Depth)

- Weight: 3.3 kg (7.28 lbs)
- Indicators:

  k) LED 1, Green LED:

  1) Blinking Green @ 4Hz frequency: Sync Start State, Power Supply Unit is ready to turn on its output and awaiting the sync Start signal

  2) Solid Green: 50V is ON and available

3) No LED: 50V output off

l) LED 2, Amber LED:

1) Blinking Amber @ 4Hz frequency: Bootloading

2) Solid Amber: 50V Fault

3) No LED: 50V Normal

2 Operation

2.1 DC Input Protection Device Requirements/Recommendations

Refer to the system documentation supplied with the system within which the Power Supply Unit is installed.

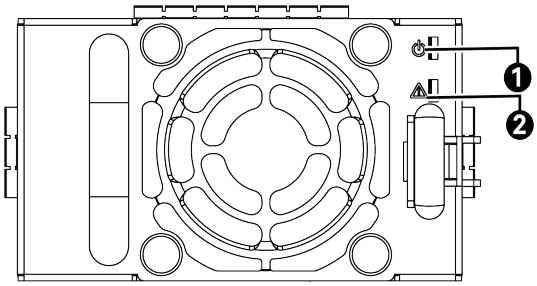
2.2 Local Indicators

Location and Identification: Refer to **Figure 2.1**.

Description: There are two (2) indicators located on the Power Supply Unit's front panel. The functions of these indicators are as shown in **Table 2.1**.

NOTE! *DC voltage must be present at the Power Supply Unit output terminals (from battery or an operating Power Supply Unit) or DC voltage at the input terminals.*

Figure 2.1 Local Indicator Locations



Item	Description
1	Power Indicator (Green)
2	Protection Indicator (Amber)

Table 2.1 Power Supply Unit Module Indicators

Indicator	Normal State	Alarm State	Alarm Cause
Power (Green)	On	Off	No input voltage.
		Blinking	Sync Start State, the Power Supply Unit is ready to turn on its output and awaiting the sync Start signal
Protection (Amber)	Off	On	Primary/Secondary/Fan/boot loading Failure and/or loss of DC output
		Blinking	Boot loading

2.3 Power Supply Unit High Voltage Shutdown and Lockout Restart

Procedure

Turn the power to the Power Supply Unit off or remove the Power Supply Unit, wait 30 seconds or more (until the LEDs on the Power Supply Unit extinguish), then turn the power to the Power Supply Unit on or re-insert the Power Supply Unit.

2.4 PSU Connector PIN Assignment

Figure 2.2 PIN Assignment

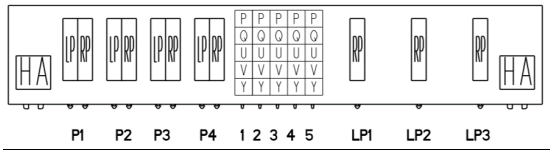


Table 2.2 PIN Definition

Pin	Name	Description
P1	VOUT_POS	Mate Last
P2	VOUT_POS	Mate Last
P3	VOUT_RTN	Mate First
P4	VOUT_RTN	Mate First
LP1	PE	Mate First
LP2	AC Phase_1	Mate Last
LP3	AC Phase_2	Mate Last

Table 2.3 Signal PIN Definition

PSU Pinout	Signal Name	Type	Function
P1	PSU_A0	Input	Address 0 – PSU ID A0
P2	PSU_A1	Input	Address 1 – PSU ID A1
P3	PSU_A2	Input	Address 2 – PSU ID A2
P4	BUSBAR_CLIP_TEMP_P	Input	Busbar clip + contact temperature sensor
P5	BUSBAR_CLIP_TEMP_N	Input	Busbar clip – contact temperature sensor
Q1	Ground		
Q2	PMBALERT_N	Ground	Low: Fault or Warning High: OK
Q3	RESET_LATCH_FAULT	Input/ Active high	Low: Default, No reset High for 1-2s: clear faults and start PSU if not operating due to a fault
Q4	12V_STANDBY	Power	Always on auxiliary supply to power the PSC Shall have fault and backfeeding protection
Q5	ISENSE_P	Output	Fast ORed current monitoring signal Diode is contained within each module to OR onto a common bus
U1	OVERCURRENT_N		Reserved for future feature When PSU current passes programmed threshold acts as fast path to trigger PSC for power regulation
U2	AC_LOSS_N	Output	Detect loss of AC Low: AC ok High: AC loss
U3	PSKILL (Short Pin)	Input/ Active High	Quick shut down Output to mitigate hot unplug arcing. Low: Output turn on High: Output turn off
U4	CANH		CANH

U5	CANL		CANL
V1	PRESENT_N		
V2	PMBUS_I2C_SDA		PMBus I2C Data
V3	PMBUS_I2C_SCL		PMBus I2C Clock
V4	Ground	Ground	PMBus I2C ground
V5	ISHARE_N	Analog	Reserved for possibility of differential current sharing bus.
Y1	ISHARE_P	Analog	Main Output current share bus
Y2	POWER_SELECT	Input	Reserved for future use.
Y3	SYNC_START_N	BI	Synchronizing turn-on main output
Y4	ISENSE_N	Output	Fast ORed current monitoring signal Diode contained within each module to OR onto a common bus
Y5	Ground	Ground	

2.5 Installing Power Supply Units

CAUTION! The Power Supply Unit contains double-pole, neutral-fusing. Disconnect mains before servicing. The fuse is non-replaceable by the customer.

CAUTION! Before using the Power Supply Unit, ensure that the system is reliably grounded. The Power Supply Unit must be replaced by an authorized technician.

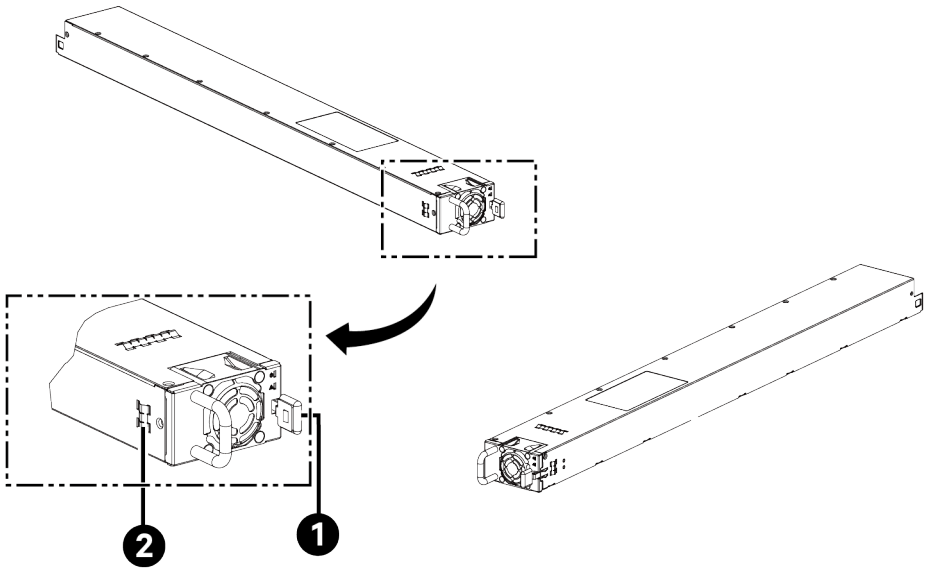
The Power Supply Unit is hot swappable. It can be removed and installed with the system operating and without affecting the output bus.

Procedure

NOTE! *Refer to Figure 2.3 as this procedure is performed.*

1. Unpack the Power Supply Unit.
2. Partially slide the Power Supply Unit into the shelf.
3. Push the spring latch handle located on the front of the Power Supply Unit to the right (this will retract the securing latch located on the side of the Power Supply Unit).
4. Slide the Power Supply Unit completely into the shelf and release the spring latch handle (the securing latch located on the side of the Power Supply Unit will pop into a notch in the shelf to secure the Power Supply Unit to the shelf).
5. After the Power Supply Unit s are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.
6. If the system is operating, ensure that there are no local or remote alarms active on the system.

Figure 2.3 Installing Power Supply Unit



Item	Description
1	Spring Latch Handle
2	EMI Gasket

3 Troubleshooting and Repair

3.1 Troubleshooting

3.1.1 Power Supply Unit Current Sharing Imbalance

When multiple Power Supply Units are operating in parallel and the load is greater than 20%, if the current sharing imbalance among them is greater than 5%, check if the Power Supply Unit is properly seated in the shelf.

If the current sharing imbalance still persists following the verification suggested above, replace the Power Supply Unit exhibiting the current imbalance.

3.1.2 Power Supply Unit Fault Symptoms and Troubleshooting

- The fault indicators that can be displayed by the Power Supply Unit are as follows. Refer to

Table 3.1 for a list of possible causes and corrective actions.

- Power Indicator (Green) Off.
- Protection Indicator (Amber) ON.
- Protection Indicator (Amber) Blinking.

Table 3.1 Power Supply Unit Module Troubleshooting

Symptom	Alarm Cause	Suggested action(s)
Power (Green)	No input voltage.	Make sure there is input voltage
	Sync Start State, the Power Supply Unit is ready to turn on its output and awaiting the sync Start signal	
Protection (Amber)	Primary/Secondary/Fan/boot loading Failure and/or loss of DC output	Fan rotor blocked: remove any object that may be blocking the fan or replace the Power Supply Unit
	Boot loading	

3.2 Replacement Procedures

3.2.1 Power Supply Unit Module Replacement

The Power Supply Unit is hot swappable. It can be removed and installed with the system operating and without affecting the output bus.

CAUTION! The Power Supply Unit contains double pole fusing; the fuse is non-replaceable.

Procedure

NOTE! *Refer to Figure 2.3 as this procedure is performed.*

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. Push the spring latch handle located on the front of the Power Supply Unit to the right (this will retract the securing latch located on the side of the Power Supply Unit).
3. Pull the Power Supply Unit out of the shelf and release the spring latch handle.

4. Grasp the handle and pull firmly to remove the module from the shelf.
5. Place the replacement Power Supply Unit module into the mounting position without sliding it in completely.
6. Push the spring latch handle located on the front of the Power Supply Unit to the right (this will retract the securing latch located on the side of the Power Supply Unit).

Slide the Power Supply Unit completely into the shelf and release the spring latch handle (the securing latch located on the side of the Power Supply Unit will pop into a notch in the shelf to secure the Power Supply Unit to the shelf).

After the Power Supply Unit s are physically installed in the mounting shelf(s), they are ready for operation immediately after power is supplied to them.

If the system is operating, ensure that there are no local or remote alarms active on the system.

3.2.2 Power Supply Unit Fan Replacement

Each Power Supply Unit uses a fan for cooling. If fan replacement should become necessary, perform the following procedure.

Refer to **Figure 3.1** as this procedure is performed.

WARNING! In a system with NO redundant Power Supply Unit, battery must have sufficient reserve to power the load(s) while the Power Supply Unit is removed for fan replacement.

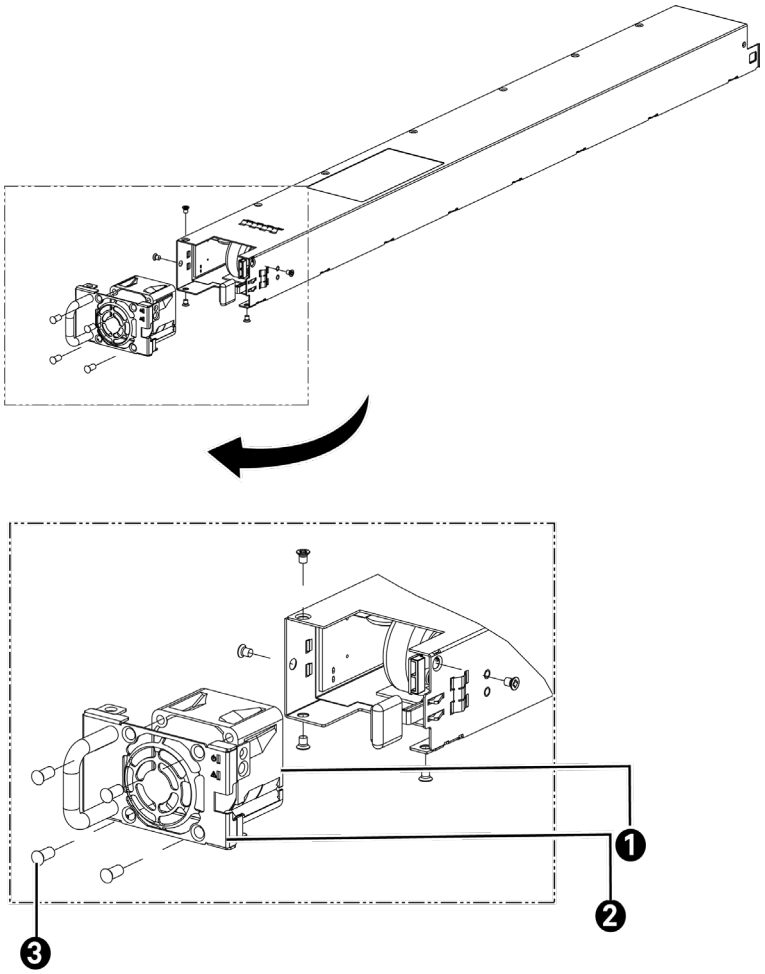
NOTE! *When performing any step in this procedure that requires removal of existing hardware, retain all hardware for use in subsequent steps.*

Procedure

1. Performing this procedure may activate external alarms. Do one of the following. If possible, disable these alarms. If these alarms cannot be easily disabled, notify the appropriate personnel to disregard any alarms associated with this system while this procedure is performed.
2. Remove the Power Supply Unit from the shelf. Refer to a previous procedure for step-by-step instructions.
3. Place the Power Supply Unit on a static-safe work surface. Connect an approved grounding strap to your wrist for the remainder of this procedure.
4. On this Power Supply Unit, remove the front panel by removing the four (4) screws securing the front panel to the chassis.
5. For proper orientation of the new fan, observe the location of the fan wires and the fan rotation and air flow arrows on the old fan.
6. Carefully remove the fan from the Power Supply Unit chassis and unplug the fan power cable from the printed circuit card.
7. Plug the power cable of the replacement fan into the connector on the printed circuit card. Carefully slide the replacement fan into the Power Supply Unit chassis (ensure the fan wires and fan rotation and air flow arrows match the orientation of the old fan).
8. Note that the fan has four holes in the front corners and that the faceplate has four tabs. Carefully slide the faceplate into position, aligning the fan holes with the faceplate tabs. Secure the faceplate to the Power Supply Unit chassis with the four (4) screws previously removed.
9. Replace the Power Supply Unit into the shelf. Refer to the previous procedure for step-by-step instructions.
10. When the fan starts, check to ensure that it is providing front-to-back airflow. If air direction is wrong, immediately remove the Power Supply Unit from the shelf. Repeat previous steps to check fan orientation and correct as necessary. Reinstall the Power Supply Unit and again check for proper airflow.

11. Enable the external alarms or notify appropriate personnel that this procedure is finished.
12. Ensure that there are no local or remote alarms active on the system.

Figure 3.1 Fan Replacement



Item	Description
1	Fan
2	Faceplate
3	Screw

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