

## Electrical Specifications—Summary

Table E.1 Specifications for 6000 Watt units (10V to 60V Models)

Models	10-600	20-300	30-200	40-150	60-100
<b>Output Ratings:</b>					
Output Voltage <sup>1</sup>	0–10 V	0–20 V	0–30 V	0–40 V	0–60 V
Output Current <sup>2</sup>	0–600 A	0–300 A	0–200 A	0–150 A	0–100 A
Output Power	6000 W	6000 W	6000 W	6000 W	6000 W
<b>Line Regulation: <sup>3</sup></b>					
Voltage (0.01% of Vmax)	1 mV	2 mV	3 mV	4 mV	6 mV
Current (0.05% of Imax)	300 mA	150 mA	100 mA	75 mA	50 mA
<b>Load Regulation: <sup>4</sup></b>					
Voltage (0.05% of Vmax + 5 mV)	10 mV	15 mV	20 mV	25 mV	35 mV
Current (0.1% of Imax + 20 mA)	620 mA	320 mA	220 mA	170 mA	120 mA
<b>Meter Accuracy:</b>					
Voltage (0.15% of Vmax)	15 mV	30 mV	45 mV	60 mV	90 mV
Current (0.5% of Imax)	3 A	1.5 A	1.0 A	750 mA	500 mA
<b>Output Noise (0–20 MHz):</b>					
Voltage (p–p)	75 mV	75 mV	75 mV	75 mV	100 mV
<b>Output Ripple (rms):</b>					
Voltage	10 mV	10 mV	12 mV	15 mV	15 mV
Current <sup>5</sup>	3100 mA	1600 mA	1000 mA	750 mA	450 mA
<b>OVP Adjustment Range: (0% to 103% of Vmax)</b>					
	0–10.3 V	0–20.6 V	0–30.9 V	0–41.2 V	0–61.8 V
<b>Efficiency: <sup>6</sup></b>					
	0.85	0.87	0.87	0.87	0.89

1. Minimum output voltage is <0.3% of rated voltage at zero output setting.
2. Minimum output current is <0.2% of rated current at zero output setting when measured with rated load resistance.
3. For input voltage variation over the AC input voltage range, with constant rated load.
4. For 0–100% load variation, with constant nominal line voltage.
5. Current mode noise is measured from 10% to 100% of rated output voltage, full current, unit in CC mode.
6. Typical efficiency at nominal input voltage and full output power.

Table E.2 Drift Specifications for 6000 Watt units (10V to 60V Models)

Models	10–600	20–300	30–200	40–150	60–100
Drift (30 minutes): <sup>1</sup>					
Voltage (0.04% of Vmax)	4 mV	8 mV	12 mV	16 mV	24 mV
Current (0.6% of Imax)	3600 mA	1800 mA	1200 mA	900 mA	600 mA
Drift (8 hours): <sup>2</sup>					
Voltage (0.02% of Vmax)	2 mV	4 mV	6 mV	8 mV	12 mV
Current (0.04% of Imax)	240 mA	120 mA	80 mA	60 mA	40 mA
Temperature Coefficient: <sup>3</sup>					
Voltage (0.04% of Vmax/°C)	4 mV	8 mV	12 mV	16 mV	24 mV
Current (0.06% of Imax/°C)	360 mA	180 mA	120 mA	90 mA	60 mA

1. Maximum drift over 30 minutes with constant line, load, and temperature, after power on.
2. Maximum drift over 8 hours with constant line, load, and temperature, after 30 minute warm-up.
3. Change in output per °C change in ambient temperature, with constant line and load.

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Table E.3 Specifications for 6000 Watt units (80V to 600V Models)

Models	80–75	100–60	150–40	300–20	600–10
Output Ratings:					
Output Voltage <sup>1</sup>	0–80 V	0–100 V	0–150 V	0–300 V	0–600 V
Output Current <sup>2</sup>	0–75 A	0–60 A	0–40 A	0–20 A	0–10 A
Output Power	6000 W	6000 W	6000 W	6000 W	6000 W
Line Regulation: <sup>3</sup>					
Voltage (0.01% of Vmax)	8 mV	10 mV	15 mV	30 mV	60 mV
Current (0.05% of Imax)	37.5 mA	30 mA	20 mA	10 mA	5 mA
Load Regulation: <sup>4</sup>					
Voltage (0.05% of Vmax + 5 mV)	45 mV	55 mV	80 mV	155 mV	305 mV
Current (0.1% of Imax + 20 mA)	95 mA	80 mA	60 mA	40 mA	30 mA
Meter Accuracy:					
Voltage (0.15% of Vmax)	120 mV	150 mV	225 mV	450 mV	900 mV
Current (0.5% of Imax)	375 mA	300 mA	200 mA	100 mA	50 mA
Output Noise (0–20 MHz):					
Voltage (p–p)	100 mV	100 mV	150 mV	250 mV	350 mV
Output Ripple (rms):					
Voltage	15 mV	20 mV	20 mV	30 mV	80 mV
Current <sup>5</sup>	320 mA	230 mA	120 mA	50 mA	25 mA
OVP Adjustment Range: (0% to 110% of Vmax)					
	0–88 V	0–110 V	0–165 V	0–330 V	0–660 V
Efficiency: <sup>6</sup>					
	0.89	0.90	0.90	0.91	0.91

1. Minimum output voltage is <0.3% of rated voltage at zero output setting.
2. Minimum output current is <0.2% of rated current at zero output setting when measured with rated load resistance.
3. For input voltage variation over the AC input voltage range, with constant rated load.
4. For 0–100% load variation, with constant nominal line voltage.
5. Current mode noise is measured from 10% to 100% of rated output voltage, full current, unit in CC mode.
6. Typical efficiency at nominal input voltage and full output power.

Table E.4 Drift Specifications for 6000 Watt units (80V to 600V Models)

Models	80–75	100–60	150–40	300–20	600–10
Drift (30 minutes): <sup>1</sup>					
Voltage (0.04% of Vmax)	32 mV	40 mV	60 mV	120 mV	240 mV
Current (0.6% of I <sub>max</sub> )	450 mA	360 mA	240 mA	120 mA	60 mA
Drift (8 hours): <sup>2</sup>					
Voltage (0.02% of Vmax)	16 mV	20 mV	30 mV	60 mV	120 mV
Current (0.04% of I <sub>max</sub> )	30 mA	24 mA	16 mA	8 mA	4 mA
Temperature Coefficient: <sup>3</sup>					
Voltage (0.04% of Vmax/°C)	32 mV	40 mV	60 mV	120 mV	240 mV
Current (0.06% of I <sub>max</sub> /°C)	45 mA	36 mA	24 mA	12 mA	6 mA

1. Maximum drift over 30 minutes with constant line, load, and temperature, after power on.
2. Maximum drift over 8 hours with constant line, load, and temperature, after 30 minute warm-up.
3. Change in output per °C change in ambient temperature, with constant line and load.

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Table E.5 Specifications for 12000 Watt units (10V to 60V Models)

Models	10-1200	20-600	30-400	40-300	60-200
<b>Output Ratings:</b>					
Output Voltage <sup>1</sup>	0–10 V	0–20 V	0–30 V	0–40 V	0–60 V
Output Current <sup>2</sup>	0–1200 A	0–600 A	0–400 A	0–300 A	0–200 A
Output Power	12000 W	12000 W	12000 W	12000 W	12000 W
<b>Line Regulation: <sup>3</sup></b>					
Voltage (0.01% of Vmax)	1 mV	2 mV	3 mV	4 mV	6 mV
Current (0.1% of Imax)	1200 mA	600 mA	400 mA	300 mA	200 mA
<b>Load Regulation: <sup>4</sup></b>					
Voltage (0.05% of Vmax + 5 mV)	10 mV	15 mV	20 mV	25 mV	35 mV
Current (0.2% of Imax + 40 mA)	2440 mA	1240 mA	840 mA	640 mA	440 mA
<b>Meter Accuracy:</b>					
Voltage (0.15% of Vmax)	15 mV	30 mV	45 mV	60 mV	90 mV
Current (0.5% of Imax)	6 A	3 A	2.0 A	1.5 A	1 A
<b>Output Noise (0–20 MHz):</b>					
Voltage (p–p)	75 mV	75 mV	75 mV	75 mV	100 mV
<b>Output Ripple (rms):</b>					
Voltage	10 mV	10 mV	12 mV	15 mV	15 mV
Current <sup>5</sup>	6200 mA	3200 mA	2000 mA	1500 mA	900 mA
<b>OVP Adjustment Range: (0% to 103% of Vmax)</b>					
	0–10.3 V	0–20.6 V	0–30.9 V	0–41.2 V	0–61.8 V
<b>Efficiency: <sup>6</sup></b>					
	0.85	0.87	0.87	0.87	0.89

1. Minimum output voltage is <0.3% of rated voltage at zero output setting.
2. Minimum output current is <0.2% of rated current at zero output setting when measured with rated load resistance.
3. For input voltage variation over the AC input voltage range, with constant rated load.
4. For 0–100% load variation, with constant nominal line voltage.
5. Current mode noise is measured from 10% to 100% of rated output voltage, full current, unit in CC mode.
6. Typical efficiency at nominal input voltage and full output power.

Table E.6 Drift Specifications for 12000 Watt units (10V to 60V Models)

<b>Models</b>	<b>10–1200</b>	<b>20–600</b>	<b>30–400</b>	<b>40–300</b>	<b>60–200</b>
Drift (30 minutes): <sup>1</sup>					
Voltage (0.04% of Vmax)	4 mV	8 mV	12 mV	16 mV	24 mV
Current (0.6% of Imax)	7200 mA	3600 mA	2400 mA	1800 mA	1200 mA
Drift (8 hours): <sup>2</sup>					
Voltage (0.02% of Vmax)	2 mV	4 mV	6 mV	8 mV	12 mV
Current (0.05% of Imax)	600 mA	300 mA	200 mA	150 mA	100 mA
Temperature Coefficient: <sup>3</sup>					
Voltage (0.04% of Vmax/°C)	4 mV	8 mV	12 mV	16 mV	24 mV
Current (0.06% of Imax/°C)	720 mA	360 mA	240 mA	180 mA	120 mA

1. Maximum drift over 30 minutes with constant line, load, and temperature, after power on.
2. Maximum drift over 8 hours with constant line, load, and temperature, after 30 minute warm-up.
3. Change in output per °C change in ambient temperature, with constant line and load.

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Table E.7 Specifications for 12000 Watt units (80V to 600V Models)

Models	80–150	100–120	150–80	300–40	600–20
Output Ratings:					
Output Voltage <sup>1</sup>	0–80 V	0–100 V	0–150 V	0–300 V	0–600 V
Output Current <sup>2</sup>	0–150 A	0–120 A	0–80 A	0–40 A	0–20 A
Output Power	12000 W	12000 W	12000 W	12000 W	12000 W
Line Regulation: <sup>3</sup>					
Voltage (0.01% of Vmax)	8 mV	10 mV	15 mV	30 mV	60 mV
Current (0.1% of Imax)	150 mA	120 mA	80 mA	40 mA	20 mA
Load Regulation: <sup>4</sup>					
Voltage (0.05% of Vmax + 5 mV)	45 mV	55 mV	80 mV	155 mV	305 mV
Current (0.2% of Imax + 40 mA)	340 mA	280 mA	120 mA	100 mA	60 mA
Meter Accuracy:					
Voltage (0.15% of Vmax)	120 mV	150 mV	225 mV	450 mV	900 mV
Current (0.5% of Imax)	750 mA	600 mA	400 mA	200 mA	100 mA
Output Noise (0–20 MHz):					
Voltage (p–p)	100 mV	100 mV	150 mV	250 mV	350 mV
Output Ripple (rms):					
Voltage	15 mV	20 mV	20 mV	30 mV	80 mV
Current <sup>5</sup>	640 mA	460 mA	240 mA	100 mA	50 mA
OVP Adjustment Range: (0% to 110% of Vmax)					
	0–88 V	0–110 V	0–165 V	0–330 V	0–660 V
Efficiency: <sup>6</sup>					
	0.89	0.90	0.90	0.91	0.91

1. Minimum output voltage is <0.3% of rated voltage at zero output setting.
2. Minimum output current is <0.2% of rated current at zero output setting when measured with rated load resistance.
3. For input voltage variation over the AC input voltage range, with constant rated load.
4. For 0–100% load variation, with constant nominal line voltage.
5. Current mode noise is measured from 10% to 100% of rated output voltage, full current, unit in CC mode.
6. Typical efficiency at nominal input voltage and full output power.

Table E.8 Drift Specifications for 12000 Watt units (80V to 600V Models)

Models	80–150	100–120	150–80	300–40	600–20
Drift (30 minutes): <sup>1</sup>					
Voltage (0.04% of Vmax)	32 mV	40 mV	60 mV	120 mV	240 mV
Current (0.6% of I <sub>max</sub> )	900 mA	720 mA	480 mA	240 mA	120 mA
Drift (8 hours): <sup>2</sup>					
Voltage (0.02% of Vmax)	16 mV	20 mV	30 mV	60 mV	120 mV
Current (0.05% of I <sub>max</sub> ) <sup>3</sup>	75 mA	60 mA	40 mA	20 mA	16 mA
Temperature Coefficient: <sup>4</sup>					
Voltage (0.04% of Vmax/°C)	32 mV	40 mV	60 mV	120 mV	240 mV
Current (0.06% of I <sub>max</sub> /°C)	90 mA	72 mA	48 mA	24 mA	12 mA

1. Maximum drift over 30 minutes with constant line, load, and temperature, after power on.
2. Maximum drift over 8 hours with constant line, load, and temperature, after 30 minute warm-up.
3. Current drift for 600V-20A unit is 0.08% of I<sub>max</sub>.
4. Change in output per °C change in ambient temperature, with constant line and load.



## AC Line Input Specifications

The input to the power supply requires the following specifications.

### AC Line Input Voltage Operating Ranges

Table E.9 AC Line Input Specifications

Operating Range	
nominal 208V <sub>rms</sub> (Standard)	190 to 242 V <sub>ac</sub> 3 $\phi$ (3 wire + safety ground)
nominal 400V <sub>rms</sub> (with HV-Input option)	342 to 500 V <sub>ac</sub> 3 $\phi$ (3 wire + safety ground)
Frequency Range	47 to 63 Hz
Maximum Peak In-rush Current at turn on	35 A <sub>rms</sub> (6000 Watt) 70 A <sub>rms</sub> (12000 Watt)
Minimum Power Factor <sup>1</sup>	
nominal 208V <sub>rms</sub> (Standard)	0.95
nominal 400V <sub>rms</sub> (with HV-Input option)	0.9
Operating Current	
nominal 208V <sub>rms</sub> (Standard)	
Maximum <sup>2</sup>	24 A (6000 Watt) 48 A (12000 Watt)
Typical <sup>3</sup>	20 A (6000 Watt) 40 A (12000 Watt)
Operating Current	
nominal 400V <sub>rms</sub> (with HV-Input option)	
Maximum <sup>4</sup>	13 A (6000 Watt) 26 A (12000 Watt)
Typical <sup>5</sup>	11 A (6000 Watt) 22 A (12000 Watt)

1. At nominal input voltage and maximum power
2. At 190V<sub>ac</sub> input voltage, 55°C ambient temperature and maximum power
3. At 208V<sub>ac</sub> input voltage, 25°C ambient temperature and maximum power
4. At 342V<sub>ac</sub> input voltage, 50°C ambient temperature and maximum power
5. At 400V<sub>ac</sub> input voltage, 25°C ambient temperature and maximum power

## Output Performance Specifications

These specifications define the electrical performance specifications of the power supply output. These specifications apply to both local and remote sense configurations, except where noted. These specifications apply to all programming sources, except where noted.

### Rated Output Range

Voltage	0–100%
Current	0–100%

### Efficiency

- Typical 89% efficiency at nominal line voltage and ambient temperature.
- Minimum 82% efficiency. Specific minimum efficiency limits are model dependent.

### Load Regulation

Voltage	5 mV + 0.05% of $V_{max}$
Current	6000 W: 20 mA + 0.1% of $I_{max}$ 12000 W: 40 mA + 0.2% of $I_{max}$
Power	1% of $P_{max}$

### Line Regulation

Voltage	0.01% of $V_{max}$
Current	6000 W: 0.05% of $I_{max}$ 12000 W: 0.1% of $I_{max}$
Power	1% of $P_{max}$

### Programming Range for Voltage, Current, and Power

Voltage and Current	From 0–103% of the rated maximum output
Power	From 3–103% of the rated maximum output

### OVP Programming Range

- 0–103% of maximum rated voltage

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### Typical Programming Resolution

Front Panel or Remote Digital Interface	
Voltage	0.002% of Vmax
Current	0.002% of Imax
Power	0.05% of Pmax
Over Voltage Protection	0.002% of Vmax
Remote Analog Programming Interface	
Voltage	0.002% of Vmax
Current	0.002% of Imax

### Typical Measurement Resolution

Front Panel or Remote Digital Interface	
Voltage	0.002% of Vmax
Current	0.002% of Imax
Power	0.05% of Pmax
Remote Analog Programming Interface	
Voltage	0.002% of Vmax
Current	0.002% of Imax

### Programming Accuracy<sup>1</sup>

Front Panel or Remote Digital Interface	
Voltage Programming	0.1% of Vmax
Current Programming	0.5% of Imax
Power Programming	0.5% of Pmax
Over voltage Programming	0.1% of Vmax
Remote Analog Programming Interface	
Voltage Programming	0.2% of Vmax
Current Programming	0.5% of Imax

### Readback Accuracy

Front Panel or Remote Digital Interface	
Voltage Readback	0.15% of Vmax
Current Readback	0.5% of Imax
Power Readback	0.5% of Pmax
Remote Analog Programming Interface	
Voltage Readback	0.3% of Vmax
Current Readback	0.5% of Imax

1. Accuracy specifications apply for settings in range of 1% to 100% of rated output

### 30 Minute Drift<sup>1</sup>

Voltage	0.04% of Vmax
Current	0.6% of Imax
Power	6000W: 1% of Pmax 12000W: 2% of Pmax

### 8 Hour Drift Temperature Stability<sup>2</sup>

Voltage	0.02% of Vmax
Current	6000W: 0.04% of Imax 12000W: 0.05% of imax 12000W 600V model: 0.08% of Imax
Power	0.1% of Pmax

### Temperature Coefficients

Front Panel or Remote Digital Interface	
Voltage Programming	0.04% of Vmax/°C
Current Programming	0.06% of Imax/°C
Power Programming	0.1% of Pmax/°C
Voltage Readback	0.04% of Vmax/°C
Current Readback	0.06% of Imax/°C
Power Readback	0.1% of Pmax/°C
Remote Analog Programming Interface	
Voltage Programming	0.04% of Vmax/°C
Current Programming	0.06% of Imax/°C
Voltage Readback	0.04% of Vmax/°C
Current Readback	0.06% of Imax/°C

### Analog Programming Interface

Programming Lines, Impedance	
0-5 V <sub>dc</sub> range	>30 kOhm
0-10 V <sub>dc</sub> range	>30 kOhm
Readback Lines, Impedance	
0-5 V <sub>dc</sub> range	<500 Ohm
0-10 V <sub>dc</sub> range	<1 kOhm
Isolation, all program and readback lines	
	300 Vdc with respect to chassis potential or negative output

1. At 25°C ±5°C, with full power load
2. At 25°C ±5°C after 30 minutes full load operation

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### Output Performance Specifications

#### User Line Interface

Includes auxiliary status lines, interlock, and external trigger lines.

Maximum Current Sink Capability, Each Output	10 mA
Maximum Supply Voltage	15 V <sub>dc</sub>
Minimum Supply Voltage	4 V <sub>dc</sub>
Isolation	300 Vdc with respect to chassis potential or negative output

#### Switching Frequency

Typical 31 kHz; 62 kHz output ripple

#### Rise Time

5 to 95% step in output voltage.

Load Condition	Time (Max)
No Load	100 ms
Full Load	100 ms

#### Fall Time

For a programmed 95% to 5% step in output voltage.

Load Condition	Time (Max)
No Load <sup>1</sup>	3 s
Full Load	50 ms

1. Fall time is  $\leq 4$ s for 300 V and 600 V units.

#### Time Delay From Power On Until Output Stable

5 s maximum

(Within regulation envelope)

#### Time Delay From Output Enable Until Output Stable

2 s maximum

(Within regulation envelope)

#### Output Hold-Up Time – Power Off

Minimum 4 ms (at full load)

### Output Hold-Up Time – Source Interruption

Minimum 4 ms with output deviation less than 5% of maximum output voltage after source interruption.

### Transient Response Time<sup>1</sup>

Time to recover within 0.75% of rated output of previous level after step change in load current between 50% and 100%.

Mode	Time
Voltage Mode	3 ms (6000 W models)
Voltage Mode	35 ms (12000 W models)

### Mode Crossover

Maximum deviation as a percentage of rated output voltage.

CV – CC Overshoot	1%
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### Peak–Peak and RMS Noise Bandwidth Limits

The frequency range for Peak to Peak measurements is 10 Hz–20 MHz.

The frequency range for RMS measurements is 10 Hz–100 kHz.

### Maximum Remote Sense Line Drop Compensation

Minimum 3.8 V for each line, 5 V typical

### Isolation

AC Input to Output	1350 V <sub>ac</sub>
AC Input to Chassis	1350 V <sub>ac</sub>
Output to Chassis	600 V <sub>ac</sub>

1. Time for the output voltage to recover within 0.75% of rated output of its previous level after a step change in load current of up to 50% - 100% and 100% to 50% of rated output

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Environmental Specification

## Environmental Specification

Operating Altitude	Up to 6,500 feet (2,000 m)
Storage Altitude	Up to 50,000 feet (15,000 m)
Installation Category	II (IEC 1010-1)
Polution Degree	2 (IEC 1010-1)

### Thermal Specification

Operating Temperature Range	0°C–50°C <sup>1</sup>
Storage Temperature Range	–40°C–+85°C

1. Consult the factory for operation below 0°C and above 50°C.

### Humidity Specification

Operating Humidity Range	< 95% RH, Non-condensing
Storage Humidity Range	< 95% RH, Non-condensing

## International Approvals

CE-marked units meet: EN61010-1, EN50081-2 and EN500082-2.

CSA C/US certified to C22.2 No 1010.1 and UL3111-1.

Meets USA EMC standard: FCC, part 15, class A.

Meets Canadian ECMC standard: ICES-001.

### Mechanical Specification

Weight 6000 W: approx. 75 lb. (34 kg) for 10 V-600 A unit, without packaging  
12000 W: approx. 170 lb. (77 kg) for 10 V-1200 A unit, without packaging

### Size

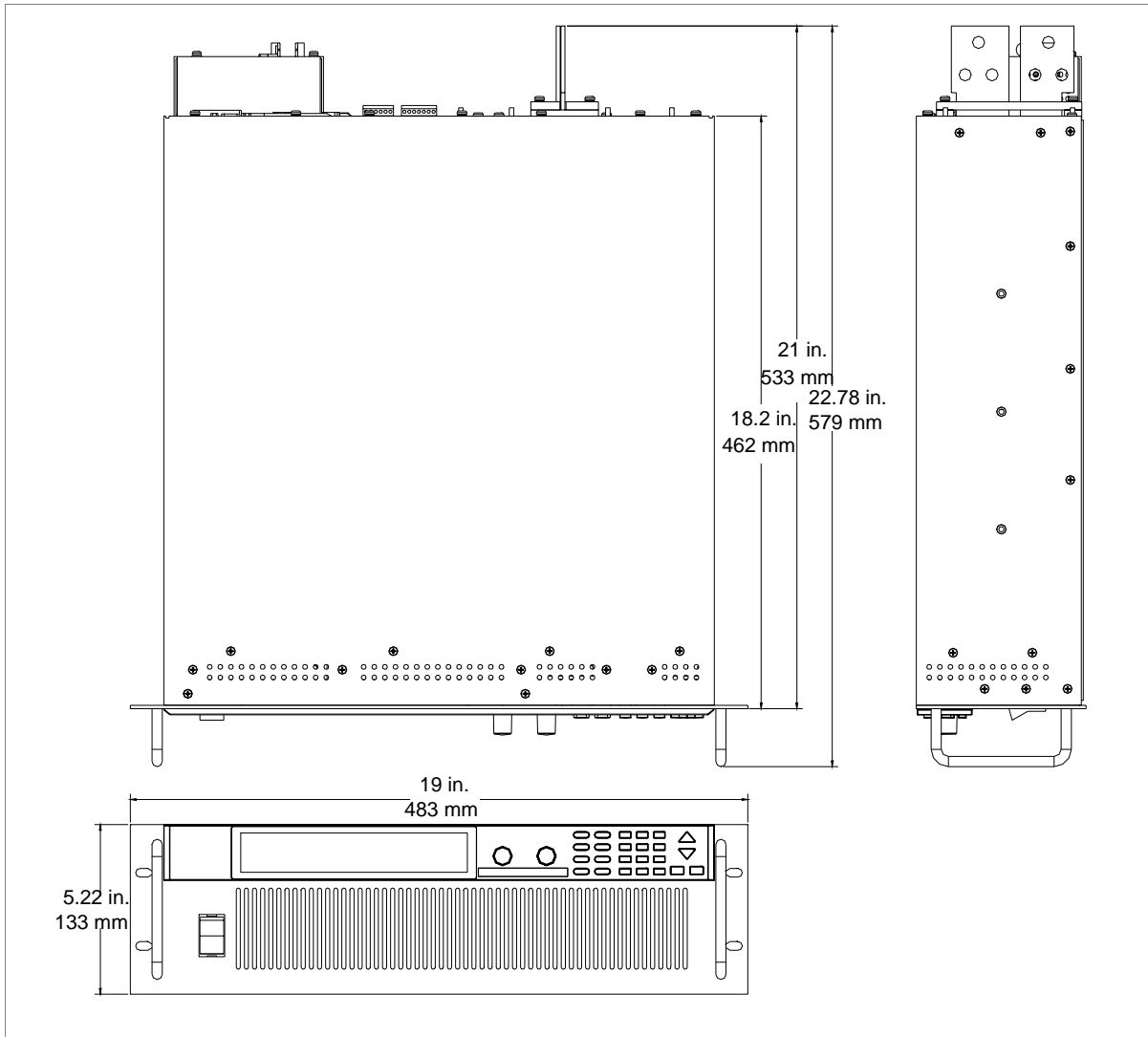


Figure E.1 Power Supply Dimensions (6000 Watt unit)



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Mechanical Specification

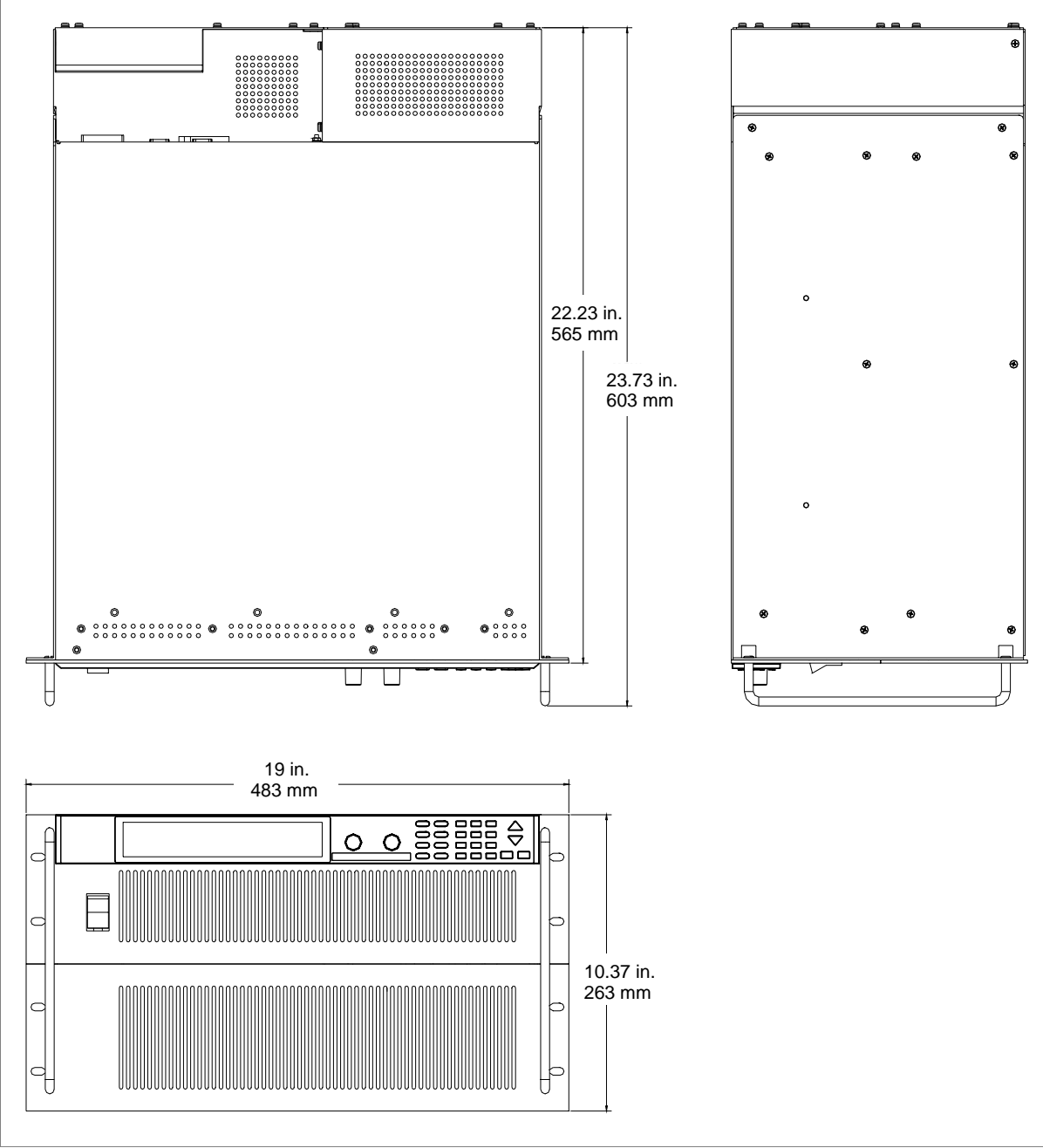


Figure E.2 Power Supply Dimensions (12000 Watt unit)