

# Series 2268

## 850W DC Power Supplies

- Six 850W models with maximum voltage outputs from 20V to 150V, maximum current outputs from 42A to 5.6A
- Compact 1U, half-rack enclosure provides the highest power in the smallest package
- Two auxiliary outputs support driving or signaling external devices, often eliminating the need for additional instrumentation
- Isolated analog inputs minimize control line noise
- Built-in LAN, USB, GPIB, RS-232, RS-485 interfaces and analog inputs are all standard
- Constant voltage, constant current, and constant power setting control
- Auto sequence control supports internal execution of commands to minimize bus communication time
- Control up to 30 supplies through a single controller interface
- Foldback mode with programmable delay shuts down the output on transitions between CV and CC operation to protect voltage- or current-sensitive devices
- Numerous safety features protect the load and the supply, including: over-voltage and under-voltage protection, over-current protection, over-temperature protection, loop protection for multiple-supply configurations, and a hardware output interlock

### APPLICATIONS

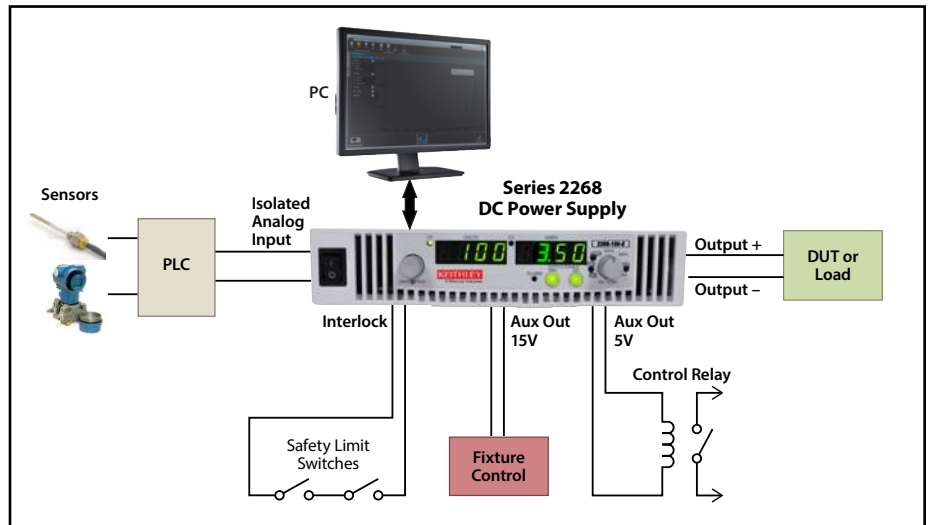
- Production testing
- Environmental testing
- Accelerated life testing
- Process control systems



The six models in the 850W DC Power Supplies in the Series 2268 provide voltage and current output levels well suited for automated test applications. They offer maximum voltage outputs of 20V, 40V, 60V, 80V, 100V, and 150V with corresponding maximum current outputs of 42A, 21A, 14A, 10.5A, 8.5A, and 5.6A. Series 2268 supplies allow outputting any current, including the maximum current, at any voltage. They provide both analog and digital control options and a number of digital interface options and can operate in constant voltage (CV), constant current (CC), or constant power modes to address a broad array of applications. These high-efficiency, soft-starting power supplies provide reliable performance and long life.

### 850W in the Most Compact Package

The Series 2268 supplies offer the highest power density in the smallest package. The Series 2268 supplies are packaged in a low profile 1U high, half-rack width enclosure. These supplies take up minimum space in a test rack. When multiple supplies are needed, these supplies can easily mount side-by-side in a test rack to provide two outputs in a 1U height space. Ventilation for the Series 2268 supplies is from the front of the instrument to the back so additional rack space for airflow above, below, or to the side of the supplies is not required. Thus, only 1U of total rack height is all that is needed. Furthermore the Series 2268 power supplies operate at temperatures up to 50°C so that they can perform reliably even in test racks that have elevated temperatures.



Use a Series 2268 DC supply as part of a control system. Analog control signals can program the supply's output. In addition to driving the load, the supply's two auxiliary outputs can drive external devices or circuits. The auxiliary outputs can eliminate the need for extra power sources in a test system. Interlock connections can turn off the supply's output if an unsafe external condition is detected.

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# Series 2268

## 850W DC Power Supplies

### Ordering Information

- 2268-20-42**  
850W DC Power Supply, 20V, 42A
- 2268-40-21**  
850W DC Power Supply, 40V, 21A
- 2268-60-14**  
850W DC Power Supply, 60V, 14A
- 2268-80-10**  
850W DC Power Supply, 80V, 10.5A
- 2268-100-8**  
850W DC Power Supply, 100V, 8.5A
- 2268-150-5**  
850W DC Power Supply, 150V, 5.6A

### Accessories Supplied

CD with manual, power cord, test lead connection hardware (for 2268-20-42 and 2268-40-21 only)

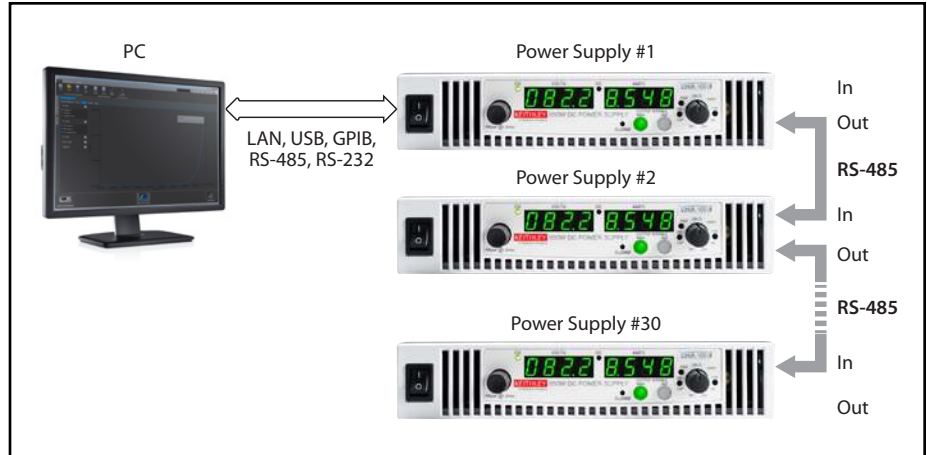
Downloads from [www.keithley.com](http://www.keithley.com)

IVI driver

LabVIEW driver

### ACCESSORIES AVAILABLE

2268-HDR	Hardware to Connect Test Lead Lugs to the 2268-20-42 or 2268-40-21
2268-RMK-1	Rack Mount Kit for One Series 2268 DC Power Supply
2268-RMK-2	Rack Mount Kit for Two Series 2268 DC Power Supplies
USB-1-1	USB Cable
CA-180-3A	Ethernet Crossover Cable
KPCI-488LPA	IEEE-488.2 Interface Board for the PCI Bus
KUSB-488B	IEEE 488.2 USB-GPIB Interface Adapter for USB port
7007-05	Double Shielded Premium IEEE-488 Interface Cables, 0.5m (1.6 ft)
7007-1	Double Shielded Premium IEEE-488 Interface Cables, 1m (3.2 ft)
7007-2	Double Shielded Premium IEEE-488 Interface Cables, 2m (6.5 ft)
7007-3	Double Shielded Premium IEEE-488 Interface Cables, 3m (10 ft)
7007-4	Double Shielded Premium IEEE-488 Interface Cables, 4m (13 ft)



Control up to 30 Series 2268 power supplies through one interface to a master supply. The additional supplies are daisy-chained to the master through serial RS-485 connections.

### A Full Complement of Control and Interface Options

Series 2268 power supplies offer users a wide range of interface options, including built-in LAN, USB, GPIB, RS-232, and RS-485 control interfaces. The supplies can also be controlled by analog control signals. A supply's voltage output and current can be set using either voltage or resistance input values.

Both isolated and non-isolated analog inputs are available. When long control lines or control lines exposed to an electrically noisy environment create signal integrity concerns, the isolated analog inputs can reduce or eliminate the susceptibility to signal degradation.

An auto sequence program mode gives Series 2268 supplies the built-in intelligence needed to execute lists of commands. Multiple commands can be downloaded, stored in the power supply's memory, and executed using a single command from the controller. The program can be repeated a specific number of times or cycled continuously. This ability to execute a set of commands internally saves test time by eliminating the delays involved in sending individual commands over a PC bus.

For large power systems that require multiple power supplies, up to 30 Series 2268 supplies can be controlled through a single interface by linking all the supplies together through their RS-485 interfaces. That allows controlling all the supplies through a master unit, which can use any of the five standard PC interfaces. This greatly simplifies managing multiple power supplies in a single system.

### Auxiliary Outputs for External Device Control

In addition to the main output power, Series 2268 power supplies offer two auxiliary outputs, 15V output and a 5V output, for signaling and control tasks, such as to supply signals to a device handler or a test fixture control input. These auxiliary outputs can also drive external control relays. For test systems that require a few control signals or relay control, these outputs can eliminate the need for another power supply or data I/O card.

### Expand Voltage or Current Capacity for Higher Output Requirements

For test applications that require a higher voltage or current output than a single supply can produce, up to two Series 2268 power supplies can be connected in series or up to four of them connected in parallel to produce the required output. Using the analog control lines, the supplies can be arranged in a master-slave configuration. The safety settings for the master supply control the complete configuration of supplies so that all supplies are protected.

When an application requires a bipolar output, two Series 2268 power supplies can be linked with the low terminal of one supply connected to the high terminal of the second one. This connection can be tied to the common of the bipolar load; one supply produces a positive output and the second supply effectively produces a negative output.

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## Protection for the Load and the Power Supplies

Series 2268 power supplies provide one set of parameters designed to protect the load from damage and another set that protect the supplies themselves. For applications that require outputting voltages only within a narrow range, Series 2268 supplies support setting both over-voltage and under-voltage shutdown levels. Over-current protection prevents excess current from damaging the load, the supply, or both. An over-temperature limit prevents excessively high temperatures that could damage the supply's internal components.

The Series 2268 power supplies incorporate a standard foldback function which, when enabled, will turn the output off if the load condition causes the supply to switch between the CV and CC control modes. In addition, the Series 2268 supplies add a programmable delay time to the foldback function to allow a time delay before the output is turned off. Thus, if the supply is powering a load with a high in-rush current which is large enough to cause the supply to switch to the CC mode from the CV mode, the delay would prevent the foldback function from an unwanted shutdown of the output so that the load stays powered and reaches its steady-state current level. If an external interlock circuit loses continuity, the hardware output interlock can be used to turn off a supply's output. Input/output lines allow external shutdown control and provide an output on/off status.

For test systems that integrate multiple Series 2268 supplies, loop protection allows up to four supplies to be shut down as a group; there is no need to shut down the whole system.

## SERVICES AVAILABLE

Model Number* <sup>EW</sup>	1 additional year of factory warranty
Model Number-5Y- <sup>EW</sup>	2 additional years of factory warranty beyond the standard 3-year warranty
C/Model Number-3Y- <sup>STD</sup>	3 calibrations within 3 years of purchase
C/Model Number-3Y-DATA	3 (ANSI-Z540-1 compliant) calibrations within 3 years of purchase
C/Model Number-5Y- <sup>STD</sup>	5 calibrations within 5 years of purchase
C/Model Number-5Y-DATA	5 (ANSI-Z540-1 compliant) calibrations within 5 years of purchase

\* Replace Model Number with a power supply model number. For example, if the Model 2268-60-14 is selected, then the part number for 1 year of additional warranty option is 2268-60-14-EW. Similarly, for the 3 standard calibrations option, the part number is C2268-60-14-3Y-STD.

## SPECIFICATION CONDITIONS

This document contains specifications and supplemental information for Series 2268 850 Watt DC Power Supplies. Specifications are the standards against which Series 2268 instruments are tested. Upon leaving the factory, Series 2268 instruments meet these specifications. Supplemental and typical values are nonwarranted, apply at 23°C, and are provided solely as useful information.

## SPECIFICATIONS

### OUTPUT

Model	2268-20-42	2268-40-21	2268-60-14	2268-80-10	2268-100-8	2268-150-5
<b>Output Voltage and Current</b>						
Maximum Output Voltage <sup>1</sup>	20 V	40 V	60 V	80 V	100 V	150 V
Maximum Output Current <sup>2</sup>	42 A	21 A	14 A	10.5 A	8.5 A	5.6 A
Maximum Output Power <sup>3</sup>	850 W	850 W	850 W	850 W	860 W	850 W
<b>Line Regulation (% of rated output + offset)</b>						
Voltage (0.005% + 2mV) <sup>4</sup>	3.0 mV	4 mV	5 mV	6 mV	7 mV	9.5 mV
Current (0.01% + 1mA) <sup>4</sup>	5.2 mA	3.1 mA	2.4 mA	2.1 mA	1.9 mA	1.6 mA
<b>Load Regulation (% of rated output + offset)</b>						
Voltage (0.005% + 2mV) <sup>5</sup>	3.0 mV	4 mV	5 mV	6 mV	7 mV	9.5 mV
Current (0.02% + 4mA) <sup>6</sup>	12.4 mA	8.2 mA	6.8 mA	6.1 mA	5.7 mA	5.1 mA
<b>Output Noise (RMS, 300kHz)</b>						
Voltage	8 mV	8 mV	8 mV	8 mV	8 mV	10 mV
Current <sup>7</sup>	75 mA	45 mA	35 mA	25 mA	20 mA	16 mA
<b>Output Ripple (peak-peak, 20MHz)</b>						
Voltage	50 mV	50 mV	50 mV	80 mV	80 mV	100 mV
<b>Maximum recommended remote sense line drop compensation per line<sup>8</sup></b>						
	1.5 V	2 V	3 V	5 V	5 V	5 V
<b>Protection</b>						
Over-voltage trip point range	1 V to 24 V	2 V to 44 V	3 V to 66 V	3 V to 95 V	3 V to 125 V	3 V to 180 V
Over-voltage trip-point accuracy	±0.24 V	±0.44 V	±0.66 V	±0.95 V	±1.25 V	±1.80 V
Over-voltage programming resolution	2.9 mV	5.3 mV	8 mV	11.4 mV	15 mV	21.6 mV
Over-current program setpoint range	0% to 105% of rated current					

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## ACCURACY AND RESOLUTION

Model	2268-20-42	2268-40-21	2268-60-14	2268-80-10	2268-100-8	2268-150-5
<b>Accuracy</b>						
Voltage Programming <sup>9</sup>	±20 mV	±40 mV	±60 mV	±80 mV	±100 mV	±150 mV
Current Programming <sup>10</sup>	±84 mA	±42 mA	±28 mA	±21 mA	±17 mA	±11.2 mA
Power Programming <sup>11</sup>	±2.52 W	±2.52 W	±2.52 W	±2.52 W	±2.55 W	±2.52 W
Voltage Readback <sup>9</sup>	±20 mV	±40 mV	±60 mV	±80 mV	±100 mV	±150 mV
Current Readback <sup>10</sup>	±84 mA	±42 mA	±28 mA	±21 mA	±17 mA	±11.2 mA
Power Readback <sup>11</sup>	±2.52 W	±2.52 W	±2.52 W	±2.52 W	±2.55 W	±2.52 W
Meter Accuracy	0.5% of output voltage or current ±1 count					
<b>Resolution<sup>12</sup></b>						
Voltage Programming	2.4 mV	4.8 mV	7.2 mV	9.6 mV	12 mV	18 mV
Current Programming	5.04 mA	2.52 mA	1.68 mA	1.26 mA	1.02 mA	0.67 mA
Power Programming	102 mW	102 mW	102 mW	102 mW	102 mW	102 mW
Voltage Readback	2.4 mV	4.8 mV	7.2 mV	9.6 mV	12 mV	18 mV
Current Readback	5.04 mA	2.52 mA	1.68 mA	1.26 mA	1.02 mA	0.67 mA
Power Readback	100.8 mW	100.8 mW	100.8 mW	100.8 mW	102 mW	100.8 mW

## TIMING

Response time (by model)	2268-20-42	2268-40-21	2268-60-14	2268-80-10	2268-100-8	2268-150-5
Up-programming, 0~Vmax <sup>13</sup>	60 ms	60 ms	60 ms	100 ms	100 ms	100 ms
Down-programming, full load	50 ms	50 ms	50 ms	80 ms	100 ms	150 ms
Down-programming, no load	600 ms	800 ms	900 ms	1000 ms	1200 ms	1800 ms

OUTPUT HOLD-UP TIME: Typical 20ms at any rated input line.

TRANSIENT RESPONSE TIME<sup>14</sup>: Less than 1ms for 20V, 40V, and 60V models. Less than 2ms for 80V, 100V, and 150V models.

DATA READBACK TRANSFER TIME<sup>15</sup>: 3ms.

PROGRAMMING AND READBACK TIME: <300ms (time from sending command to getting readback voltage and current).

## ANALOG CONTROL

### ANALOG VOLTAGE INPUT PROGRAMMING RANGE FOR VOLTAGE AND CURRENT OUTPUT:

0.0V to a maximum voltage, which can be set from 2.0V to 10V.

Resolution of the maximum voltage is 0.1V.

0.0V to maximum voltage corresponds to 0 to rated output.

### ANALOG RESISTANCE INPUT PROGRAMMING RANGE FOR VOLTAGE AND CURRENT OUTPUT:

0.0kΩ to a maximum resistance, which can be set from 2.0kΩ to 10kΩ.

Resolution of the maximum resistance is 0.1kΩ.

0kΩ to the maximum resistance corresponds to 0V to the rated output voltage.

### VOLTAGE AND CURRENT MONITOR OUTPUTS:

0.0V to a maximum voltage, which can be set from 2.0V to 10V.

Resolution of the maximum voltage is 0.1V.

0.0V to maximum voltage corresponds to 0V to rated voltage output and 0A to rated current output.

VOLTAGE PROGRAMMING ACCURACY: ±0.5% of rated output voltage, typical.

CURRENT PROGRAMMING ACCURACY: ±1.0% of rated output current, typical.

VOLTAGE READBACK ACCURACY: ±1.0% of maximum monitor voltage.

CURRENT READBACK ACCURACY: ±1.0% of maximum monitor voltage.

ISOLATION: Programming and readback lines:

**Non-isolated I/O Lines:** 500V, with respect to chassis potential.

**Isolated I/O Lines:** 600V, with respect to chassis potential. 1500V, to either output.

**SHUTDOWN CONTROL (isolated input)<sup>16</sup>:** Shutdown can be programmed either on logic high or logic low; dry contact compatible. **Logic Low:** 0V to 1.4V. **Logic High:** 2V to 15V.

**AUXILIARY OUTPUT ON/OFF CONTROL (isolated output):** TTL level or dry-contact compatible.

**On:** TTL high. **Off:** TTL low.

**POWER SUPPLY STATUS SIGNAL (isolated output):**

**OK:** TTL high (4V to 5V). **Fail:** TTL low (0V to 0.6V).

**INTERLOCK ENABLE/DISABLE (isolated input line):**

Dry contact; open/short: On or off, programmable.

**CONSTANT VOLTAGE (CV) AND CONSTANT CURRENT (CC) INDICATOR (non-isolated output):**

**CV:** TTL high (4V to 5V). **CC:** TTL low (0V to 0.6V).



Rear panel of the 2268-20-42 and 2268-40-21 showing the bar output connectors and all analog and digital interface connectors.



Rear panel of the 60V and higher voltage versions showing the terminal block output connectors and all analog and digital interface connectors.

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## GENERAL CHARACTERISTICS

**PARALLEL OPERATION:** Up to 4 instruments in a master/slave configuration.

**SERIES OPERATION:** Up to 2 instruments (with external diodes).

**POWER SUPPLY RATED AC INPUT VOLTAGE/FREQUENCY:** 100VAC to 240VAC, 47Hz to 63Hz.

**OPERATIONAL AC INPUT VOLTAGE/FREQUENCY:** 85VAC to 265VAC, continuous, single-phase, 47Hz to 63Hz, 360Hz to 440Hz.

**INPUT CURRENT (100/200VAC):** 11.5/6A (850W).

**INPUT POWER:** 1100VA.

**INRUSH CURRENT (100/200VAC):** <25A (850W).

**POWER FACTOR CORRECTION:** 0.99 at 100/200VAC, rated output power.

**EFFICIENCY<sup>17</sup> (100/200VAC input):** Model 2268-20-42: 82/85%. All other models: 83/87%.

**TEMPERATURE COEFFICIENT:** 100ppm/°C from rated output voltage, after a 30-minute warm-up period.

**DRIFT (8 hours):** 0.05% of rated output (over an 8-hour interval with constant line, load, and temperature, after a 30-minute warm-up period).

**AUXILIARY OUTPUTS (2)<sup>18</sup>:**  
 +5V: 0.5 A maximum recommended load current.  
 +15 V: 0.5 A maximum recommended load current.

**ISOLATION<sup>19</sup>:** 1500VAC or 2121VDC between mains terminals and accessible conductive parts/chassis ground; output to chassis 500VAC.

**DIGITAL INTERFACES:**  
 RS-232: 57.6 Kbps maximum data rate.  
 RS-485: 57.6 Kbps maximum data rate.  
 LAN: 100-BaseT.  
 USB: USB 2.0.  
 GPIB: IEEE-488.2.

**REAR-PANEL CONNECTORS:** Power output connectors  
 2268-20-42, 2268-40-21: Terminal bars with 6.5 mm (0.039 in.) diameter holes.  
 All Other Models: Terminal blocks.  
 Analog I/O Connector: 18-pin terminal block.  
 Isolated Analog I/O and Auxiliary Output Connector: 15-pin D-sub connector.  
 GPIB connector: 21-pin, female connector.  
 USB: USB 2.0 device.  
 RS-232/RS-485 and RS-485 connectors: 8-pin, RJ-45 jack.

**COOLING:** Forced air cooling by internal fans.

**OPERATING TEMPERATURE RANGE:** 0° to 50°C, 100% load.

**STORAGE TEMPERATURE RANGE:** -20° to 70°C.

**OPERATING HUMIDITY RANGE:** 30% to 90% relative humidity (no condensation).

**STORAGE HUMIDITY RANGE:** 10% to 95% relative humidity (no condensation).

**OPERATING ALTITUDE:** Up to 2000m (6500 ft).

**INSTALLATION CATEGORY:** II (IEC 1010-1).

**POLLUTION DEGREE:** 2 (IEC 1010-1).

**SAFETY:** CSA 22.2 No. 61010-1, 60950-1-07 and UL61010-1 and UL60950-1 (2nd ed.)<sup>19</sup>. Marked with cCSAus, CE for EMC and European Union Low Voltage Directive.

**EMC:** Conforms with European Union Low Voltage Directive.

**DIMENSIONS:** 44 mm high × 214 mm wide × 495 mm deep (1.72 in. × 8.43 in. × 19.48 in.).

**WEIGHT:** 5 kg (11 lb).

**WARRANTY:** Three (3) years.

## NOTES

- When setting 0V, using either the front panel or digital remote programming, the maximum output voltage is  $\pm 0.2\%$  of the rated output voltage.
- When setting 0A, using either the front panel or digital remote programming, the maximum output current is  $\pm 0.4\%$  of the rated output current.
- Maximum Output Power is the sum of: (Maximum Output Voltage × Maximum Output Current) + 10W. The 10W is the maximum power output from the two auxiliary outputs, AUX1 (5V × 0.5A) and AUX2 (15V 0.5A).
- From 85VAC to 132VAC or 170VAC to 265VAC, constant load.
- From no load to full load, constant input voltage.
- Voltage change is rated output voltage, constant input voltage.
- Measured at 10% to 100% output voltage and full output current.
- When using remote sense, the total of the load voltage and the load line drops must not exceed the rated output of the power supply.
- Calculation:  $\pm 0.1\%$  of output voltage specification.
- Calculation:  $\pm 0.2\%$  of output current specification.
- Calculation:  $\pm 0.3\%$  of output power specification.
- Calculation: 0.012% of full scale parameter.
- With rated, resistive load.
- Time for the output voltage to recover within 0.5% at its rated output for a load change 10% to 90% of rated output current. Output set point 10% to 100%.
- Time to provide data back to the controller using the LAN interface (does not include A/D conversion time).
- The shutdown input has user-selectable negative logic operation from the front panel or remote digital input/output.
- At maximum output power.
- Current: 0.51A minimum guaranteed, 0.72A typically available. The maximum current with these outputs shorted is limited to 0.4A. Over-current protection (each output) is automatic, non-latching. When over-current protection (OCP) is tripped, the auxiliary voltage folds back and will recover to nominal condition when the over-current condition is removed (typical <0.2A). To protect external circuits attached to the auxiliary outputs, use an appropriately rated fuse in series with the auxiliary outputs in use.
- Double insulation on primary to secondary isolation barriers. Basic insulation primary to protective earth ground.

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