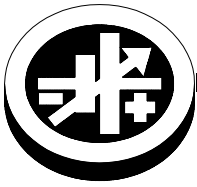


# OPERATOR MANUAL



**KEPCO** An ISO 9001 Company.

**KDN**  
Series



## SINGLE OUTPUT 24V DIN RAIL POWER SUPPLIES

### I — INTRODUCTION

**SCOPE OF MANUAL.** This instruction manual covers the installation and operation of the Kepco KDN Series of RoHS (Reduction of Hazardous Substances) compliant 24V Switching Power Supplies.

**DESCRIPTION.** The Kepco KDN 24V Din Rail Series consists of three models of switching power supplies rated at 5A, 10A and 20A, each with a single 24V output as shown in Table 1. Units may be operated with a nominal 100V a-c to 240V a-c (input voltage range 90 to 264 Va-c), 50-60 Hz (input fre-

quency range 47-63Hz. These units employ active PFC (Power Factor Correction) using ZVS (Zero Voltage Switching). Overvoltage protection and current limiting with automatic recovery from short circuit are featured. Units are convection cooled.

### II — SPECIFICATIONS

The following specifications are at nominal input voltages and 25°C and apply to all models unless otherwise specified.

**TABLE 1. OUTPUT RATINGS AND SPECIFICATIONS, KDN SERIES**

MODEL	OUTPUT (Nominal Volts)	ADJUSTMENT RANGE (Volts)	OVP RANGE <sup>(3)</sup> (Volts)	OUTPUT CURRENT (Amperes)			EFFICIENCY (typical)		CURRENT LIMIT PROTECTION (Amperes)		RIPPLE/NOISE <sup>(2)</sup> (mV p-p)
				Min.	Rated	Peak <sup>(1)</sup>	115V a-c	230V a-c	Limit (Typical)	Short Circuit	
KDN 24-5	24	23.5 - 28	29-34	0	5	6	87%	90%	7.8 <sup>(4)</sup>	(4)	<40
KDN 24-10	24	23.5 - 28	32 - 38	0	10	12	85%	90%	14 <sup>(4)</sup>	(4)	<50
KDN 24-20	24	23.5 - 28	31.5 - 35.5	0	20	25	85%	90%	28 <sup>(4)</sup>	(4)	<240

(1) One minute minimum duration @ 25°C ambient. The total RMS output current and power shall be kept within rated values.

(2) Bandwidth 15 MHz. Full load, nominal line, output terminated with 0.47 µF capacitor.

(3) To restart (reset) the unit, removed a-c input power, wait approximately 40 seconds, then restore a-c input power.

(4) Hiccup mode with auto recovery.

### INPUT CHARACTERISTICS:

#### INPUT VOLTAGE:

Nominal 100-240V a-c,  
Range: 90-264V a-c, 125-370V d-c: polarity insensitive.  
NOTE: Safety agency approval applies only to a-c input operation.

#### INPUT SOURCE FREQUENCY:

Range 47-63 Hz (Units operate up to 440 Hz, however the leakage current exceeds the UL leakage safety specification limit, and power factor and efficiency specifications may not be met.)

#### INPUT CURRENT:

KDN 24-5: <2A @115V a-c, <1A @ 230V a-c  
KDN 24-10: <6A @115V a-c, <2.6A @ 230V a-c  
KDN 24-20: <10A @115V a-c, <5A @ 230V a-c

**INPUT PROTECTION:** Units are protected against shorts by an input fuse. Fuse value 10A, 250V.

**INPUT SURGE:** An inrush current limiting resistor reduces start-up surge. Cold start 25 °C:  
30A max. @ 115V a-c, 60A max. @ 230V a-c

#### LEAKAGE CURRENT:

Line to ground, input: 115V a-c, 60Hz  
KDN 24-5: <0.2mA  
KDN 24-10: <0.25mA  
KDN 24-20: <0.35mA

**POWER FACTOR:** Meets EN 61000-3-2, Class D

115V a-c: 0.99  
130V a-c: 0.95

#### SWITCHING FREQUENCY:

KDN 24-5: 120KHz  
KDN 24-10: 120KHz  
KDN 24-20: 62KHz

## OUTPUT CHARACTERISTICS:

**SOURCE EFFECT:**  $\pm 1\%$  @ 115V a-c and 230V a-c,  $\pm 10\%$ , rated load

### LOAD EFFECT:

KDN 24-5:  $\pm 1\%$  max. from 0 to 5A  
KDN 24-10:  $\pm 2\%$  max. from 0 to 10A  
KDN 24-20:  $\pm 1\%$  max. from 12A down to 4A and from 12A up to 20A

**SETTING TOLERANCE:**  $\pm 2\%$

**TRANSIENT RECOVERY:** Excursion produced by step load change from 20% to 100% and 100% to 20%:

KDN 24-5: 100mV max., 1mS max. recovery  
KDN 24-10: 200mV max., 1mS max. recovery  
KDN 24-20: 1V max., 1mS max. recovery

### START UP TIME:

KDN 24-5: 1.7S typ @ 115V a-c, <1S @ 230V a-c  
KDN 24-10: 1.9S typ @ 115V a-c, <1S @ 230V a-c  
KDN 24-20: 1.8S typ @ 115V a-c, <1S @ 230V a-c

**HOLD UP TIME:** 115V a-c input voltage, rated load: >20 milliseconds typical (measured from end of last charging pulse to when output drops to 95%)

### EFFICIENCY:

KDN 24-5: 87% (typ.)  
KDN 24-10: 85% (typ.)  
KDN 24-20: 85% (typ.)

**POWER OK INDICATOR:** OFF when unit in overcurrent protection, a-c input is off, and as follows:

KDN 24-5: Output voltage <15V d-c  
KDN 24-10: Output voltage <20.5V to 23.5V d-c  
KDN 24-20: Output voltage <11 to 13V d-c

## ENVIRONMENTAL CHARACTERISTICS

**OPERATING TEMPERATURE:** See Figure 2 for temperature derating. Do not allow the power supply vents to become dust covered because that will decrease the cooling efficiency of the unit and cause insulation to deteriorate.

KDN 24-5:  $-10^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$   
KDN 24-10:  $0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$   
KDN 24-20:  $-10^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ ; start up:  $-10^{\circ}\text{C}$ ,  
@ nominal input voltage only.

**STORAGE TEMPERATURE:**  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

**COOLING:** Natural convection.

**ALTITUDE:** 0 to 10,000 feet.

## GENERAL CHARACTERISTICS

**MTBF:** Per MIL HDBK 217F (GB), 230V a-c line,  $40^{\circ}\text{C}$ :  
KDN 24-5: 260,000h @ 24V d-c, 5A  
KDN 24-10: 425,000h @ 24V d-c, 10A  
KDN 24-20: 310,000h @ 24V d-c, 20A

**OVERVOLTAGE PROTECTION:** When output voltage exceeds OVP value (see Table 1) output is cut off to protect the load. To reset, briefly remove, then restore, a-c input power.

**OVERCURRENT PROTECTION:** Power supply enters hiccup mode if short circuit or overcurrent condition exists; recovery is automatic when cause is removed.

**EMC - EMISSIONS:** Designed to meet:

Radiated Noise 30MHz to 1GHz:  
FCC docket 20780 Class B, EN55022-B  
Conducted Noise 0.15MHz to 30MHz:  
FCC Class B, EN55022-B  
Input Harmonics (on AC Mains) 0 to 2KHz:  
EN 61000-3-2 Class D

**EMC - IMMUNITY:**

ESD (6KV contact discharge, 8KV air discharge):  
EN 61000-4-2  
Radiated Field:  
EN 61000-4-3 (10mV, Criteria B)  
Electrical Fast Transient/Burst (EFT):  
EN 61000-4-4 (2KV)  
Surge:  
EN 61000-4-5 (4KV)  
Conducted Noise:  
EN 61000-4-6 (Criteria A)  
Power Frequency Magnetic Field:  
EN 61000-4-8 (Criteria A)  
Voltage Dips, Short Interruptions, Voltage Variation:  
EN 61000-4-11

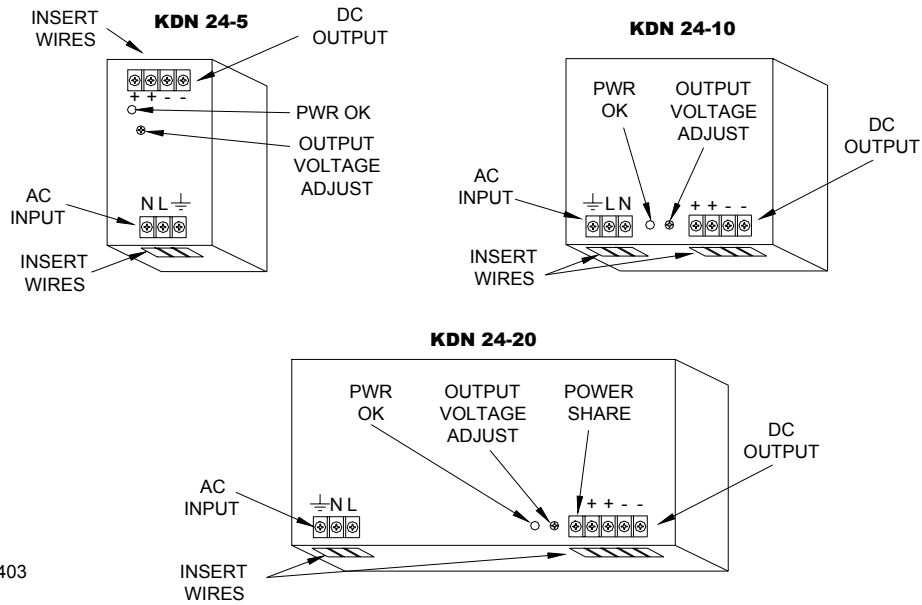
**SAFETY:** All units are UL 508 listed and are designed to meet UL 1950, CSA 22.2 No. 950-M90 and EN 60950. KDN units are CE marked per the Low Voltage Directive (LVD), EN 60950.

**ORIENTATION:** Vertical only (see Figure 1)

**WEIGHT:**

KDN 24-5: 1.61 lbs (730g)  
KDN 24-10: 2.43 lbs (1100g)  
KDN 24-20: 4.36 lbs (1980g)

**WARRANTY:** One year.



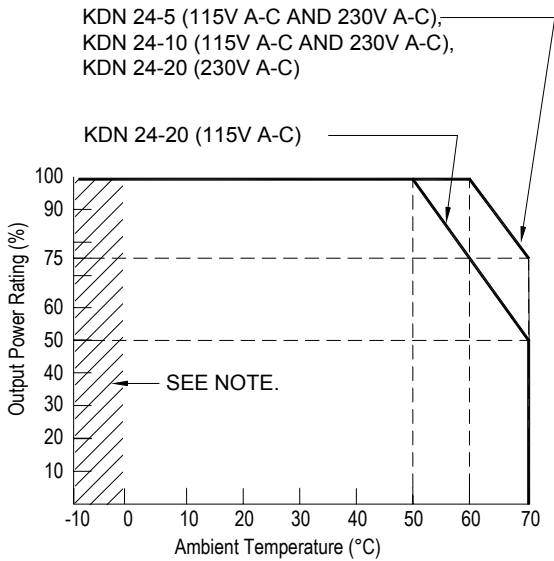
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FIGURE 1. COMPONENT LOCATIONS

### III — INSTALLATION/REMOVAL

**MOUNTING ON DIN RAIL.** The KDN Series is designed to mount on a 35mm DIN rail only as shown in Figure 3 with ventilation holes at top and bottom. Install by inserting one edge of mounting bracket on DIN rail as shown, then press down to snap onto DIN rail.

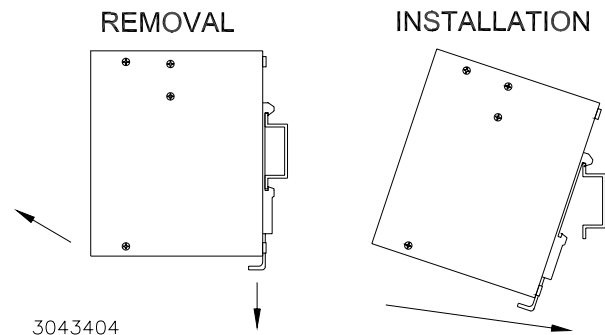
**REMOVAL.** Remove by pulling hook down to release mounting bracket from DIN rail, then swing power supply away from DIN rail.



NOTE: Operation from -10°C to 0°C is as follows:  
 KDN 24-5: Yes, normal operation  
 KDN 24-10: No  
 KDN 24-20: Start up at -10°C, nominal line voltage only.

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FIGURE 2. OUTPUT POWER VS. TEMPERATURE



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FIGURE 3. POWER SUPPLY MOUNTING

**CONNECTIONS.** Connect the load to the power supply d-c output + + and – – terminals shown in Figure 1. The AC input power is applied via the terminal block. Make sure to connect

the AC input Neutral, Line and Ground wires to the respective terminals of the terminal block (see Figure 1). Wire strip length for both a-c and d-c connector is approximately 1/4 inch (6 - 7mm). See Figure 4 for connecting multiple loads.

#### IV — OPERATION

The Output Voltage Adjust trimmer (see Figure 1) allows adjustment of the output voltage within the range specified in Table 1. When output voltage is within specified adjustment range, the green LED is on. The LED is off as described in "Power OK Indicator:" on page 2.

**PARALLEL OPERATION:** Model KDN 24-20 (only) may be operated in parallel for increased current capability (see Figure 5). Connecting the PS (Power Share) terminals forces the current load to be shared equally among paralleled units.

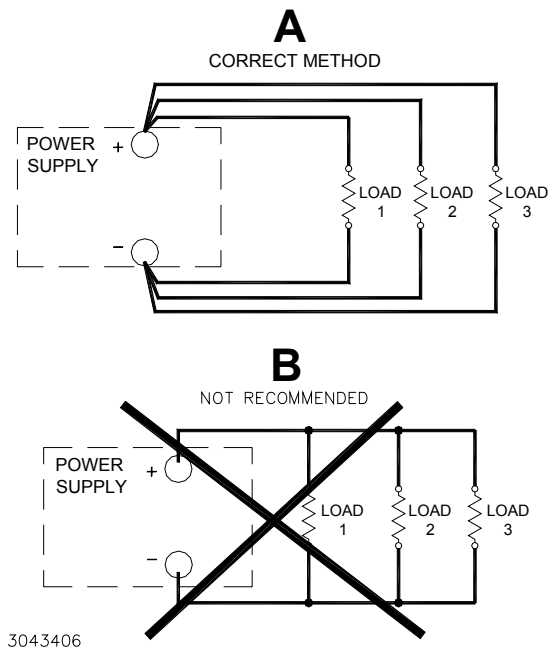


FIGURE 4. LOAD CONNECTIONS

NOTE: ISOLATION DIODES ARE INCLUDED IN KDN 24-20.

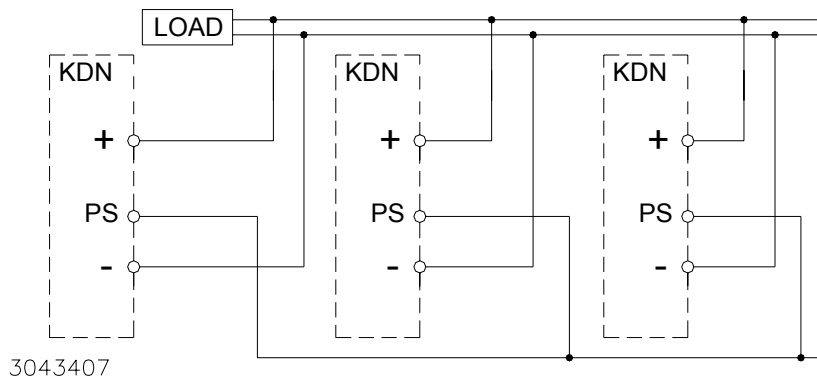
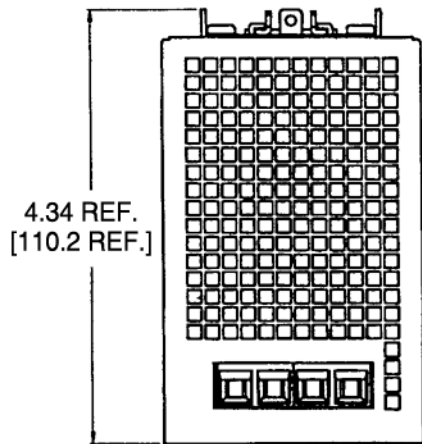


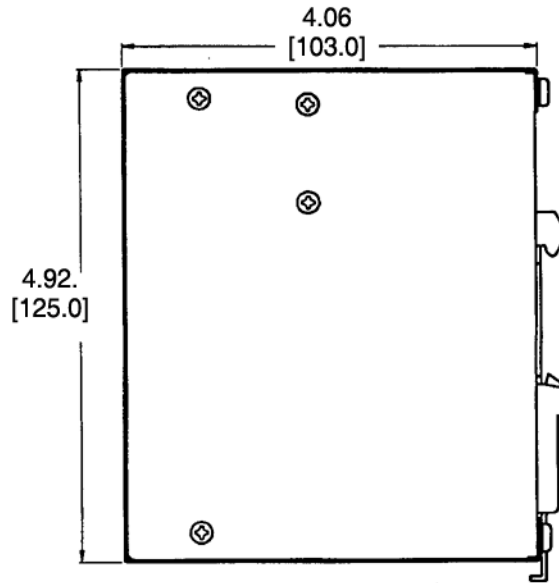
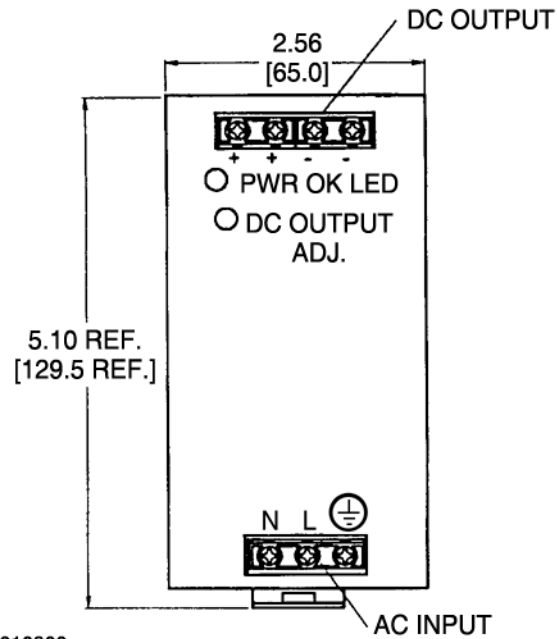
FIGURE 5. PARALLEL CONNECTIONS (KDN 24-20 ONLY)



NOTE:

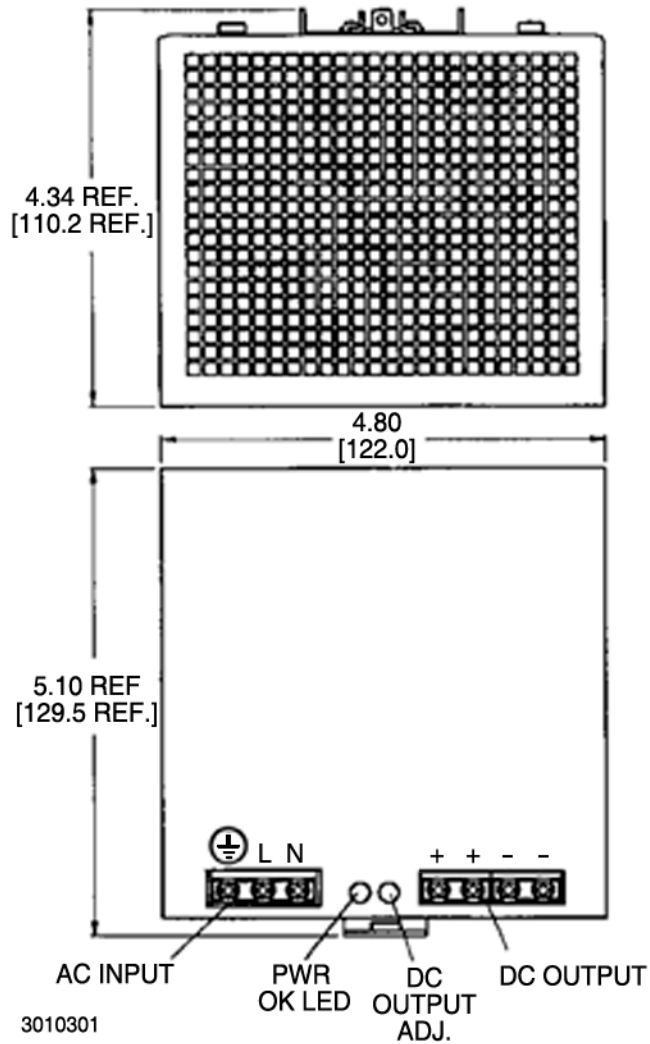
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN BRACKETS ARE IN MILLIMETERS

2. TOLERANCES ARE  $\pm 0.016$  IN. [0.4 MM].



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FIGURE 6. KDN 24-5 MECHANICAL OUTLINE DIAGRAM



NOTE:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN BRACKETS ARE IN MILLIMETERS
2. TOLERANCES ARE  $\pm 0.016$  IN. [0.4 MM].

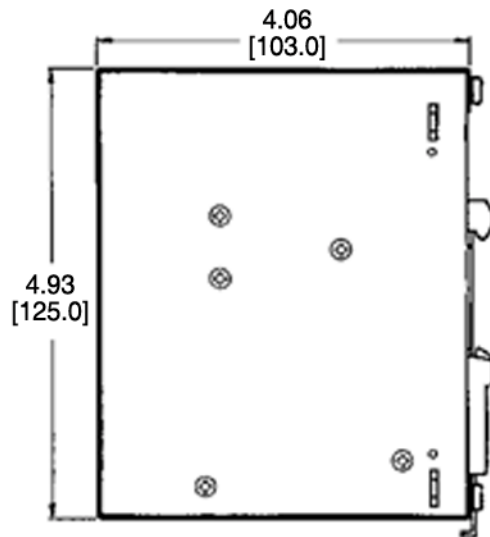


FIGURE 7. KDN 24-10 MECHANICAL OUTLINE DIAGRAM

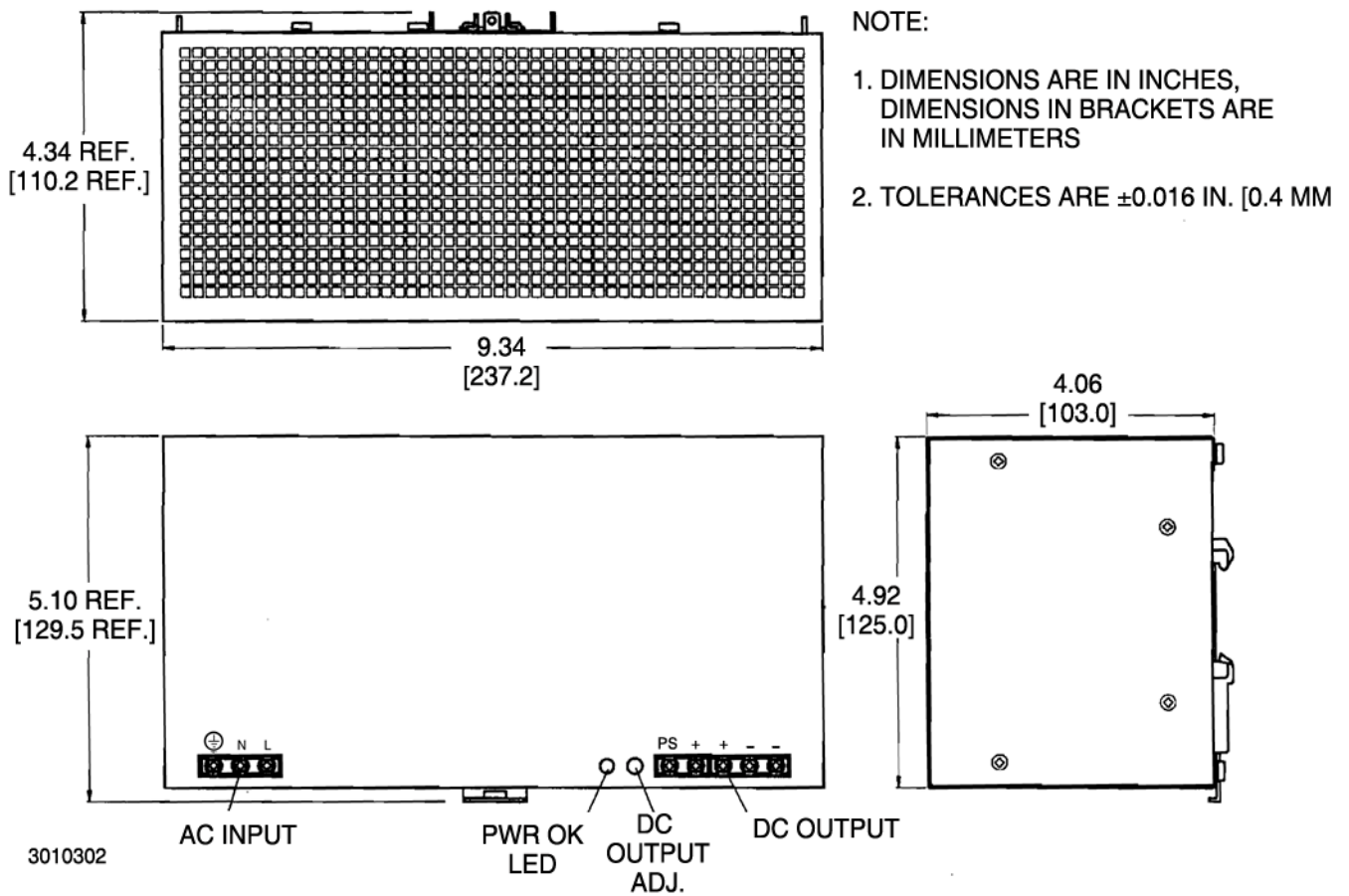


FIGURE 8. KDN 24-20 MECHANICAL OUTLINE DIAGRAM