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Power Distribution Unit (PDU)

MODEL PDU 2000

OPERATION MANUAL

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ELGAR ONE-YEAR WARRANTY

Elgar Electronics Corporation (hereinafter referred to as Elgar) warrants its products to be free from defects in material and workmanship. This warranty is effective for one year from the date of shipment of the product to the original purchaser. Liability of Elgar under this warranty shall exist provided that:

- the Buyer exposes the product to normal use and service and provides normal maintenance on the product;
- Elgar is promptly notified of defects by the Buyer and that notification occurs within the warranty period;
- the Buyer receives a Return Material Authorization (RMA) number from Elgar's Repair Department prior to the return of the product to Elgar for repair, phone 800-73-ELGAR (800-733-5427), ext. 2295;
- the Buyer returns the defective product in the original, or equivalent, shipping container;
- if, upon examination of such product by Elgar it is disclosed that, in fact, a defect in materials and/or workmanship does exist, that the defect in the product was not caused by improper conditions, misuse, or negligence; and,
- that Elgar QA seal and nameplates have not been altered or removed and the equipment has not been repaired or modified by anyone other than Elgar authorized personnel.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness of the product to a particular purpose. Elgar, its agents, or representatives shall in no circumstance be liable for any direct, indirect, special, penal, or consequential loss or damage of any nature resulting from the malfunction of the product. Remedies under this warranty are expressly limited to repair or replacement of the product.

CONDITIONS OF WARRANTY

- To return a defective product, contact an Elgar representative or the Elgar factory for an RMA number. Unauthorized returns will not be accepted and will be returned at the shipper's expense.
- For Elgar products found to be defective within thirty days of receipt by the original purchaser, Elgar will absorb all ground freight charges for the repair. Products found defective within the warranty period, but beyond the initial thirty-day period, should be returned prepaid to Elgar for repair. Elgar will repair the unit and return it by ground freight pre-paid.
- Normal warranty service is performed at Elgar during the weekday hours of 7:30 am to 4:30 pm Pacific time. Warranty repair work requested to be accomplished outside of normal working hours will be subject to Elgar non-warranty service rates.
- Warranty field service is available on an emergency basis. Travel expenses (travel time, per diem expense, and related air fare) are the responsibility of the Buyer. A Buyer purchase order is required by Elgar prior to scheduling.
- A returned product found, upon inspection by Elgar, to be in specification is subject to an inspection fee and applicable freight charges.
- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Elgar factory.

ELGAR

Committed to Quality...Striving for Excellence

SAFETY NOTICE

BEFORE APPLYING POWER to a unit, verify that the PDU 2000 is properly configured for the user's particular application.

WARNING

HAZARDOUS VOLTAGES MAY BE PRESENT WHEN COVERS ARE REMOVED. QUALIFIED PERSONNEL MUST USE EXTREME CAUTION WHEN SERVICING THIS EQUIPMENT. CIRCUIT BOARDS, TEST POINTS AND OUTPUT VOLTAGES MAY ALSO BE FLOATING ABOVE (BELOW) CHASSIS GROUND.

Installation and servicing must be performed by QUALIFIED PERSONNEL who are aware of properly dealing with attendant hazards. This includes such simple tasks as fuse verification.

Ensure that the ac power line ground is properly connected to the PDU 2000 input connector or chassis. Similarly, other power ground lines including those to application and maintenance equipment MUST be properly grounded for both personnel and equipment safety.

Always ensure that facility ac input power is de-energized prior to connecting or disconnecting the input/ output power cables or the RS-232 interconnecting cable between the PDU and a computer or terminal. Similarly, the PDU 2000 circuit breaker and main power switch must be switched OFF prior to connecting or disconnecting input power.

In normal operation, the operator does not have access to hazardous voltages within the chassis. However, depending on the user's application configuration, **HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY** may be normally generated on the output terminals. The Customer/User must ensure that the output power lines are properly labeled as to the SAFETY hazards and any that inadvertent contact with hazardous voltages is eliminated.

Guard against risks of electrical shock during open cover checks by NOT TOUCHING any portion of the electrical circuits. Even when power is OFF, capacitors may retain an electrical charge. Use SAFETY GLASSES during open cover checks to avoid personal injury by any sudden component failure.

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SECTION I

GENERAL DESCRIPTION

1.1 INTRODUCTION

The PDU 2000 is a power distribution unit (PDU) which provides intelligent power management and communications interface between an uninterruptible power supply (UPS), a power conditioner, equipment loads, and a host computer. The PDU provides a means of power distribution from the UPS and power conditioner to eight loads, supporting both manual and computer control of the load power.

Furthermore, microcontroller–based circuitry provides RS–232 communications with a computer for annunciation of the PDU mode of operation and alarm conditions, as well as monitoring the ac power that is applied to the loads. The PDU 2000 also serves as a serial data router, allowing communications between a computer and a UPS while only requiring one RS–232 port on the computer.

Figure 1–1 provides the front view of the PDU 2000 and Figure 1–2 provides the rear view.

1.2 GENERAL DESCRIPTION

1.2.1 Output Power Control

Eight NEMA 15A/115V receptacles are provided, individually controlled with front panel switches. The status of each outlet is annunciated with front panel indicators. Sequenced start–up of the equipment loads provides control of load inrush current by energizing enabled loads in a sequential manner over a 2 second interval.

1.2.2 Input Power Control

The PDU 2000 accepts power from a UPS and a power conditioner, and allows the user to manually select, with a front panel switch, whether the UPS or power conditioner would be utilized to supply the equipment loads.

A main power switch is provided that disconnects power to the output loads and, through a relay, to the UPS. An ac input circuit breaker is provided for overload protection.

1.2.3 Status Annunciation

Front panel indicators are provided to identify operating conditions. Input power indicators are "MAIN POWER" and "UPS BYPASS.". An individual indicator is provided for each ac output, "OUTPUT STATUS," as well as the "+5V" and "+12V" dc output. Also, alarm indicators are provided for reporting "OVR TMP," "BATL SHRT," and "UPS PWR."

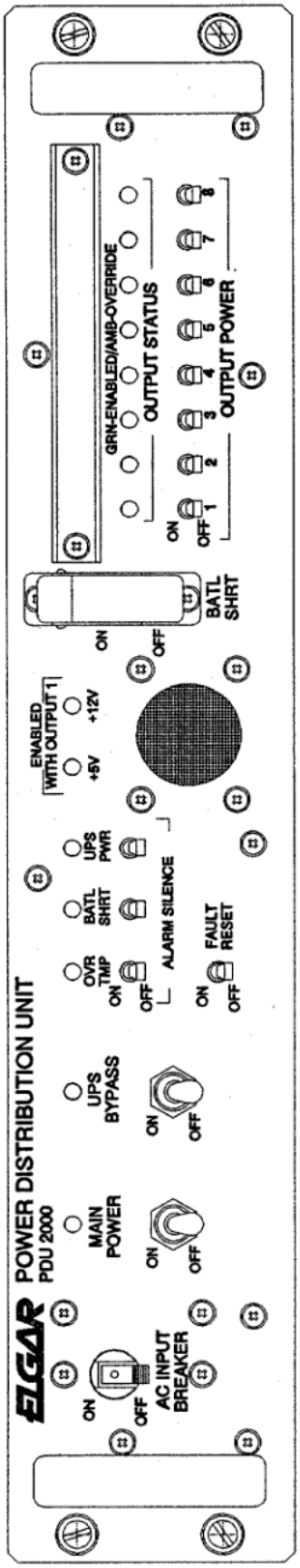


Figure 1-1. PDU 2000 (Front View)

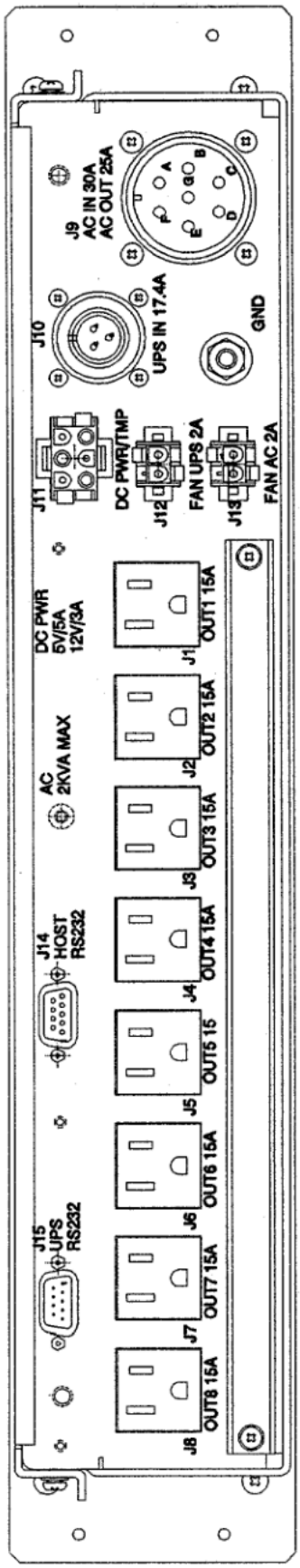


Figure 1-2. PDU 2000 (Rear View)

1.2.4 User Controls

The PDU 2000 provides full manual control of its mode of operation with front panel switches:

- A "MAIN POWER" switch controls power to the PDU and, through a relay, to the UPS;
- An "AC INPUT BREAKER" circuit breaker provides overload protection;
- A "UPS BYPASS" switch, through a relay, disconnects ac power going to the UPS, and selects the power conditioner as the output load power source;
- Eight "OUTPUT POWER" selector switches control the ac/dc output power;
- Three "ALARM SILENCE" switches disable the audible alarm;
- A "FAULT RESET" switch restarts the PDU following a fault induced shutdown; and
- A "BATL SHRT" switch overrides the PDU microcontroller and maintains output power to any enabled output loads.

1.2.5 Auxiliary Power Supply Outputs

In addition to supplying ac output power to the equipment load, the PDU 2000 has auxiliary output capability; two dc outputs and two ac outputs are provided. The dc outputs are 5V/5A and 12V/3A, and have the same manual/computer control facilities as the load outputs. The ac outputs are 115V/2A, and is used to power rack cooling fans; "FAN AC" is derived from "AC IN" while "FAN UPS" is derived from "UPS IN," allowing a choice as to which source supplies the fans.

1.2.6 Alarm Annunciation

The PDU 2000 supports annunciation of fault conditions through an audible alarm and front panel indicators. Three conditions are monitored:

- The ambient temperature of the rack ("OVR TMP" indicator);
- Whether the UPS is drawing power from its battery ("UPS PWR" indicator); and
- Whether the battle short switch has been engaged ("BATL SHRT" indicator).

The repetition rate of the audible alarm is different for the three conditions to allow differentiation by the user. The alarm indicators flash at a rate that matches the audible alarm; silencing the audible alarm also stops the flashing of the indicators and maintains them continuously on.

1.2.7 Monitoring Capabilities

The ac input power is continually monitored during "UPS BYPASS" operation to determine whether it is suitable for the loads. At start–up, if the voltage or frequency is inappropriate for operation of the loads, the PDU 2000 protects the loads by not energizing any of the outputs. During operation, if the voltage or frequency goes outside the allowed ranges, the output loads are shut down.

The PDU 2000 also continually monitors the ambient temperature at the equipment rack and provides an alarm indicating high ambient temperature. System shutdown would be executed if an overtemperature condition of greater than 45°C (112°F) is reached.

The 5V and 12V dc outputs are also monitored. If an output drops to 90% of rated voltage, both the 5V and 12V outputs are shut down. The front panel indicator for the supply that caused the shutdown flashes, allowing the user to determine how the shutdown occurred.

1.2.8 RS–232 Interface

The PDU 2000 provides two RS–232 ports:

- One for connecting to a computer (or an ASCII data terminal), and
- Another for connecting to a UPS.

This allows the flexibility of operating as a stand–alone controller (only manual control), with only a computer (for status communications), or with a computer and UPS. When used with a UPS, the PDU serves as a serial data router, retransmitting data/commands (not intended for the PDU) between the computer and UPS. The configuration of the system is automatically determined, requiring no user selection; also, no software is required, since the integral firmware supports operation in all configurations.

1.3 SPECIFICATIONS

1.3.1 Input Characteristics

1.3.1.1 AC IN

Description: "AC IN" is the input for an ac source (which could be the output of a power conditioner, providing isolation and surge/transient protection) that would supply the UPS with power. The is also the source of power to the loads if "UPS BYPASS" is selected.

Ac Input Voltage: 115V, nominal; 85V to 132V.

Ac Input Current: 29A, maximum.

Ac Input Frequency: 47 to 63 Hz.

1.3.1.2 UPS IN

Description: "UPS IN" is the input for an UPS. It supplies the loads during normal operation.

Ac Voltage: 115V, regulated.

Ac Current: 17.4A, nominal.

Ac Frequency: 60 Hz, regulated.

1.3.2 Output Characteristics

1.3.2.1 OUT 1-8

Description: "OUT 1-8" consist of eight 15A/125V NEMA receptacles which are individually switchable through relays. The "OUT 1-8" is derived from either "UPS IN" or "AC IN", as selected by the "UPS BYPASS."

1.3.2.2 Normal Mode (UPS IN is source of power)

Ac Output Voltage: 115V, regulated.

Ac Output Current, Aggregate: 17.4A, nominal.

Ac Output Frequency: 60 Hz, regulated.

1.3.2.3 UPS Bypass Mode (AC IN is source of power)

Ac Output Voltage: 115V, nominal; 85V to 132V.

Ac Output Current, Aggregate: 17.4A, nominal.

Ac Output Frequency: 47 to 63 Hz.

1.3.2.4 AC OUT

Description: "AC OUT" supplies ac power to the UPS. It has the same voltage, current, and frequency characteristics as "AC IN". However, "AC OUT" is protected with the two–pole ac input circuit breaker, "AC INPUT BREAKER."

Ac Output Voltage: 115V, nominal; 85V to 132V.

Ac Output Current: 25A, maximum.

Ac Output Frequency: 47 to 63 Hz.

1.3.2.5 FAN AC, FAN UPS

Description: "FAN AC, FAN UPS" are 115V auxiliary outputs that provide power to rack cooling fans. The "FAN AC" derives power from the "AC IN" and "FAN UPS" derives power from "UPS IN."

Ac Output Voltage: Same as the source from which power is derived.

Ac Output Current: 2A, maximum.

Ac Output Frequency: Same as the source from which power is derived.

1.3.2.6 DC PWR

Description: "DC PWR" provides dc power at 5V/5A and 12V/3A. The returns of both outputs are connected to the PDU chassis at the rear panel "GND" stud.

Output Voltage: 5.1V and 12V.

Output Current: 5A, maximum at 5.1V and 3A, maximum at 12V.

Minimum Load Current: 20% of rated output current on each output.

Output Voltage Regulation (line plus load): 1% for 5.1V output and 5% for 12V output.

Overload Protection: Electronic current limit; sustained–overload shutdown executed when an overload causes the output voltage to drop to 90% of nominal (resettable with front panel "FAULT RESET" switch).

Return Ground: The returns are grounded to the PDU chassis at rear panel ground stud, "GND".

1.3.3 TMP

Description: "TMP" provides input for a precision thermistor that is used to monitor the rack temperature. The PDU controller determines the "OVR TMP" condition based on the temperature of this thermistor.

Thermistor: Negative temperature coefficient thermistor, 4,850 Ω at 41°C (106°F).

Overtemperature Threshold: 41°C (106°F), ±1°.

Overtemperature Shutdown Threshold: 46°C (115°F), ±1°.

1.4 ENVIRONMENTAL

Altitude: Operating, 0 to 10,000 feet (0 to 3048 meters); Non–Operating, 0 to 40,000 feet (0 to 12,192 meters).

Temperature: Operating, 0°C to 50°C (32°F to 122°F); Non–Operating, –40°C to 65°C (–40°F to 149°F).

Humidity: 5% to 95%, non–condensing, operating and non–operating.

Air Flow Requirement: 100LFM across the surface of the enclosure.

1.5 GENERAL

Enclosure: Rack–mountable with slides; EIA–310–D compatible.

Size: 3.5"H × 19"W × 12.6"D (89mm x 483mm x 320mm) (2U panel height).

Weight: 12 lbs. (5.44 kg).

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION II

INSTALLATION

2.1 INTRODUCTION

The Elgar Model PDU 2000 has been fully calibrated and tested prior to shipment. Therefore, the unit is ready for immediate use upon receipt. The enclosure is designed to be installed in a standard 19" (483 mm) RETMA rack; pem–nuts are provided for mounting rack slides.

The following checks should be made to ensure that the unit was not damaged during shipment.

WARNING

Hazardous voltages are present when operating this equipment. Read the "SAFETY" notices on page ii prior to performing installation, operation, or maintenance.

2.2 UNPACKING

Perform a visual inspection of the shipping container prior to accepting the package from the carrier. If extensive damage to the shipping container is evident, a description of the damage should be noted on the carrier's receipt and signed by the driver of the carrier agent.

If damage is not apparent until the unit is unpacked, a claim for concealed damage should be placed with the carrier. In addition, the shipping container(s) and filler material should be saved for inspection. Forward a report of damage to the Elgar Service Department. Elgar provides instructions for repair or replacement of the unit upon request.

If the unit needs to be returned to Elgar, suitable shipping containers and packing materials must be used. If proper packing material is not available, contact Elgar to provide containers and shipping instructions.

2.3 PRE–INSTALLATION INSPECTION

Perform a visual inspection of the unit when it is removed from the shipping container. Check for shipping damage such as dents, scratches, distortion, and damaged connectors. If the unit or container(s) show signs of rough handling, remove the covers from the unit to ensure that no loose or broken components are evident.

2.4 INSTALLATION

The Model PDU 2000 is 3.5" (89 mm) high and is designed to be installed in a standard 19" (483 mm) wide cabinet enclosure.

CAUTION

The unit is natural convection cooled and requires a clearance of 1.75" around the unit top, bottom and sides. Operation across the full temperature range requires at least 100 LFM of air flow across the unit.

2.5 COOLING REQUIREMENTS

The PDU 2000 requires air movement through its enclosure for proper cooling at elevated temperatures. This requires at least 100 LFM of air flow when the unit is operated at full power and full temperature range. Ensure that air flow within the rack is unimpeded near the PDU by providing adequate clearance between the PDU and other equipment.

2.6 INPUT/OUTPUT CONNECTORS

Table 2–1 provides a listing of the PDU input and output connectors while Table 2–2 provides a listing of the connector pinouts.

2.7 INSTALLATION/DIMENSIONAL DRAWINGS

Refer to Figures 2–1 through 2–4 for the PDU 2000 dimensions (front, rear, top, and side dimensions, respectively).

Table 2-1. PDU 2000 Input/Output Connectors

J1 Through J8 AC OUTPUT Connectors	
Panel Connector	NEMA 5-15R
Mating Connector	NEMA 5-15P

J9 AC IN/AC OUT Connector	
Panel Connector	MS3102E-24-10P
Mating Connector	MS3106E-24-10S

J10 UPS IN Connector	
Panel Connector	MS3102E-16-10P
Mating Connector	MS3106-16-10S

J11 DC PWR/TMP Connector	
Panel Connector	AMP #350781-1
Mating Connector	AMP #350715-1
Mating Terminal	AMP #350547-2

J12 FAN UPS Connector	
Panel Connector	AMP #1-480699-0
Mating Connector	AMP #1-480698-0
Mating Terminal	AMP #350547-2

J13 FAN AC Connector	
Panel Connector	AMP #1-480699-0
Mating Connector	AMP #1-480698-0
Mating Terminal	AMP #350547-2

J14 HOST RS-232 Connector	
Panel Connector	Female 9-pin Sub-D
Mating Connector	Male 9-pin Sub-D

J15 UPS RS-232 Connector	
Panel Connector	Male 9-pin Sub-D
Mating Connector	Female 9-pin Sub-D

GND (Ground) Connector
1/4-20 Stud

Table 2-2. PDU 2000 Connector Pinout

J1 Through J8 – AC OUTPUT Connectors	
Narrow Blade	AC1
Wide Blade	AC2
Round Blade	Ground
J9 – AC IN/AC OUT Connector	
Pin A	115 VAC Input ("AC IN" AC1)
Pin B	115 VAC Input ("AC IN" AC2)
Pin C	"AC IN" Ground
Pin D	"UPS IN" Ground
Pin E	115 VAC Output ("AC OUT" AC2)
Pin F	115 VAC Output ("AC OUT" AC1)
Pin G	Not Used
J10 – UPS IN Connector	
Pin A	115 VAC Input (AC1)
Pin B	115 VAC Input (AC2)
Pin C	Ground
J11 – DC PWR/TMP Connector	
Pin 1	Temperature Sensor
Pin 2	5.1V Output
Pin 3	12V Output
Pin 4	Temperature Sensor Return
Pin 5	5.1V Return
Pin 6	12V Return

Table 2–2. PDU 2000 Connector Pinout (continued)

J12 – FAN UPS Connector	
Pin 1	AC1
Pin 2	AC2
J13 – FAN AC Connector	
Pin 1	AC1
Pin 2	AC2
J14 – HOST RS-232 Connector	
Pin 2	RXD (Input)
Pin 3	TXD (Output)
Pin 5	Return
Pin 7	RTS (Output)
Pin 8	CTS (Input)
Pins 1, 4, 6, 9	Not Used
J15 – UPS RS-232 Connector	
Pin 1	UPS Power Return
Pin 2	RXD (Input)
Pin 3	TXD (Output)
Pin 5	Return
Pin 7	RTS (Output)
Pin 8	CTS (Input)
Pin 9	UPS Power
Pins 4, 6, 9	Not Used

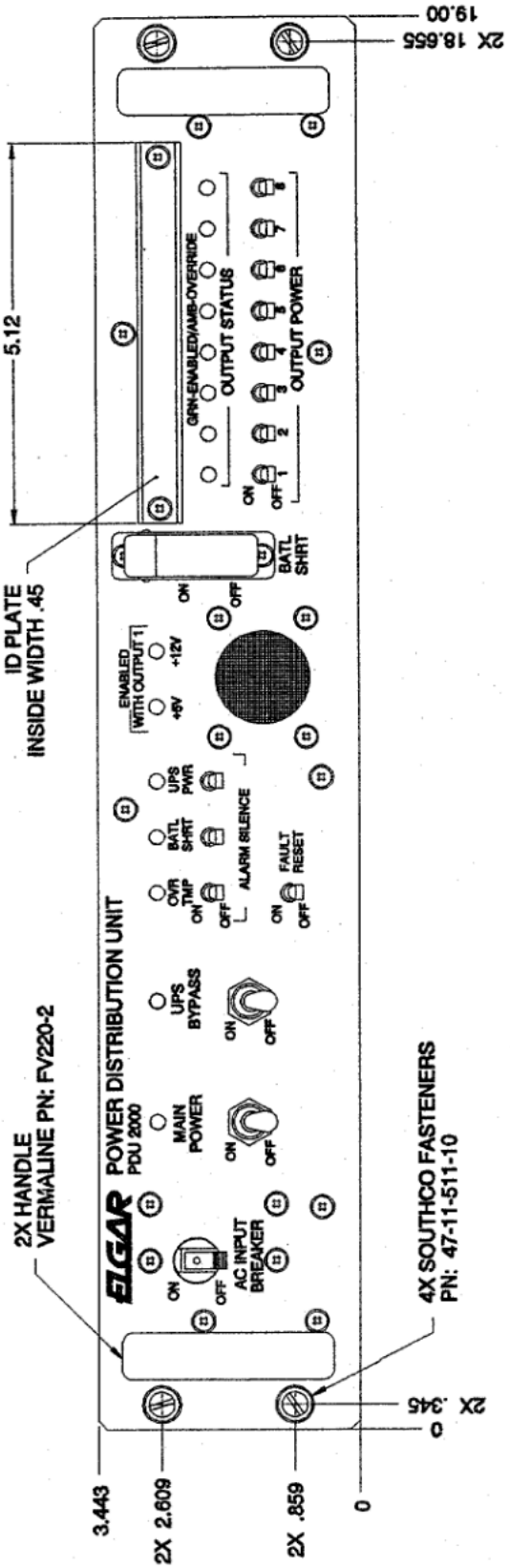


Figure 2-1. PDU 2000 Front Dimensions

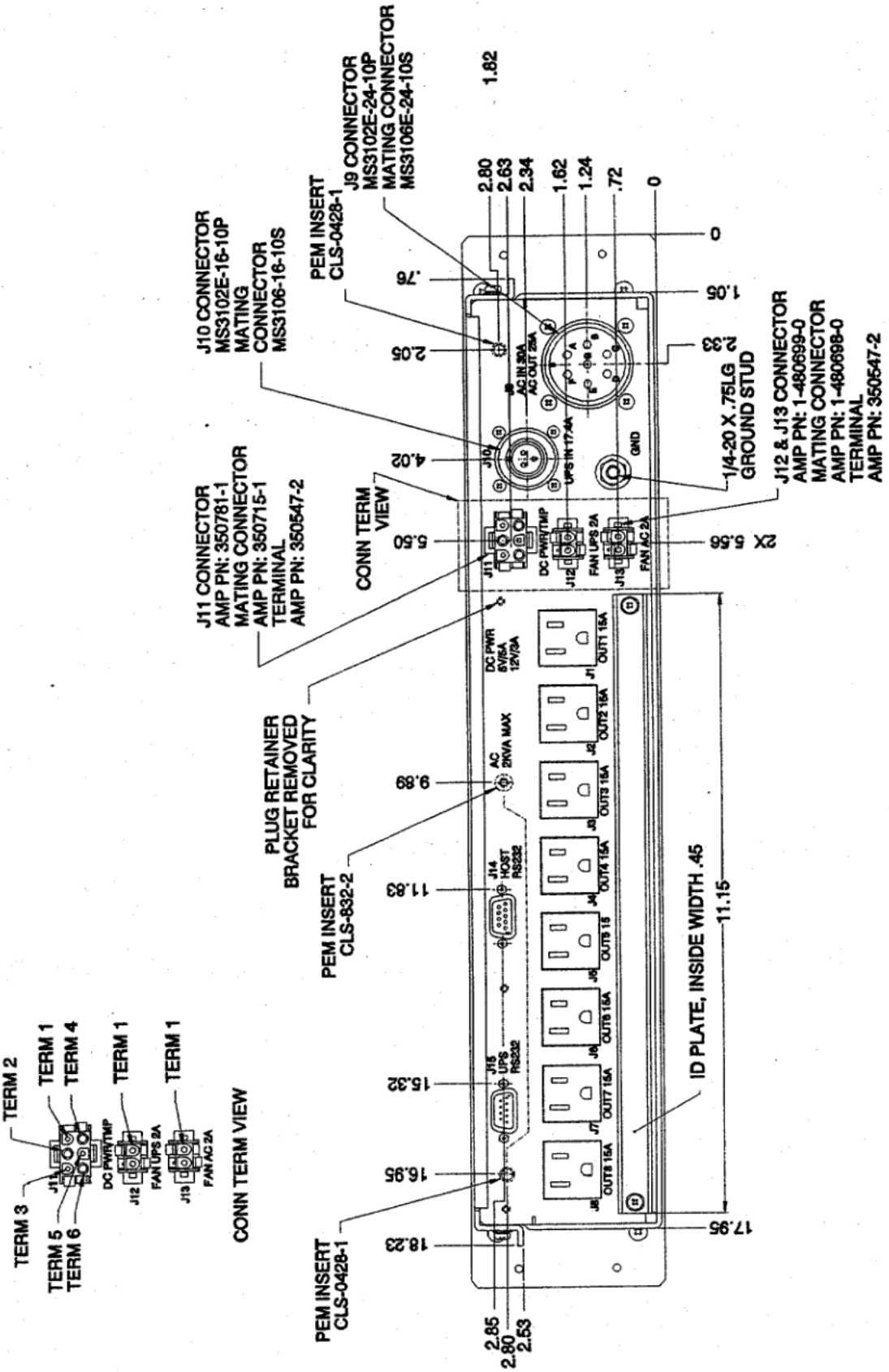


Figure 2-2. PDU 2000 Rear Dimensions

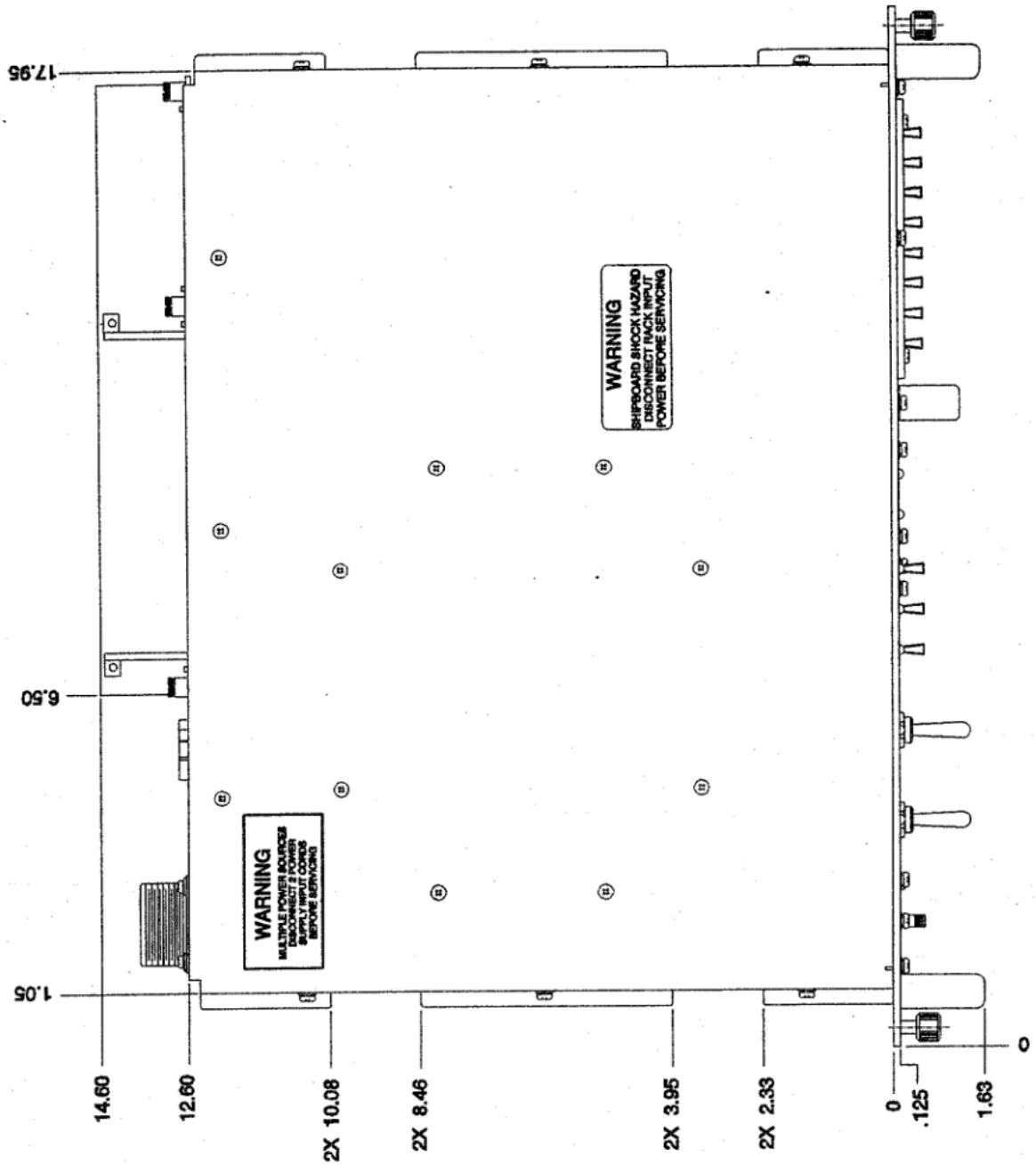


Figure 2-3. PDU 2000 Top Dimensions

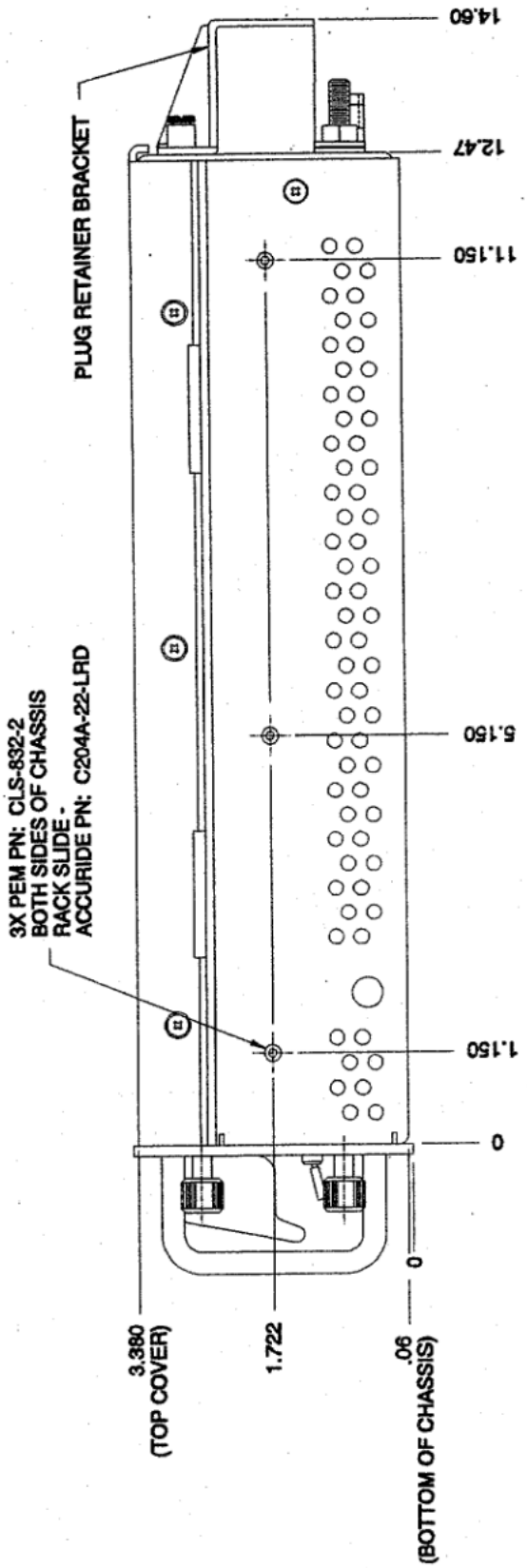


Figure 2-4. PDU 2000 Side Dimensions

2.8 INPUT POWER REQUIREMENTS

The PDU 2000 accepts power from two sources: an ac input, "AC IN," and an UPS input, "UPS IN." In the normal mode of operation, the "UPS IN" is utilized as the source of power for the PDU and the loads, "OUT 1–8." Also, "AC IN" is the source of power for the UPS through "AC OUT."

The PDU 2000 requires 30A service for operation at full load. The "AC IN" and "AC OUT" wiring should be AWG #10 or larger. The "UPS IN" wiring should be AWG #12 or larger.

If the "UPS BYPASS" switch is turned on, the ac power to the UPS is disconnected, and the source of power for the loads is switched to "AC IN". This mode of operation allows the UPS to be removed for service. For maximum protection of the loads when in "UPS BYPASS," the ac input should be derived from an isolation transformer that provides noise attenuation and surge/transient protection.

CAUTION

Before turning on the "UPS BYPASS" switch, the output loads, "OUT 1–8," and the PDU must be shut down ("MAIN POWER" switch must be first turned off).

2.9 POWER CONNECTION

WARNING

Hazardous voltages are present when operating this equipment. Read the "SAFETY" notices on page ii prior to performing installation, operation, or maintenance.

WARNING

To minimize shock hazard, the PDU chassis must be connected to an electrical safety ground. The unit must be connected to the ac power source through a three–conductor cable, with the third wire connected to an electrical safety ground. A ground stud, "GND," is located on the rear panel of the unit.

CAUTION

Before applying input power to the PDU, ensure that the front panel circuit breaker, "AC INPUT BREAKER," and the main power switch, "MAIN POWER," are in the off (down) position.

2.10 TEMPERATURE SENSOR MOUNTING

A temperature sensor is provided that allows monitoring of the rack ambient temperature. This sensor should be located at the air intake of the rack. Ensure that it is not located near hot components that could heat the sensor and produce inaccurate readings. Also, the sensor is for monitoring air temperature and should not be immersed in liquids.

2.11 OUTPUT CABLE RETENTION BRACKET

An output cable retention bracket is provided that prevents the ac output load cables from being accidently removed. To mount the bracket, first insert the plugs into the outputs "OUT 1-8" then route the cables through the slots of the bracket. The bracket should then be secured to the rear panel.

2.12 OUTPUT LOAD MARKER STRIPS

Marker strip carriers are provided at the front and rear panels that allow the user to mount labels for identification of the ac output loads "OUT 1-8."

2.13 DC PWR/TMP CABLE

The DC PWR/TMP Cable assembly provides a means of interconnection between the PDU and the user's equipment. The assembly consists of three 10-foot cables, the temperature sensor, and the 5V and 12V cables. The 5V and 12V cables are terminated in two 4-position connectors. Refer to Table 2-3 for a listing of the connectors and Table 2-4 for the pinout.

Table 2-3. DC PWR/TMP Cable Connectors

P11 - DC PWR/TMP PDU Connector	
Connector	AMP #350715-1
Connector Terminal	AMP #350547-2
P16, P17 - DC PWR Connectors	
Connector	MOLEX 15-24-4048
Connector Terminal	MOLEX 02-08-1202

Table 2–4. DC PWR/TMP Cable Pinout

P11 – DC PWR/TMP PDU Connector	
Pin 1	Temperature Sensor
Pin 2	5.1V Output
Pin 3	12V Output
Pin 4	Temperature Sensor Return
Pin 5	5.1V Return
Pin 6	12V Return
P16, P17 – DC PWR Connector	
Pin 1	12V Output
Pin 2	12V Return
Pin 3	5V Return
Pin 4	5V Output

SECTION III

OPERATION

3.1 INTRODUCTION

The PDU 2000 provides a complement of controls and indicators that allow the user to fully control the mode of operation of the unit and to determine its status. Furthermore, RS–232 data communications ports are available that allow interface between the host computer, the PDU 2000, and an UPS.

3.2 CONTROLS AND INDICATORS

3.2.1 Controls

3.2.1.1 *"AC INPUT BREAKER" Circuit Breaker*

The "AC INPUT BREAKER" circuit breaker provides overload protection for the PDU as well as the "AC OUT" output; it is a two–pole device that breaks both lines of the ac input. If the PDU is supplying the output loads from the UPS (normal mode of operation), opening of the breaker only interrupts ac power to the UPS; the UPS would then run from its internal battery and would continue to maintain ac power to the loads until depleting its battery.

3.2.1.2 *"MAIN POWER" Switch*

The "Main Power" switch provides on/off power control for the PDU, the output loads "OUT 1–8", and, through a relay, the "AC OUT"; it is a two–pole device that switches both lines of the ac power.

3.2.1.3 *"UPS BYPASS" Switch*

The "UPS BYPASS" switch allows the ac power to the UPS to be disconnected, and selects the source of PDU output power, "OUT 1–8," from either "AC IN" or "UPS IN." When turned on, "UPS BYPASS" disconnects, through a relay, ac input power to the UPS ("AC OUT" is switched off), and connects the output loads, "OUT 1–8", to the "AC IN"; this mode of operation allows the UPS to be removed for service. If the "MAIN POWER' switch is turned off while the "UPS BYPASS" switch is on, the "AC INPUT BREAKER" circuit breaker must be turned off in order to isolate the "AC OUT" from the ac input power.

3.2.1.4 *"BATL SHRT" Switch*

"BATL SHRT" is a battleshort switch that overrides the overtemperature and ac input fault monitors of the PDU and places the load under manual control with the front panel switches. A protective switch guard is provided to prevent accidentally turning on of the switch.

3.2.1.5 *"FAULT RESET" Switch*

The "FAULT RESET" switch allows restart of the PDU and the ac/dc output loads following a shutdown due to overtemperature or an out–of–range ac input. It is also used to re–enable the 5V and 12V supplies after an overload shutdown had occurred.

3.2.1.6 *"OUTPUT POWER" Switches*

The "OUTPUT POWER" switches individually energize the eight outputs of the PDU, "OUT 1–8."

3.2.1.7 *"ALARM SILENCE" Switches*

The "ALARM SILENCE" switches allow disabling the audible alarm for the three alarm conditions: "OVR TMP", "BATL SHRT", and "UPS PWR".

3.2.2 Front Panel Indicators

3.2.2.1 *"MAIN POWER" Indicator*

The "MAIN POWER" indicator is a two–color LED that indicates the condition of the ac power that would be applied to the output loads: green indicates proper power, while a flashing red indicates that the voltage and/or the frequency are out of their allowed ranges. If the ac power is inappropriate at start–up of the PDU during the "UPS BYPASS" mode of operation, the ac outputs, "OUT 1–8" is not energized. During operation, if the ac power goes outside the allowed range, the ac outputs are turned off.

3.2.2.2 *"UPS BYPASS" Indicator*

The "UPS BYPASS" indicator is an amber LED that indicates that the ac power to the UPS has been disconnected and that the ac outputs, "OUT 1–8", are being supplied by "AC IN."

3.2.2.3 *"OVR TMP" Indicator*

The "OVR TMP" indicator is a red LED that indicates that the ambient temperature of the rack is 40°C (104°F) or greater.

3.2.2.4 *"BATL SHRT" Indicator*

The "BATL SHRT" indicator is a red LED that indicates that the "BATL SHRT" switch has been engaged.

3.2.2.5 *"UPS PWR" Indicator*

The "UPS PWR" indicator is a red LED that indicates that the UPS is drawing power from its battery because its ac input has failed (self–clearing when normal operation of the UPS is resumed).

3.2.2.6 *"OUTPUT STATUS" Indicators*

The "OUTPUT STATUS" (1 to 8) indicators are two–color LED's that indicate whether the ac outputs, "OUT 1–8," could be energized:

- Green indicates that an ac output, "OUT 1–8", is ON;
- Amber indicates that an "OUTPUT POWER" switch is ON, but the respective ac output has not been energized because of microcontroller override.

3.2.2.7 *"+5V" Indicator*

The "+5V" indicator is a green LED that indicates that the 5V supply is available. The indicator flashes when the 5V supply caused a shutdown of the dc supplies; this occurs when the dc output voltage drops to 90% of its rated value.

3.2.2.8 *"+12V" Indicator*

The "+12V" indicator is a green LED that indicates that the 12V supply is available. The indicator flashes when the 12V supply caused a shutdown of the dc supplies; this occurs when the dc output voltage drops to 90% of its rated value.

3.3 ALARMS AND MONITORS

3.3.1 Alarm Conditions

When an alarm condition occurs, the audible alarm sounds and the respective indicator flashes. The repetition rate (with 50% duty cycle) is unique for each alarm. If multiple alarms are present at the same time, the repetition rate is modified to allow differentiating whether two or three alarms are present.

3.3.2 "OVR TMP" Alarm

The "OVR TMP" alarm indicates that the ambient temperature of the rack is 40°C (104°F) or greater. If the temperature reaches 45°C (113°F), the PDU shutdowns 55 seconds after issuing a warning to the host computer. The repetition rate is 5 PPS.

3.3.3 "UPS PWR" Alarm

The "UPS PWR" alarm indicates that the UPS is on battery power because its ac input has failed. Load output power would be lost when the UPS shuts down after depleting its battery. The repetition rate of the alarm is 3 PPS.

3.3.4 "BATL SHRT" Alarm

The "BATL SHRT" alarm indicates that the "BATL SHRT" switch has been engaged. PDU shutdown for fault conditions is disabled, and those ac outputs that are turned on remain on. The repetition rate is 4 PPS.

3.3.5 PDU Monitors

3.3.5.1 Ac Voltage Monitor

The ac voltage monitor determines the condition of the ac power during the "UPS BYPASS" mode of operation, and qualifies enabling of the ac and dc outputs. If, during start-up, the ac voltage exceeds the range of 84V, ±1V or 133V, ±1V, the ac output power, "OUT 1-8," and dc output power, "DC PWR", are not enabled. If, during operation, the ranges are exceeded then the outputs are turned off.

3.3.5.2 Ac Frequency Monitor

The ac frequency monitor determines the condition of the ac power during the "UPS BYPASS" mode of operation, and qualifies enabling of the ac and dc outputs. If during start-up the ac frequency exceeds the range of 47 Hz ±1 Hz or 63 Hz ±1 Hz, the ac output power, "OUT 1-8," and dc output power, "DC PWR," are not enabled. If, during operation, the ranges are exceeded then the outputs are turned off.

3.3.5.3 Dc Voltage Monitor

The dc voltage monitor determines the condition of the 5V and 12V outputs. If either of the dc outputs drops to 90% of rated value, both dc outputs are turned off. The output which caused the shutdown is identified by flashing its front panel indicator. Operation could be re-enabled by turning on the "FAULT RESET" switch.

3.3.5.4 UPS Power

A contact closure from J15-Pin 9 to J15-Pin 1 (logic low level) is used to signify that the UPS is operating from its battery. The contacts must switch 5VDC at 2.3 mA. The contact closure initiates the "UPS PWR" alarm and changes the "UA" status to UA=1.

3.4 GENERAL OPERATION

3.4.1 Normal Mode Power Up

In the normal mode of operation, the PDU 2000 uses the output of the UPS to supply the ac loads and dc power supplies. Also, the UPS is supplied ac power from "AC IN." In normal mode, the PDU should be powered up in the following manner:

1. Ensure that the ac input circuit breaker "AC INPUT BREAKER," the main power switch "MAIN POWER," and the UPS bypass switch "UPS BYPASS" are in the OFF (down) position.

2. Ensure that the input power is connected to "AC IN" and "UPS IN." Ensure that the output loads are connected to "AC OUT," "OUT 1-8," "DC PWR," and "FAN AC" or "FAN UPS."

3. Turn the "AC INPUT BREAKER" circuit breaker to the ON (up) position.

4. Turn on the UPS and enable its output power.

5. Turn the "MAIN POWER" switch to the ON (up) position.

6. Turn on the output loads by switching the required "OUTPUT LOAD" switches. Alternately, the required "OUTPUT LOAD" switches could be in the ON (up) position prior to turning on the "MAIN POWER" switch. This would result in a sequenced start up where the selected output loads would be turned on (from 1 to 8) within a two-second interval.

3.4.2 UPS Bypass Mode Power Up

In the UPS Bypass mode of operation, the PDU 2000 disconnects ac input power from the UPS; the ac loads and dc power supplies are powered from "AC IN." This mode allows the removal of the UPS for service.

CAUTION

In order to turn ON the "UPS BYPASS" switch, the output loads and the PDU must be turned OFF ("AC INPUT BREAKER" circuit breaker and "MAIN POWER" switch must be turned OFF).

In the UPS Bypass mode, the PDU should be powered up in the following manner:

1. Ensure that the ac input breaker ("AC INPUT BREAKER") and the main power switch ("MAIN POWER") are in the OFF (down) position.

2. Ensure that the UPS bypass switch ("UPS BYPASS") is in the ON (up) position.

3. Ensure that the input power is connected to "AC IN." UPS ac power could be connected to "UPS IN," but would not be utilized.

4. Ensure that the output loads are connected to "OUT 1–8," "DC PWR," and "FAN AC." The UPS could be connected to "AC OUT," but its ac power would be disconnected. Also, fans connected to "FAN UPS" would not be energized if the UPS is OFF.

5. Turn the "AC INPUT BREAKER" circuit breaker to the ON (up) position.

6. Turn the "MAIN POWER" switch to the ON (up) position.

7. Turn on the output loads by switching the required "OUTPUT LOAD" switches. Alternately, the required "OUTPUT LOAD" switches could be in the ON (up) position prior to turning on the "MAIN POWER" switch. This would result in a sequenced start up where the selected output loads would be turned on (from 1 to 8) within a two–second interval.

   If the ac input power is not suitable (ac input voltage or frequency out of allowed range), the output loads would not be energized and the "AC INPUT" indicator would be flashing red.

3.5 RS–232 COMMUNICATIONS INTERFACE

3.5.1 "HOST–RS232"

The "HOST–RS232" communications port interconnects the PDU with the host computer and allows bi–directional communications between the host computer, the PDU, and the UPS through action of the PDU micro–controller. The PDU acts as an intelligent dual port data router: Any messages received by the PDU from the host computer which are not of the proper format as required by the PDU are retransmitted to the UPS. The "HOST–RS232" port is opto–isolated from the "UPS–RS232" port. This port is also compatible with an ASCII data terminal.

- **Baud Rate**: 1,200
- **Data Bits**: 7
- **Start Bits**: 1
- **Stop Bits**: 1
- **Parity**: Even

3.5.2 "UPS-RS232"

The "UPS-RS232" communications port interconnects the PDU with the UPS and allows bi-directional communications between the host computer, the PDU, and the UPS. All messages from the UPS are retransmitted to the host computer. The "UPS-RS232" port signals are referenced (dc-coupled) to the PDU chassis. This port is also compatible with an ASCII data terminal.

- **Baud Rate**: 1,200
- **Data Bits**: 7
- **Start Bits**: 1
- **Stop Bits**: 1
- **Parity**: Even

3.5.3 System Configuration Determination

The PDU 2000 functions as a DTE device for the host computer, and for the UPS. The PDU determines that a host computer is connected by detecting the presence of an active CTS line on the "HOST-RS232" port. The PDU determines whether an UPS is present by sensing the CTS on the "UPS-RS232" port; if an UPS is not present when the PDU powers up, the PDU sends a "UA=1" in the status message.

3.5.4 Message Packets

When requested by the host computer or when the operational status of the PDU changes, the PDU issues a status message consisting of three lines of data with all items on a line separated with a colon and a space. All messages begin with a valid text character; also, they are preceded and followed with a carriage return (CR) and line feed (LF).

3.5.5 Status Message Format

The three-line status message sent by the PDU has the following format:

```
(CR)(LF)CHANN 1:*~2:*~3:*~4:*~5:*~6:*~7:*~8:*(CR)(LF)
        OT:*~BS:*~UA:*~BY:*~ER:*~CS:*(CR)(LF)
        VER:x.xx~TEMP:xx~V:xxx.x~F:xx.x(CR)(LF)
```

Where:

~, space

*, status value

x, parameter value

CHANN 1–8: Output status; *, 0 = OFF, 1 = ON

OT: Overtemperature (OVR TMP); *, 0 = NO, 1 = YES

BS: Battleshort (BATL SHRT); *, 0 = OFF, 1 = ON

UA: UPS Battery Active (UPS PWR); *, 1 = YES, 0 = NO

BY: UPS BYPASS selected (disregard UA status); *, 0 = NO, 1 = YES

ER: Error, break, or bad message; *, 0 = NO, 1 = YES

CS: Checksum; *, ? = BAD, 1 = GOOD

VER: Version number; x.xx, major and minor

TEMP: Temperature; xx, in °C

V: Ac voltage; xxx.x, in volts

F: Ac frequency; xx.x, in hertz

Conditions for Sending Status Message:

The host computer requests a status message with the following command: **S(CR)(CR)**; the second carriage return (CR) must be sent within 3 seconds or the message is retransmitted to the UPS.

The PDU sends a status message when any of the following conditions occur:

- An "OUTPUT POWER" switch is turned on.
- An "OUTPUT POWER" switch is turned off.
- An overtemperature condition (OVR TMP) of 40°C (104°F) or greater.
- An overtemperature shutdown condition of 45°C (113°F) or greater.
- A reduction in temperature from above 40°C (104°F) to less than 40°C.
- The "BATL SHRT" switch is turned on.
- The PDU encounters an error, break, or bad message.
- The "UA" status, UPS Battery Active (UPS PWR), changes state.

SECTION IV

OPERATOR MAINTENANCE

4.1 INTRODUCTION

This section contains information on maintaining the PDU 2000. There are no adjustments accessible to the user. This maintenance section deals with general operational concerns only.

WARNING

Hazardous voltages are present when operating this equipment. Read the "SAFETY" notices on page ii prior to performing installation, operation, or maintenance.

4.2 SERVICE INFORMATION

Questions concerning the operation, repair or service of this instrument should be directed to the Elgar Repair Department. Include the model number and serial number in any correspondence concerning this instrument. DO NOT return the unit to the factory without prior authorization.

ELGAR
Repair Department
9250 Brown Deer Road
San Diego, CA 92121-2294
1-800-733-5427
Tel: (858) 450-0085
Fax: (858) 678-4482
www.elgar.com

4.3 TROUBLESHOOTING

In the event that problem arises during unit operation, the guidelines listed in Table 4–1 should be used to assist in determining the cause and solution.

Table 4-1. PDU 2000 Troubleshooting Guide

Symptom	Probable Cause	Suggested Solution
No indicators are illuminated.	No ac input power at "AC IN" or "UPS IN."	Ensure that ac input power is present.
The "MAIN POWER" indicator flashes red.	Ac power is out of the allowed range in voltage and/or frequency.	Ensure that the ac input power is appropriate. Reset with the "FAULT RESET" switch.
The "+5V" indicator is flashing.	The output voltage of the 5V power supply is too low.	Check for an overload on the 5V output. Reset with the "FAULT RESET" switch.
The "+12V" indicator is flashing.	The output voltage of the 12V power supply is too low.	Check for an overload on the 12V output. Reset with the "FAULT RESET" switch.
The "OVR TMP" indicator is illuminated.	The ambient temperature at the temperature sensor location is 40°C (104°F) or greater.	Check for proper operation of the cooling fans; check for obstructions in the air intake and exhaust; reduce ambient temperature.
Output loads are shut down with the "OVR TMP" indicator illuminated.	The ambient temperature at the thermistor location reached 45°C (112°F) or greater.	Check for proper operation of the cooling fans; check for obstructions in the air intake and exhaust; reduce ambient temperature.
The "UPS PWR" indicator is illuminated.	The UPS is running on its internal batteries.	Check that the ac input voltage for the UPS is appropriate.

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