ELGAR

GLOBAL UNINTERRUPTIBLE POWER SUPPLY (GUPS)

MODEL GUPS 2400A

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.

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SAFETY NOTICE

BEFORE APPLYING POWER to the System, verify that the GUPS 2400A is properly configured for the user's particular application.

WARNING

HAZARDOUS VOLTAGES IN EXCESS OF 280 VRMS, 400V PEAK 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 GUPS 2400A 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 and DC input power is de-energized prior to connecting or disconnecting the power cables. Similarly, the GUPS 2400A circuit breaker must be switched OFF prior to connecting or disconnecting output 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.

Always disconnect the AC and DC input power, and allow **three minutes, minimum**, prior to performing any internal servicing.

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GENERAL DESCRIPTION

1.1 INTRODUCTION

The Elgar Model GUPS 2400A is a 2400 VA Global Uninterruptible Power Supply (GUPS) that provides regulated 115 VRMS, 60 Hz output power at up to 20.8 Amps RMS load current. The GUPS 2400A accepts AC input voltages from 85V to 280V at frequencies from 45 Hz to 450 Hz. A battery backup of 5 minutes at 2400 VA output is also provided by a removable battery pack. Output power is continuous when transferring from AC to battery or battery to AC.

1.2 GENERAL DESCRIPTION

The Elgar Model GUPS 2400A is contained in a 7" (178 mm) high by 19" (483 mm) wide by 21" (533 mm) deep rack-mount enclosure. All input and output connections are made at the rear panel. Cooling air is drawn in through a filter on the front panel and exhausted out the rear panel. Operational and input/output power status is indicated by front panel LEDs. A master power switch and control pushbutton switches are also provided on the front panel. There are no operator adjustments.

1.3 SPECIFICATIONS

AC Input Voltage: There are two ranges, automatically selected: 85 to 140V or 170 to 280V (the input circuit breaker must be de-energized when switching between the two ranges).

AC Input Current (2400 VA, 0.8 Power Factor Output Load): 33A, nominal, at 120 VAC input voltage; 17A, nominal, at 240 VAC input voltage.

AC Input Frequency: 45 to 450 Hz.

Extended Battery Input Voltage: 192 VDC, nominal, through an optional extended battery connector (non-isolated from the AC line input).

Batteries: Internal (standard), one pack; External (optional), two packs.

Battery Hold-Up Time: 5 minutes with a 2400 VA load, 0.8 power factor, and one internal battery pack.

Battery Recharge Time: 4 hours to 90% capacity.

Output Voltage: 115V ±2% over the full range of line/load regulation, stability and accuracy.

Output Frequency: 60 Hz ±0.1%.

Output Current: 20.8 Amps RMS.

Output Current Crest Factor: 3:1, maximum.

Output Distortion: 2% maximum Total Harmonic Distortion (THD) with linear loads.

Output Power: 1920 watts into a resistive load; 2400 VA into a ±0.8 power factor.

Efficiency: 70% operating on AC.

AC to DC Crossover: 85/170 VAC, minimum, and 140/280 VAC, maximum.

Power Loss During Crossover: None.

Temperature: Operating: 0°C to 40°C (32°F to 104°F); Non-Operating: -40°C to 65°C (-40°F to 149°F).

Humidity: Operating: 5% to 95% non-condensing.

Altitude: Operating: 0 to 10,000 feet; Non-Operating: 0 to 40,000 feet; 2000 feet/min. max.

Dimensions:

Height: 7" (178 mm)
Depth: 21" (533 mm)
Width: 19" (483 mm). Fits standard RETMA rack.

Weight: 78 lbs. (35 kg), maximum, without battery pack; internal battery pack weighs 48 lbs. (22 kg); 126 lbs. (57 kg), maximum, combined weight.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION II

INSTALLATION

2.1 INTRODUCTION

The Elgar Model GUPS 2400A has been aligned, calibrated, and tested prior to shipment. Therefore, the instrument is ready for immediate use upon receipt. However, the following checks should be made to ensure that the instrument was not damaged during shipment.

WARNING

The GUPS 2400A weighs 78 pounds (35 kg) without the battery pack. If installed, the battery pack adds an additional 48 pounds (22 kg). A minimum two person lift is required!

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 instrument 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 Repair Department. Elgar will provide instructions for repair or replacement of the instrument.

When returning the instrument to Elgar, suitable shipping containers and packing material must be used. If the instrument needs to be shipped and 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 instrument when it is removed from the shipping container. Check for shipping damage such as dents, scratches, distortion, and damaged connectors. If the instrument or container(s) show signs of rough handling, remove the covers from the instrument to ensure that the circuit boards are securely in place and that no loose or broken components are evident.

2.4 INSTALLATION

The Model GUPS 2400A is 7" (178 mm) high and is designed to be installed in a standard 19" (483 mm) wide cabinet enclosure or a transit case.

CAUTION

Avoid blocking the instrument air intakes or exhaust.

2.5 AIR INTAKE AND EXHAUST

The air intake is located on the front panel of the instrument and the exhaust is through the rear panel. Care must be taken not to block the air intake and exhaust. No special vertical separation is required when stacking instruments. However, a 1-3/4" (43.75 mm) vertical spacer above and below the instrument may improve cooling.

2.6 INSTALLATION/DIMENSIONAL DRAWING

Refer to Figures 2-1 through 2-3 for information on outline and mounting dimensions.

2.7 INPUT/OUTPUT CONNECTORS

Table 2–1 provides a listing of the GUPS 2400A input and output connectors.

Table 2–1. GUPS 2400A Input/Output Connectors

J1 – AC Input Connector	
Panel Connector	MS3102E 28–6P
Mating Connector	MS3106E 28–6S
J2 – RS232 Connector	
Panel Connector	15 pin Sub–D Female
Mating Connector	15 pin Sub–D Male
J3 – AC Output Connector	
Panel Connector	MS3102E 20–19S
Mating Connector	MS3106E 20–19P
J4 – Extended Battery Pack Connector	
Panel Connector	AMP 350781–1
Mating Connector	AMP 350715–1
Strain Relief	AMP 350812–01

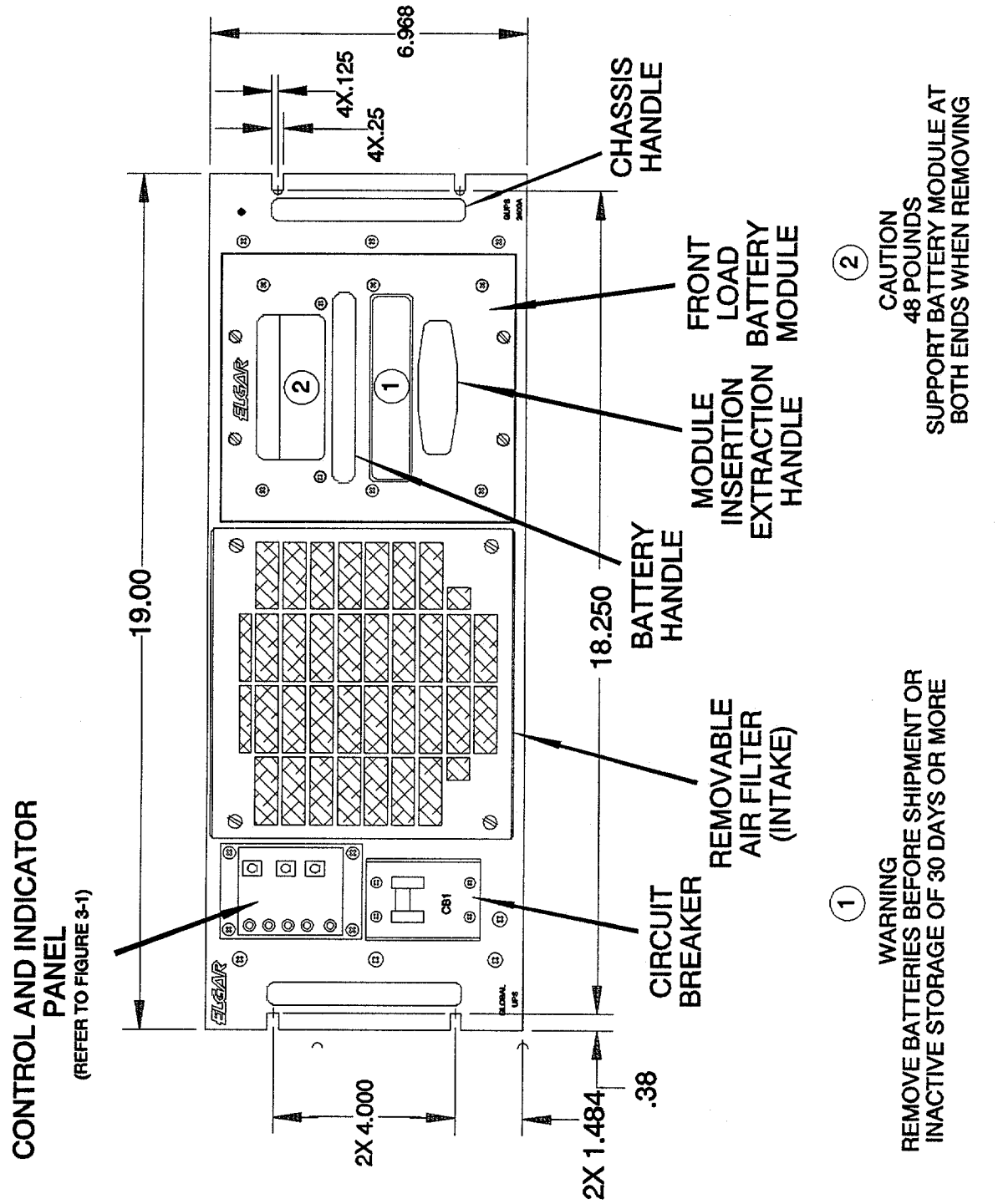

Figure 2-1. GUPS 2400A (Front View)

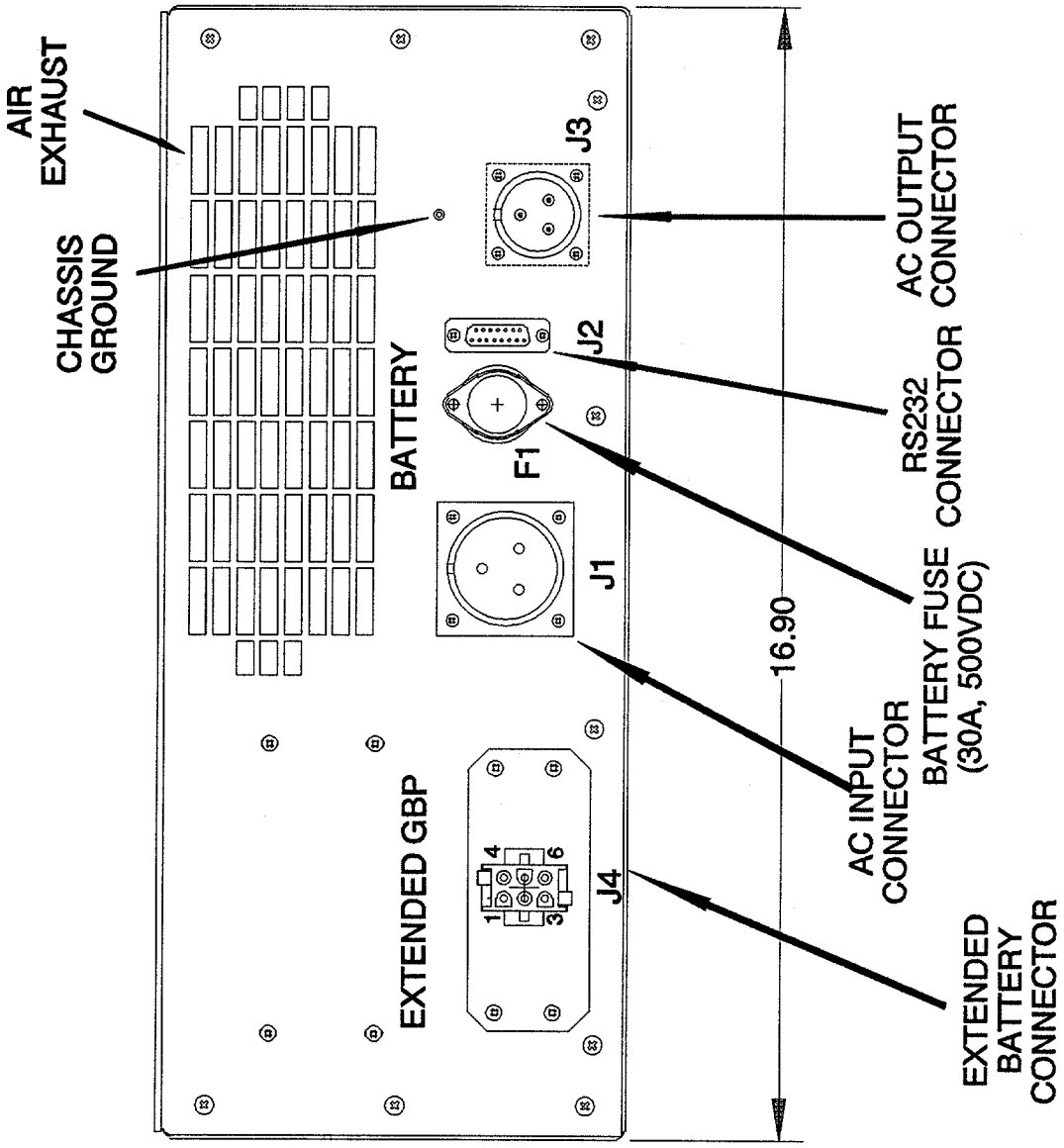

Figure 2-2. GUPS 2400A (Rear View)

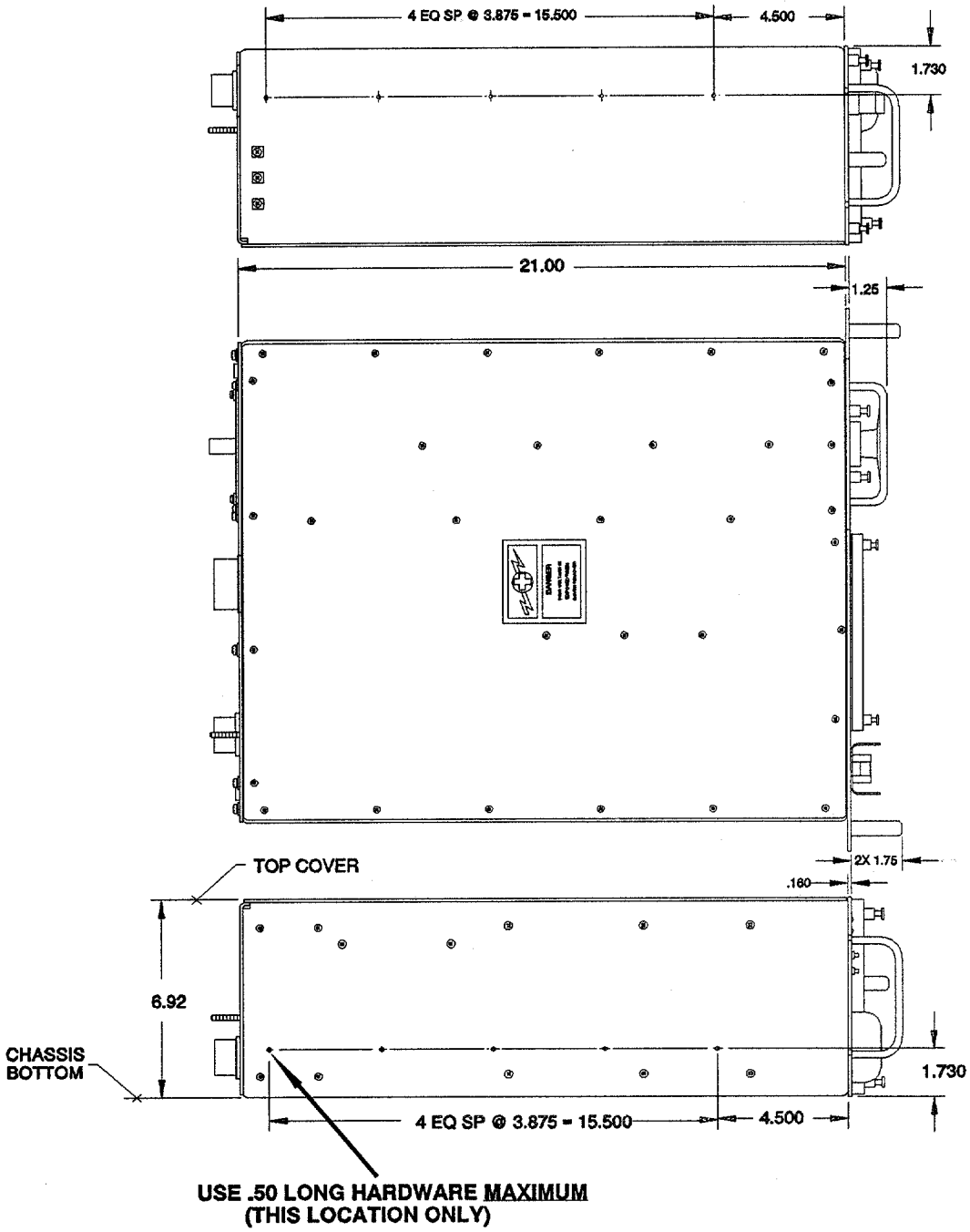

Figure 2–3. GUPS 2400A (Top and Side Views)

2.8 WIRE GAUGE SELECTION

The following guidelines assist in determining the optimum cable specification for the user's power applications. These guidelines are equally applicable to both DC and low frequency AC (up to 450 Hz) power cabling. The same engineering rules apply whether going into or out of an electrical device. Thus, this guide applies equally to the input cable and output cable for this Elgar instrument and application loads.

Power cables must be able to safely carry maximum load current without overheating or causing insulation destruction. It is important to everyday performance to minimize IR (voltage drop) loss within the cable. These losses have a direct effect on the quality of power delivered to and from instruments and corresponding loads.

When specifying wire gauge, the operating temperature needs to be considered. Wire gauge current capability and insulation performance drops with the increased temperature developed within a cable bundle and with increased environmental temperature. Thus, short cables with generously derated gauge and insulation properties are recommended for power source applications.

Avoid using published commercial utility wiring codes. These codes are designed for the internal wiring of homes and buildings and accommodate the safety factors of wiring loss, heat, breakdown insulation, aging, etc. However, these codes consider that up to 5% voltage drop is acceptable.

Such a loss directly detracts from the quality performance specifications of this Elgar instrument. Frequently, these codes do not consider bundles of wire within a cable arrangement.

In high performance applications, as in motor start-up and associated inrush/ transient currents, additional consideration is required. The cable wire gauge must consider peak voltages and currents which may be up to ten times the average values. An underrated wire gauge adds losses which alter the inrush characteristics of the application and thus the expected performance.

Table 2-2 identifies popular ratings for DC and AC power source cable wire gauges.

Table 2–2. Recommended Wire Gauge Selection Guide

Column 1	Column 2	Column 3	Column 4
Size (AWG)	Amperes (Maximum)	Ohms/100 Feet (One Way)	IR Drop/100 Feet (Col. 2 X Col. 3)
14	15	0.257	3.85
12	20	0.162	3.24
10	30	0.102	3.06
8	40	0.064	2.56
6	55	0.043	2.36
4	70	0.025	1.75
2	95	0.015	1.42
1/0	125	0.010	1.25
3/0	165	0.006	1.04

The following notes apply to Table 2–2 and to the power cable definition:

1. The above figures are based upon insulated copper conductors at 25°C (77°F), two current carrying conductors in the cable plus a safety (chassis) ground.

   Columns 3 and 4 refer to "one way" ohms and IR drop of current carrying conductors (e.g., a 50–foot cable contains 100 feet of current carrying conductor).

2. Determine which wire gauge for the application by knowing the expected peak load current (I_{peak}), the maximum tolerated voltage loss (V_{loss}) within the cable, and the one way cable length. The formula below determines which ohms/100 feet entry is required from Column 3. Read the corresponding wire gauge from Column 1.

   (Column 3 value) = $V_{loss}/[I_{peak} \times 0.02 \times (\text{cable length})]$

   Where:

   Column 3 value = Entry of the table above.

   Cable length = One way cable length in feet.

   V_{loss} = Maximum loss, in volts, permitted within cable.

Special case: Should the V_{loss} requirement be very loose, I_{peak} may exceed the maximum amperes (Column 2). In this case, the correct wire gauge is selected directly from the first two columns of the table.

Example:

A 20 ampere (I_{peak}) circuit which may have a maximum 0.5 volt drop (V_{loss}) along its 15-foot cable (one way cable length) requires (by formula) a Column 3 resistance value of 0.083. This corresponds to wire gauge size 8 AWG.

If the cable length was 10 feet, the Column 3 value would be 0.125 and the corresponding wire gauge would be 10 AWG.

3. Aluminum wire is not recommended due to soft metal migration at the terminals which may cause long term (on the order of years) poor connections and oxidation. If used, increase the wire gauge by two sizes (e.g., specify 10 gauge aluminum instead of 14 gauge aluminum).

4. Derate the above wire gauge (use a heavier gauge) for higher environmental temperatures since conductor resistance increases with temperature.

Temperature Degrees		Current Capability
C	F	
40	104	80%

5. Derate the above wire gauge (use a heavier gauge) for an increased number of current carrying conductors. This offsets the thermal rise of bundled conductors.

Number of Conductors	Current Capability
3 to 6	80%
Above 6	70%

6. The preferred insulation material is application dependent. Elgar's recommendation is any flame retardant, heat resistant, moisture resistant thermoplastic insulation rated to a nominal 75°C (167°F). Voltage breakdown must exceed the combined effects of:

   - The rated output voltage;
   - Transient voltages induced onto the conductors from any source;
   - The differential voltage to other nearby conductors; and,
   - Safety margins to accommodate degradations due to age, mechanical abrasion and insulation migration caused by bending and temperature.

7. As frequency increases, the magnetic field of the current carrying conductors becomes more significant in terms of adverse coupling to adjacent electrical circuits. Use twisted pairs to help cancel these effects. Shielded twisted pairs are even better. Avoid close coupling with nearby cables by using separate cable runs for high power and low power cables.

8. The above general values and recommendations should be reviewed, modified and amended, as necessary, for each application. Cables should be marked with appropriate safety WARNING decals as hazardous voltages may be present.

SECTION III

OPERATION

3.1 INTRODUCTION

The controls and display for the Model GUPS 2400A are easily understood after a brief overview.

3.2 CONTROL AND INDICATOR PANEL

Refer to Figure 3-1 for the location of the indicators and controls listed below. All controls and indicators for the GUPS 2400A are located on the Control and Indicator Panel. There are no operator adjustments inside the unit.

There are five indicators and three pushbutton switches on the Control and Indicator Panel. In addition, there is an input circuit breaker located immediately below the Control and Indicator Panel.

3.2.1 Indicators

3.2.1.1 AC INPUT

This indicator is illuminated green when the AC input is within the normal line range, amber when near the extremes of the line range, and red when the AC line is outside the normal operating range.

3.2.1.2 BATTERY

This indicator is illuminated green when the internal battery is within its normal operating range, amber when nearing its low condition, and red when the a low battery condition has occurred.

3.2.1.3 LOAD

This indicator is illuminated green for normal load conditions, amber when approaching full load, and red when overloads occur.

3.2.1.4 TEMP

This indicator is illuminated green for normal operating temperatures and turns red during over temperature conditions, at which time the output power is disabled.

3.2.1.5 TEST

This indicator is normally illuminated green and flashes green during testing. The indicator turns red if an internal test fails.

3.2.2 Pushbutton Switches

3.2.2.1 OUTPUT ON

This pushbutton should be pressed when the inverter output voltage is required to power a load. If the pushbutton is not pressed, the inverter will normally be on although the output will be disconnected. There will be a delay of several seconds before the relay closes after pressing the pushbutton.

3.2.2.2 TEST

Pressing this pushbutton activates the internal test routine in the micro-processor. The test status is indicated by a blinking "test" indicator. The individual indicator status will be green to indicate the test passed and red to indicate a test failure.

3.2.2.3 ALARM SILENCE

Pressing this pushbutton de-activates the audible alarm but not the failure relays on the rear panel. This pushbutton will also reset an over-temperature condition.

3.2.3 Input Circuit Breaker

The AC input circuit breaker is located below the Control and Indicator Panel. It should be turned to the ON (up) position for normal operation. The inverter will start if AC voltage is present. However, the output relay will remain open until the OUTPUT ON pushbutton is pressed.

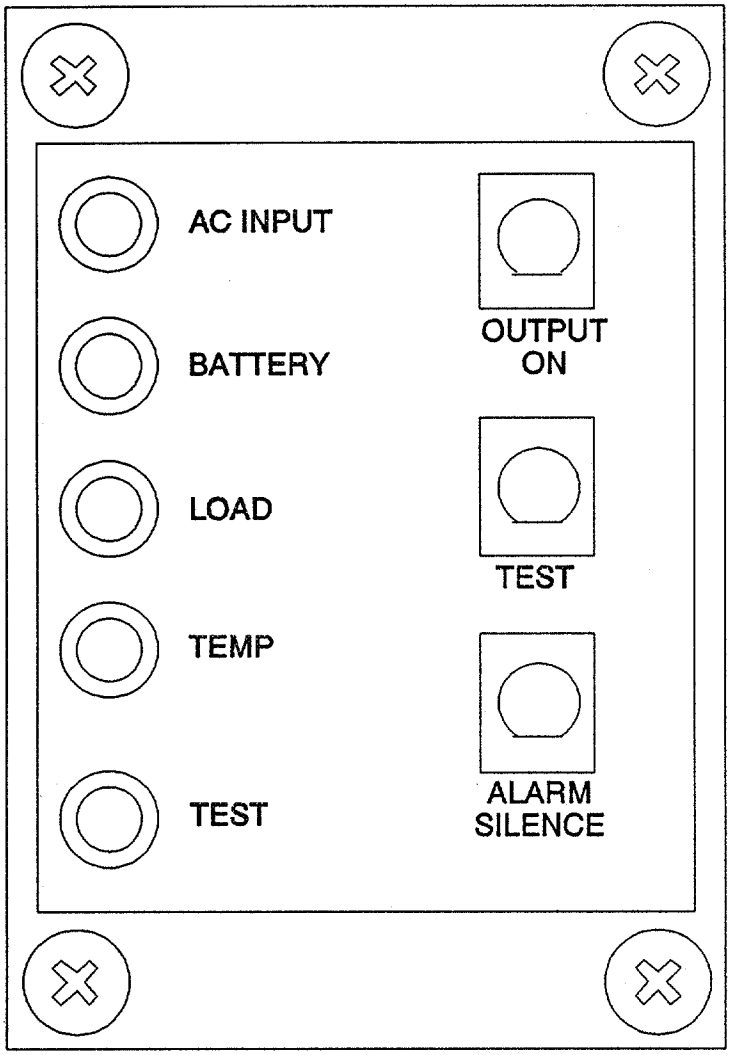

Figure 3–1. GUPS 2400A Control and Indicator Panel

3.3 CONNECTORS

The GUPS 2400A has an input connector for AC input power; one connector for the 115V, 60 Hz output power; an RS232 connector that provides relay contacts for the alarm condition; and an additional connector for an optional extended battery. Each connector has an identifying number. Pin assignments are listed in Table 3-1.

Table 3-1. GUPS 2400A Connector Pin Assignments

Connector J1, AC INPUT	
Pin	**Function**
A	115/230 VAC, 45 - 450 Hz Input
B	Neutral
C	Chassis Ground

Connector J2, POWER LOSS SIGNAL	
Pin	**Function**
1	AC Failure Relay Contact (Normally Open)
2	Low Battery Relay Contact (Normally Open)
3	Relay Common

Connector J3, AC OUTPUT	
Pin	**Function**
A	115 VAC, 60 Hz Output
B	Neutral to Chassis Ground
C	Chassis Ground

GROUND STUD	
Pin	**Function**
#10 Screw	Earth Ground

Connector J4, EXTENDED BATTERY PACK INPUT	
Pin	**Function**
1	+192V External Battery
2	Battery Return
3	Shield Ground
4	Chassis Ground
5	Not Used
6	Not Used

3.4 POWER ON SEQUENCE

To power on the GUPS 2400A, perform the following:

1. Energize the input circuit breaker located below the Control and Indicator panel by placing the circuit breaker in the ON (up) position; wait 10 seconds.

2. Press the OUTPUT ON pushbutton located on the Control and Indicator Panel. The output relay will close and connect the inverter to the load.

The above two step sequence will start the power on process for the unit. If AC input power is available, an internal test routine will commence. After all the parameters are measured and determined to be good, the inverter will start up and the fan will operate. Pressing the OUTPUT ON pushbutton will then momentarily disable the inverter, allowing the output relay to close without hot-switching. The inverter is then re-started and ramped up into the load.

If the AC line is not present when the input circuit breaker is closed, nothing will occur. However, by pressing the OUTPUT ON pushbutton, the unit will perform a full start up test routine as described above. The absence of AC power will be made known by the AC input indicator, audible alarm, and AC failure relay. The inverter will then start from the internal batteries and the output relay will close as before without hot-switching since the OUTPUT ON pushbutton has been pressed.

Operation from any AC line voltage from 85 to 280 VAC is fully automatic with the processor determining the correct operation. No jumpers are required for range changes; however, since the range is latched into memory once it is determined, the circuit breaker should be shut off whenever an unknown AC voltage is to be connected so that the processor can measure the line and determine the proper range of operation. This does not apply to a line drop-out since the circuit will detect the loss of line and remeasure it when the line returns.

Upon power on, the functionality of the GUPS is tested and, when ready, the Control and Indicator Panel LEDs will indicate the status of the test. At this point, the OUTPUT ON pushbutton can be pressed to provide power to the load. Upon loss of AC power the unit instantly switches to the battery only if the output relay has previously been closed.

3.5 BATTERY OPERATION

When AC power is available but out of the operating range of the unit (i.e., 85-140 or 170-280 VAC), the unit can be started from the internal battery by simply pressing the OUTPUT ON pushbutton. Pressing this pushbutton will allow the battery to be connected to the unit in a power on sequence and inverter operation will follow with the relay closing into the load. When the batteries are nearly discharged, the Control and Indicator Panel LED will change to red and the low battery alarm will sound.

When the battery is too low to operate, the unit will automatically shut off. When the AC power returns, the battery charger will resume operation and the batteries will begin to be recharged. Operating the inverter on the battery will result in reduced backup time unless the battery has been able to charge for 4 hours or more.

CAUTION

The unit will not operate if the battery pack has been removed.

3.6 BATTERY INFORMATION, CARE AND HANDLING

The battery used in the GUPS 2400A requires proper storage and recharging if it is to remain reliable.

During storage, the self-discharge of the battery results in a sulfate coating that builds up on the plates. This coating reduces the effective surface area of the plates which reduces the available backup time. Allowing the batteries to self-discharge for too long a period of time may result in problems with recharging or in battery degradation.

Storing the battery at reduced temperatures reduces the level of chemical activity, thus sulphation takes longer to occur. Reasonable storage times are listed in Table 3-2 for several different temperatures.

Table 3-2. Battery Storage Times

Storage Temperature	Storage Time
0°C (32°F)	20 Months
10°C (50°F)	10 Months
20°C (68°F)	5 Months
40°C (104°F)	1.5 Months

The batteries should be recharged for 72 hours after coming out of prolonged storage.

CAUTION

Failure to recharge the batteries after the storage time may result in permanent battery degradation.

3.7 AUTOMATIC BATTERY EQUALIZATION

Proper care and handling of the batteries is vital to the long term life that can be achieved in the system; therefore, the design of the battery charging system used in the GUPS 2400A includes several features to ensure long life.

The float charge voltage is temperature compensated in the battery pack to achieve the correct charging rate regardless of the ambient or battery temperature. Periodic equalization of the charge time interval is accomplished with an internal real-time clock so that it only occurs after a deep discharge or on a 3-month interval. The microprocessor keeps track of the date and time interval internally even while the power is turned off. When power is reapplied to the unit the processor will check the time and date to determine if equalization is required.

NOTES

SECTION IV

OPERATOR MAINTENANCE

4.1 INTRODUCTION

This section contains information on maintaining the GUPS 2400A. There are no adjustments accessible to the user. This maintenance section will deal with mechanical or general operational details 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, Elgar 9250 Brown Deer Road, San Diego, CA 92121-2294. Include the model number and serial number in any correspondence concerning this instrument. DO NOT return the unit to the factory without prior authorization.

4.3 SPARE AND REPAIR PARTS

When ordering spare parts or repair parts, specify the part name, part number, component value and rating, and the Elgar part number, if available.

If complete assemblies are required, contact the Elgar Repair Department. Specify the assembly part number as marked on the assembly and the unit model number, GUPS 2400A, when ordering.

4.4 PERIODIC MAINTENANCE

The only periodic maintenance required for this instrument is to remove any dust and dirt accumulated during operation. The front panel fan filter should be removed and cleaned or replaced on a periodic basis.

The amount of time between cleaning is dependent on the environment in which the unit is used. Dirt accumulation in the air filter can cause restricted air flow and subsequent overheating or reduced life on the internal components and batteries.

4.5 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 to repair the unit as quickly as possible.

Table 4-1. GUPS 2400A Troubleshooting Guide

Symptom	Probable Cause	Suggested Solution
No indicators are illuminated.	The AC line voltage is not present.	Energize the input circuit breaker; press the OUTPUT ON pushbutton.
All indicators are illuminated red.	The battery module is unplugged.	Open the input circuit breaker, unplug the battery module then re-insert the battery module into the connector.
AC is not present on the output.	The output relay is not closed.	Press the OUTPUT ON pushbutton.
The AC input indicator is illuminated red.	The AC input is either below 85V/170V or is above 140V/280V.	Ensure the AC line is within the proper operating range.
The TEMP indicator is illuminated red.	The filter is clogged.	Clean the filter, if required.
The BATTERY indicator is illuminated red.	1) Low battery voltage; 2) open battery fuse; or 3) a defective battery.	1) Recharge the battery; 2) replace the battery fuse; or 3) replace the battery, as required.
The inverter transfers to battery then quickly shuts down.	1) The batteries are discharged; 2) the batteries are sulfated; or 3) the output relay is open.	1) Allow a 4-hour recharge of the batteries; 2) allow a 72-hour recharge of the batteries; or 3) press the OUTPUT ON pushbutton, as required.
The LOAD indicator is illuminated red.	There is an overload on the output.	Reduce the load.
The LOAD indicator is not illuminated.	The output relay is open.	Press the OUTPUT ON pushbutton to close the output relay.
The TEST indicator is blinking.	The TEST pushbutton has been pressed.	
The TEST indicator does not blink when the TEST pushbutton is pressed.	The output relay is closed.	TEST will only be performed if the relay is open.

NOTES