



PORTABLE AC SYSTEM

INVERTER

INVERTER MODEL

PACS-1500

1500 WATTS, 13 AMPS CONTINUOUS

2000 WATTS, 17 AMPS SURGE

OWNER'S MANUAL



GTO ELECTRONICS
430 RITT ST.
ST. PETER, MN 56082
(507) 931-4137

COPYRIGHT © GTO ELECTRONICS 1983

PRINTED IN U.S.A.

CAT NO. 860-028

The first part of the document
 discusses the importance of
 maintaining accurate records
 and the role of the
 committee in this regard.
 It also outlines the
 procedures for handling
 confidential information
 and the responsibilities of
 the staff involved.

The second part of the document
 details the specific
 actions that should be taken
 to ensure compliance with
 the relevant regulations.

The third part of the document
 provides a summary of the
 key findings and
 recommendations.

The fourth part of the document
 contains the conclusions
 drawn from the
 investigation and the
 steps that should be
 taken to address the
 identified issues.

The fifth part of the document
 provides a list of the
 references used in the
 report.

INTRODUCTION

PACS-1500 is a heavy duty, professional quality, Portable AC System capable of providing up to 1500 watts of continuous power. The design specifications and features make your PACS-1500 truly the finest inverter on the market.

INDEX

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
I.	Application Information	3
II.	Features and Specifications	3 & 4
III.	Installation Instructions	5 & 6
IV.	Operating Information	6 & 7
V.	Maintenance	7
VI.	Troubleshooting	8
VII.	Warranty	9, 10 & 11

I. APPLICATION INFORMATION

The PACS-1500 Inverter is designed to operate virtually all 117 VAC items such as appliances and other equipment up to a maximum of 1500 watts, or 13 amps total rating. It has a surge capability of 2,000 watts, or 17 amps (for 4 seconds), which is required on motor type items.

The following is a sample of many appliances and equipment which may be operated with the PACS-1500:

Microwaves	Office Equipment
Ice Cube Makers	Electronic Test Equipment
Television Sets	Cash Registers
Small Refrigerators	Hand Power Tools
Kitchen Appliances	Most Small Motors
Lights	Sump Pumps
Radios	Furnace Motors
Mini Computers	Audio Amplifiers

plus all other items not exceeding PACS-1500 output capabilities.

Most motors and appliances driven by a motor will require at least three times more wattage to start the motor than will be required to keep it running. See Section II. (C) "Power Output", for details regarding overload.

You may use any combination of appliances, equipment or other items at one time, as long as the total of that operated at one time does not exceed PACS-1500 output capabilities.

II. FEATURES AND SPECIFICATIONS

A. Size - 11"H x 14"L x 12"W

Dimension includes 1" flange on both sides and rear of unit for permanent mounting.

B. Weight - 53 pounds, without shipping carton

C. Power Output - 1500 watts, 13 amps continuous rating and 2,000 watt, 17 amp surge (4 second maximum) capability.

NOTE: The name plate rating of the items being operated from PACS-1500 do not always reflect the actual wattage required, or the surge current required. PACS-1500 has automatic overload protection and an overload on PACS-1500 will cause it simply to quit operating, and the overload LED on the remote face panel will advise accordingly.

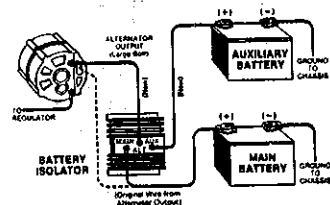
Larger equipment using split phase or similar motors may not operate due to the starting requirements (surge) of the motor.

- D. Voltage Output - 117 VAC (RMS), Quasi-sine wave. Output voltage is constant and does not vary with nominal changes in battery input voltage from 10.5 to 14.5 VDC.
- E. Frequency Output - 60 HZ + .1 HZ. Frequency is constant and does not vary with input battery voltage outlined in (D) "Voltage Output" above, or various loads applied.
- F. Voltage Input - Range 10.5 - 14.5 VDC.
- G. Amperage Input - 175 amp maximum.
- H. Efficiency - under a 1,200 watt load, the unit is 88-91% efficient.
- I. Efficient Output - PACS-1500 self adjusts to accommodate a large or small load. It does not consume power that it not used.
- J. Protected Automatically:
1. Thermo Protection - PACS-1500 shuts off automatically when subjected to excessive heat. The unit restarts automatically when cooled. PACS-1500 will operate from 32^oF or 0^oC, up to 158^oF or 70^oC ambient (room) operating temperatures.
 2. Auto Overload - with manual reset and LED indicator on face panel. See item II. (C), "Power Output" above.
 3. Auto Low Battery Shutoff - with manual reset and LED indicator on face panel. When battery input voltage drops below 10.0 volts, unit automatically shuts off until reset.
- NOTE: Reset button on face panel is the same for "overload" and "low battery".
- K. Auto On - saves battery power. See section IV. (A) "Auto On", for further information.
- L. Polarity Protection - Input fuse protects unit from damage if batteries connections are inadvertently reversed. CAUTION: DO NOT OPERATE UNIT WITHOUT THE PROPER FUSE AS YOU MAY DAMAGE INTERNAL COMPONENTS. REPLACE WITH BUSS TYPE ANN 175 ONLY.
- M. Brushed/plated, painted aluminum - for durable, attractive appearance.
- N. Remote Panel - with individual indicators for power switch, overload and low battery LED monitors and reset button.
- O. Solid State Design - no moving parts to wear out.

III. INSTALLATION INSTRUCTIONS

NOTE: In many instances, your PACS-1500 has been installed at the factory and you may ignore this section.

- A. Mounting - PACS-1500 has been designed to be permanently installed in a well ventilated area where it receives sufficient air flow and internal temperatures consistently remain below 120°F (49°C) on a normal basis. Place the unit as close as possible to the batteries supplying power to minimize loss of battery power. You should use all of the mounting holes found on all three sides to assure unit is firmly attached in a horizontal manner. **CAUTION:** Improper mounting may cause undue wear and fatigue plus shorten the "life" of its parts.
- B. Wiring - From the input batteries to PACS-1500. Always use the heaviest gauge and shortest cable as there is less of a voltage drop under heavy loads. In all instances keep your total length under 10 feet, and use 2 AWG or heavier. Smaller gauge cable will reduce peak power performance, degrade voltage regulation, and cause undue heat buildup. Assure cable connection on battery(s) and inverter are very secure to prevent excessive voltage drop. Run the positive and negative cables together to minimize electromagnetic interference.
- C. Battery Size - To obtain maximum utilization of your PACS-1500, it is necessary to use a high amperage battery(s), which are independent of your vehicles battery. You should also utilize a battery isolator to prevent the main vehicles battery from discharging while running equipment from the inverter. A battery isolator also automatically recharges all batteries as needed when alternator is in operation.



Please contact GTO Electronics Sales Department in St. Peter, MN for information on GTO Electronic's Battery Isolators, which are designed specifically for this application, including multiple auxiliary battery installation.

You may wish to consider using deep cycle batteries for your auxiliary battery(s).

To determine the battery life, or length of time that equipment can be operated, you should use the following formula as a guideline:

1. If the rating tag on the appliance states amperage, use the following formula:

$$\text{Operation time in hours} = \frac{\text{Ampere/Hr. rating of Battery}}{\text{Amp. requirements of appliance} \times 10}$$

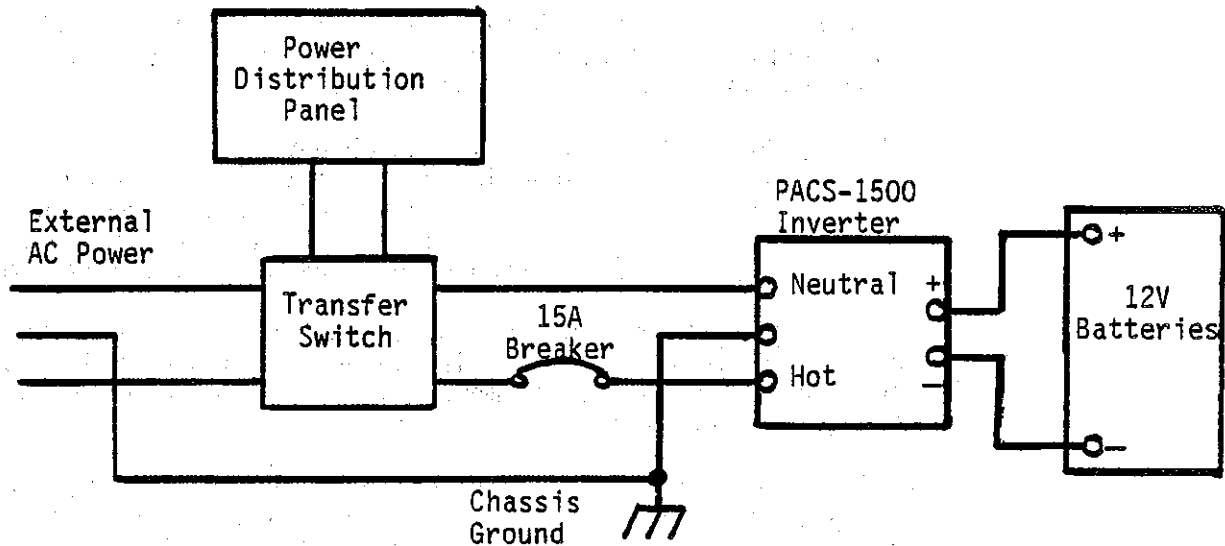
2. If the rating tag on the appliance states wattage, use the following formula:

$$\text{Operating time in hours} = \frac{\text{Ampere/Hr. rating of Battery} \times 12}{\text{Wattage rating of appliance}}$$

Keep in mind these formulas are based on theory. Your operating time will probably be less because your battery should never be drained completely unless you are using a deep-cycle battery or equivalent.

- D. Remote Power - PACS-1500 cannot be connected into external 117 VAC power without utilizing a transfer switch. For example, in some instances, you may wish to run the same equipment from external power rather than the inverter. It is extremely important that you do not "parallel" the inverter with external power, or you will damage the unit. You must also conform to all appropriate codes based on your type of application. Output wiring must be a minimum of 12 AWG.

Refer to the schematic below for applications having equipment which may run from both the inverter and external power on different occasions.



IV. OPERATING INSTRUCTIONS

- A. Auto-On - To operate PACS-1500, simply push the power switch "ON". The unit is now in an "auto-on" mode, as the inverter will turn on or off in response to load demand.

PACS-1500 requires virtually no battery power when left in an "auto-on" mode when there is no external load. The unit automatically senses the request to supply power, and turns on and shuts itself down automatically based on external load requirements. This energy savings feature will greatly extend the charge life of your battery as many appliances require intermittent power, such as ice-cube makers and refrigerators.

B. Operating Time - Your operating time is dependent on the following conditions:

- Wattage or Amperage Draw of the Item(s) Operated - Larger items will require more battery power than smaller items and will therefore discharge a battery(s) more quickly.
- Battery Size - Larger ampere/hr. rated batteries store more energy and therefore supply power longer to the same items than smaller ampere/hr. batteries.
- Battery Charge Level - A fully charged battery will supply power longer than batteries which have not received a recent charge.
- Age of Battery(s) - Older batteries do not store charge levels as long as newer batteries.
- Alternator/Generator Charging Batteries - When the PACS-1500 battery(s) are being charged while running items from your PACS-1500, your batteries will not be discharging.

NOTE: You must use batteries which have at least minimum available power as outlined in Section III. (C) "Battery Size". You will not receive peak power performance from PACS-1500 unless battery size is sufficient. We suggest a minimum battery size, or combination of batteries, totaling 175 ampere/hr.

C. Extended Periods of Non-Use - We suggest you disconnect the battery cable from the battery posts if you do not plan on using your PACS-1500 for a period of 90 days or more. This is also recommended if seasonal storage of your vehicle is anticipated.

It is not necessary to disconnect the batteries for shorter periods of non-use, as PACS-1500's Auto-On feature does not consume significant battery power when items are not being operated from PACS-1500.

CAUTION: You should protect your PACS-1500 from dust and moisture during storage, as this could damage PACS-1500 parts.

V. MAINTENANCE

- A. With proper care, PACS-1500 will provide excellent performance for years. Since PACS-1500 utilizes a solid state electronic "state of the art" design, no maintenance is required.

The only maintenance required is to your batteries.

VI. TROUBLESHOOTING CHART

IMPORTANT: The below chart is a guide to aid you on minor malfunctions. If the problem has not been corrected after following the guide, DO NOT attempt repairs.

WARNING: DO NOT remove cover. No service or repair parts inside. Refer all servicing to qualified service personnel or GTO Electronics Service Department.

TROUBLE	PROBABLE REASON
<p>1. Unit will not operate</p>	<p>A. No battery power - i.e. batteries are not properly connected or not charged.</p> <p>B. Reverse polarity - battery terminals have been attached to incorrect battery post.</p> <p>C. Fuse replacement - check fuse on PACS-1500 battery terminal connector and on units face plate.</p> <p>D. Remote panel has not been properly connected to "remote" on PACS-1500 face plate.</p> <p>E. Unit exposed to excessive temperatures - see Section II. (J-1), "Thermo Protection".</p>
<p>2. Unit will not start an item and overload occurs, LED illuminates</p>	<p>A. Item may be rated in excess of PACS-1500 performance capabilities. Check wattage or amperage rating on items serial plate to assure it does not exceed 1500 watts, 13 amps continuous or 2000 watts, 17 amps surge. See Section II. (C) "Power Output" for further information.</p> <p>B. Insufficient amperage or low battery power.</p>
<p>3. "Low Battery" LED illuminates and unit shuts down</p>	<p>A. Batteries have insufficient power. See Section II. (J-3) "Auto Low Battery Shut Off".</p>
<p>4. Unit shuts off and cannot be re-started. Neither low battery or overload LED illuminates</p>	<p>A. Unit exposed to excessive temperatures - see Section II. (J-1) "Thermo Protection.</p> <p>B. Batteries have been disconnected. Check all power connections.</p>

VII. WARRANTY

A. NOTE: Below is the warranty offered by GTO Electronics. In some instances, your PACS-1500 has been installed by the manufacturer on a vehicle and the manufacturer's warranty supercedes GTO's warranty on PACS-1500.

B. GTO ELECTRONICS, INC., 1 YEAR LIMITED WARRANTY.

1. GTO Electronics, Inc., a Minnesota corporation ("GTO"), having its principal place of business in St. Peter, Minnesota of Nicollet County, State of Minnesota, is the Warrantor of the following product (herein called the "product"):

PACS-1500 PORTABLE AC SYSTEM

2. PARTY(IES) TO WHOM THE WARRANTY IS EXTENDED: The GTO warranty extends only to the original purchaser.

3. WARRANTY DURATION: This product is warranted to the original purchaser for a period of 1 year from the original purchase date.

4. WARRANTY COVERAGE: This product is warranted against defects in material or workmanship for the period of 1 year from the original purchase date.

The Warranty does not cover the case or batteries. This warranty is void if the PACS has been damaged by shipping, accident, unreasonable use, neglect, improper service, or other causes not arising out of defects in material or workmanship.

5. WARRANTY DISCLAIMER:

A. Purchaser shall properly install and use the product according to the directions furnished by GTO. This warranty is void if the defect, malfunction, or failure of the product to conform with this warranty, was caused by accident, unreasonable use, neglect, improper installation, misapplication, or improper service (not resulting from defect or malfunctions of the product) while in the possession of the purchaser of this product.

B. Any implied warranties arising out of the sale of the product, including, but not limited to, the implied warranties of merchantability and fitness, are limited in duration to the above 1 year period.

C. No warranties are made by GTO that are not specifically set forth herein.

D. GTO shall not be liable for consequential damages for breach of any written or implied warranty on such product, including, but not limited to, loss of the use of the product or damage to any equipment used in connection with the product.

E. Warranty does not cover damage in shipping. This is the responsibility of the carrier.

6. **WARRANTY PERFORMANCE:** In the event of a valid claim under this warranty, GTO will repair the product or replace it with a re-conditioned model of equivalent quality (at the option of GTO Electronics) if the product is returned within 1 year after the date of purchase with proof of purchase (including date of purchase), freight prepaid and insured to:

GTO Electronics, Inc.
430 Ritt Street
St. Peter, Minnesota 56082

In the event of a replacement with a reconditioned model, the replacement unit will continue the warranty of the original product or 60 days, whichever is longer.

Other than freight prepaid and insured requirement, no charge will be made for such repair, adjustment, and/or replacement. After the 1 year warranty period, current repair rates will be charged.

The continued use or possession of the product after reasonable notice of any product defect and the failure to cease use of the product and return the product to GTO within 1 year after the date of purchase, shall result in a waiver by purchaser of the breach of warranty and the warranty shall be deemed to have been fulfilled.

7. **LEGAL REMEDIES:** This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

C. REPAIRS AFTER WARRANTY PERIOD HAS EXPIRED

As your satisfaction and goodwill are of primary concern to GTO Electronics, we have at your disposal, qualified service technicians and parts to properly service and test your PACS-1500. Please follow the following procedure to repair unit:

1. **IMPORTANT:** Pay special attention to assure unit is properly insured and packaged to avoid shipping damage. PACS-1500 weight and electronic components require careful packaging with cushion inserts.

NOTE: GTO is not responsible for damage in shipping. This is the responsibility of the carrier and you should have the unit insured.

2. GTO will bill at current hourly service rates in effect at the time of the repair, plus parts and a \$25.00 (current rate) handling charge. Customer pays freight and insurance.
3. GTO will warranty its repairs as outlined in "Warranty" for a period of 1 year.
4. For those customers who wish to discuss possible problems and solutions, please call GTO Service Department for assistance. GTO will not accept collect calls, but we will make every effort to resolve your problem by phone.

GTO BATTERY ISOLATOR

A battery isolator is an integral part of any inverter installation in a vehicle. It protects the vehicles starting battery from discharging when auxiliary battery(s) are used. It allows batteries to be used, independently, yet automatically charges both starting and auxiliary battery(s) when vehicle is operating, without overcharging.

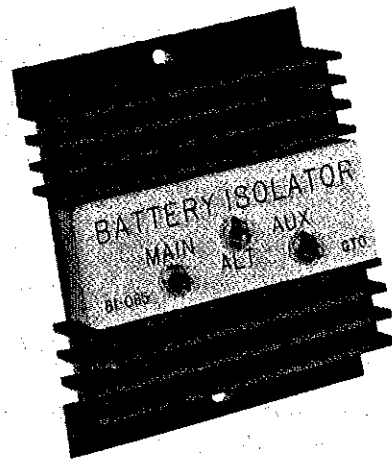
Various Sizes

Solid State Construction

No moving Parts to Arc or
Wear Out

Designed to Work With 6
to 32 Volt Negative Ground
Systems

Models Available to Conform
to Coast Guard Regulations



HOW TO ORDER ACCESSORIES OR OTHER GTO PRODUCTS:



For ordering accessories or other GTO products,
contact your Retail Outlet or GTO Electronics
at (507) 931-4137.

TRIAD-UTRAD

Converter/Battery Charger

**30 Amp 40 Amp
50 Amp 70 Amp
Models
UL & CSA listed**

Thermal Protected

Description

30 YEARS of Triad Utrad transformer design and manufacturing provides the most advanced and trouble free Converter/Battery Charger System in the industry.

The Triad Utrad design employs a Constant Voltage Transformer giving a constantly regulated DC output with any AC line input from 90 to 130 Volts. No more undercharging batteries due to low Park voltage conditions, or overcharging due to high line conditions.

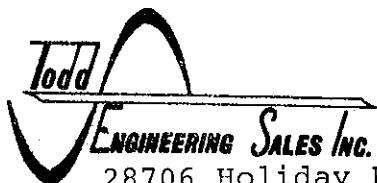
The converter has no electronic regulator circuits, which can burn up, change in value, and cause damage to batteries, water pumps, and fluorescent lights.

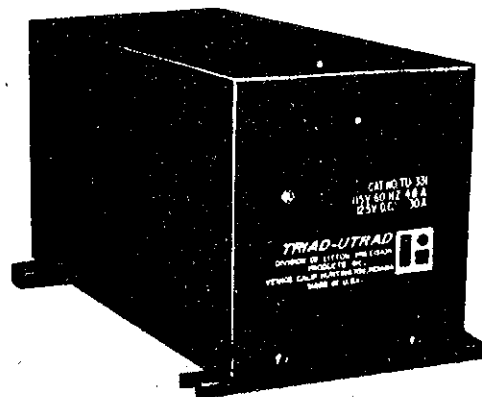
The converter provides a full 12.1 Volts output under full load, and a maximum of 14.1 Volts at the battery when it has reached full charge. The converter output cannot exceed this voltage, which is the maximum level necessary to keep a battery fully charged.

The Triad Utrad converter will never be damaged by overloads, up to, and including, a dead short. It will withstand a dead short for an indefinite time, and will resume normal operation as soon as the overload or short is removed.

The converter is exclusively produced with an external fuse distribution panel which permits improved engineering flexibility for the manufacturer. The converter can be mounted in a remote location, and the fuse panel installed for A: electrician and customer accessibility, B: improved cabinet storage, C: centralized service with the 110V breaker panel, and D: improved coach decor

DISTRIBUTED BY:

**Todd**
ENGINEERING SALES INC.
28706 Holiday Place
Elkhart, IN 46517
219-293-8633



TRIAD-UTRAD

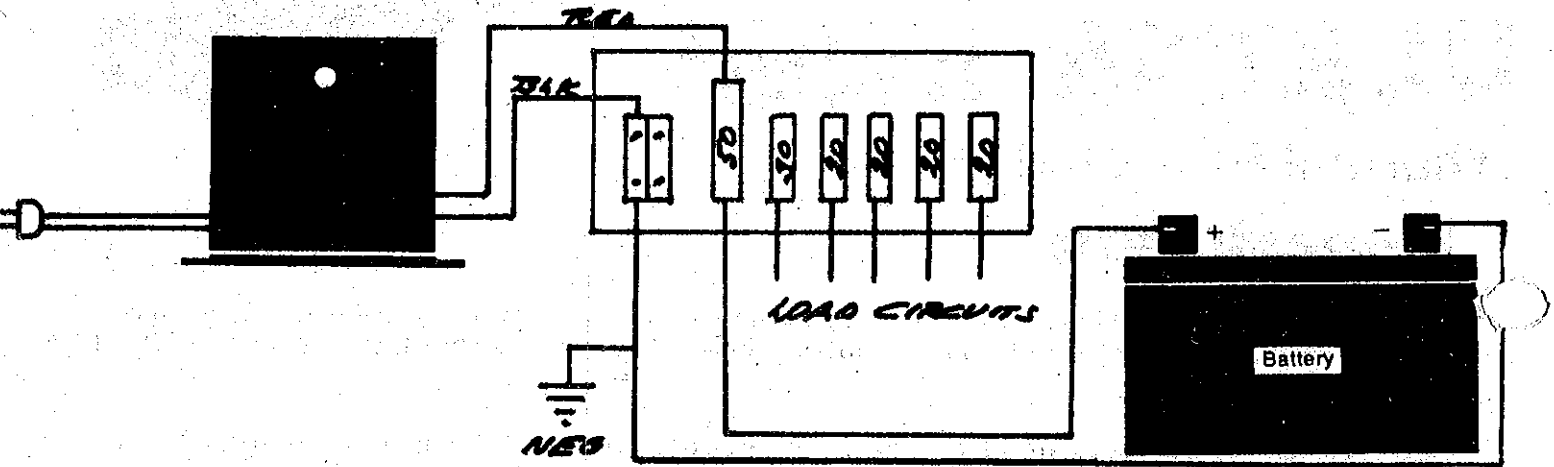
305 North Briant Street, Huntington, Indiana 46750

Specifications

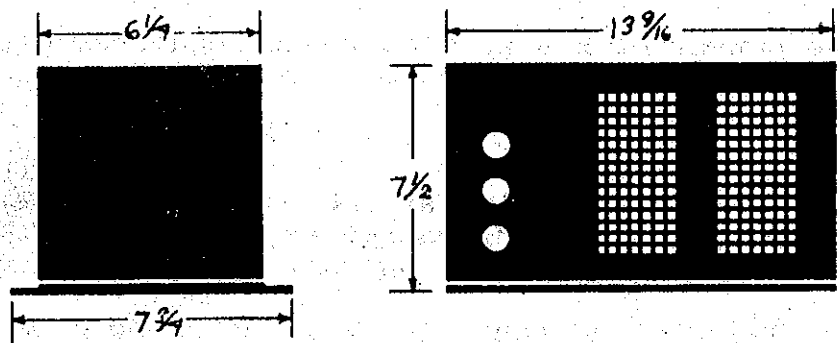
Model	Rating	Max. Load*	Output Voltage	Input Voltage	Input Curr.	Unit Weight
Tu 430-2T	30 Amp	40 Amp	12.1	90-130V 60 HZ	5.0 A	25 lbs
TU 540-2	40 Amp	50 Amp	12.1		6.3 A	37 lbs
TU 550-2	50 Amp	65 Amp	12.5		7.3 A	43 lbs
TU 570-2	70 Amp	85 Amp	11.6		11.0 A	48 lbs

* Current limit point of unit

Typical connection diagram



Dimensions



WARRANTY

TRIAD/UTRAD warrants each new TU Converter/Battery Charger for two years from date of manufacture against any defect in material or workmanship. It agrees to repair or replace any such defects, without charge for parts or labor, provided the defective unit is returned, prepaid, within this two year period.

Responsibility is not assumed for damage due to accident, faulty wiring to vehicle electrical system, use of incorrect wire sizes in conjunction with the converter/battery charger. A code indicating the date of manufacture is on each unit. For example: if the code reads "17-7338" it means that the unit was made in the 38th week of 1973.