FERRUPS Service Manual

for

FE500VA, FE700VA, FE850VA, FE1.15KVA, FE1.4KVA

and

QFESOOVA, QFE700VA, QFE850VA, QFE1 1 5KVA, QFE1.4KVA

FERRUF'S Serial Number: ______________________

FSS-0501SB

-Parameter Changes for: Model Number: ____________ Serial Number: ____________

Parameter Number	Old Value (Setting)	New Value (Setting)	Reason for Change	Date

Parameter Changes for: Model Number: ____________ Serial Number: ____________

Parameter Number	Old Value (Setting)	New Value (Setting)	Reason for Change	Date

Best Power

FERRUPS Service Manual for FE500VA, FE700VA, FE850VA, FE1 . 1 5KVA, FE1.4KVA, QFE500VA, QFE700VA, QFE850VA, QFE1. 15KVA, QFE1.4KVA

This *Service Manual* explains how the FERRUPS operates; how to maintain the unit, troubleshoot problems, and replace major **parts;** and how to contact Worldwide Service You'll fmd this information grouped in these sections:

Section 100	General Information, Worldwide Service **Information,** and Specifications
Section 200	System Description and Theory of Operation
Section 300	System Operation, Communication, and Software Information
Section 400	Maintenance
Section 500	Troubleshooting
Section 600	Parts **Lists**
Section 700	Technical Information Publications **— TIPs** and **(Q)TIPs**
Section 800	Pictorials that Identify Parts, Connection Tables for the Circuit Boards, and System Schematics

Note: This Service Manual **often** refers to the User and ***Installation*** *Manuals* that came with your unit. To understand the **FERRUPS** better, you should be familiar with the ***User*** and ***Installation*** *Manuals,* and you should keep them handy for your reference.

CAUTION!

UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may **be** present even i[illegible] **AC line voltage is removed. TEST BEFORE TOUCHING!**

Turn off the **FERRUPS** unit according to the procedure describing "How (and When) to Shut Down Your **FERRUPS" the** th[illegible] ***FERRUPS User Manual*** (Section 308). Make sure that the **FERRUPS** batteries and AC input are off or **disconnected** **before** you perform service on **the** unit.

This unit contains electrostatic-sensitive devices. If you do not **follow proper** ESD procedures, you may cause seven damage to the electrical **circuitry**.

FERRUPS batteries are **high** current sources. Shorting battery **terminals** can cause severe arcing, equipment damage, and injury A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the UPS:

A) Remove **rings, watches, and other jewelry before servicing the UPS.**
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all [illegible] **safety codes.**

Contents

[redacted]

Best Power
UNINTERRUPTIBLE
POWER SYSTEMS

TIP 605
2345
June 24, 1996

FERRUPS" Scheduled Maintenance and Service Call Report Form
For ME, QME, FD, QFD, FE and QFE Models

Please check one: ☐ Maintenance ☐ Service Service Order Number ______________________

Technician ______________________ Technician ID Number- ______________________

LOCATION OF SYSTEM: Model Number ______________________ Serial Number ______________________

Company Name, Address and Phone Number ______________________

____

Work Instructions ______________________

Bypass Type: ☐ BBM ☐ MBB Date and Time of service ______________________

1. Name and signature of contact person who authorized the maintenance and UPS test. ______________________

____

2. Comments or problems regarding the UPS ______________________

____

3. Is the UPS environment clean and free from dust and dirt? Yes☐ No ☐ **If not, correct the problem at this time.**

YOU MUST EITHER BYPASS THE UPS OR SHUT DOWN THE LOAD EQUIPMENT FOR STEPS 4, 5, AND 6.

4. **FloorSaver models only:** Is your battery extension cable (BAA-0024) installed at this time7 Yes☐ No☐ ______ If not, you must install it now. To do this you must turn off the FERRUPS. **Before installing the cable, make sure the DC switch is in the "Off" position.**

CAUTION! **Turn off the UPS and then remove AC line and DC input power before** removing **the cover and continuing with steps 5 and 6. TEST BEFORE TOUCHING!**

5 erform a visual inspection of the UPS. Check all terminal connections (battery, AC Input, and AC Output). Are connections tight, free of corrosion and in good condition7 Yes☐ No☐ **If not, correct the problem at this time.**

6. FD and FE 4.3 **KVA** - 18 KVA models only - Are there open fuses or physical damage on the Spike Suppression Board?

Yes☐ No ☐ **If yes, correct the problem at this time.**

7. List the five most recent inverter and alarm log events:

	I	___	___	___	___		'	___	___	___	___
Inverter	2	___	___	___	___	**Alarm**	2	___	___	___	___
Log	3	___	___	___	___	**Log**	3	___	___	___	___
	4	___	___	___	___		4	___	___	___	___
	5	___	___	___	___		5	___	___	___	___

8. Is there anything in the logs that implies the UPS will not sustain the equipment during an outage? Notify the site that you are going to perform a battery load test and that in the unlikely event of a problem, all equipment should be prepared for a power outage.

FOR BEST RESULTS APPLY AT LEAST 50% OF FULL LOAD FOR THE FOLLOWING TESTS

9. Is customer using UPS contacts for a communications link? Take the necessary precautions so that this contact closure will not cause a premature shutdown. **For** ME or FD model?: Perform a battery test by pressing [CONTROL] [77] [ENTER] [ENTER]. **For FE models:** Perform a system test by pressing [CONTROL] [7] [ENTER] ENTER].

  RESTRICTED

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1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

10. Perform an alarm test Check the LED status indicators to make sure they work when they should.

11. Battery load test. Remove AC line from the UPS. Witb a load applied, run inverter for 10 minutes per battery string or until each battery measures 11.5 volts. Record voltages below in the "Inverter On With Load" column. Circle the date code for any bad batteries.

Battery Number	1	2	3	4	5	6	7	8	9	10
Inverter on With Load										
Date Code										

12. Fill in the parameters in the following list that apply to the model being tested.

Parameter Number	On Inverter	On Line
0 Time	XXX	______
1 Volts In	______	
2 Volts out	______	
3 Reserved (I In FD/QFD only)	______	
4 I Out	______	
5 VA Out	______	
6 I Batt	______	
7 V Batt	______	
8 Freq	______	
9 Rn Tm	______	
10 Date	x x x	______
11 Amb Temp	______	
12 HS Temp	______	
13 Reserved (% Hum FD/QFD only)	X X X	______
14 Xfmr Temp (certain FE models)	______	
14 Unit ID (ME or FD only)	x x x	______
15 unit ID (FE only)	x x x	______

Parameter Number	On Inverter	On Line
16 Full Ld %	______	
17 watts	______	
18 PF	______	
19 VALimit	______	
20 #Pwr Out	______	
21 #OvrLds	______	______
22 Sys Hrs	______	______
23 Inv Min	______	______
26 Test Results (FE only)		
Time/Date	XXX	______
Logic RA/RD	XXX	______
Invgate L/R	XXX	______
Batt RT/DC	XXX	______
67 Hi Batt	XXX	______
73 Pkl (FD only)	______	______
74 Pk2 (FD only)	______	______

Length of load test ______ minutes. Battery Type ______

13. Record any repairs or changes that you made. Document any wiring problems and any corrective action that was taken.

______

14. List all pats, including batteries, used to repair the system.

______

15. Travel time ______ Time on Site ______ unit Operational? Yes/No ______ Return Trip required? Yes/No ______

Battery type ______ Quoted price ______ (Quoted price does not include shipping or tax, if applicable.)

P.O.# ______ A-by ______ Verified by (BEST employee) ______

Site Representative's signature ______

I have read and understood the terms and conditions listed on the reverse side of this form.

Service Representative's signature ______

SERVICE ORDER TERMS & CONDITIONS

BEST POWER, a division of General Signal Power Systems, Inc (hereinafter called BEST POWER) and Customer agree that Start-Up, Repair, Exchange, Preventive Maintenance, Training and other services or repair parts sales ("Service") provided by BEST POWER to Customer shall be performed exclusively pursuant to the charges, terms and conditions stated below in the absence of an applicable Service Agreement between BEST POWER and Customer. Charges are based on BEST POWER'S then applicable charges for Service, including labor, parts, travel (portal to portal) and other expenses.

REP: ...e charge for any repairs not covered by a Service Agreement (a "Non-covered Repair") and any re... made in the absence of a Service Agreement will be invoiced to the Customer at BEST POWER's standard rates. A Non-Covered Repair includes, but is not limited to, repairs or replacements (including all parts and labor) due to damage, unreasonable use or other cause and include, without limitation, all damage from road hazards, accident, fire or other casualty, misuse or misapplication, negligence, premises wiring, load equipment, high temperature, dirty or dusty environments, and any use or installation not in conformity with instructions furnished, as well as any repairs or replacements needed due to unauthorized modifications to the equipment or related software or the use of parts not authorized or supplied by BEST POWER, or multiple trips including trips due to denied access to the equipment.

REPAIR COMPONENTS. Under a Service Agreement or Standard Limited Warranty, parts required to repair a unit will be provided by BEST POWER and replaced on an exchange basis. In the absence of coverage under a Service Agreement or Warranty, parts are provided at the current non-warranty exchange prices, if returned parts are repairable and remarketable. If the parts returned are not repairable or remarketable then the customer will be invoiced for the full list price of the parts. All parts removed or unused become the property of BEST POWER and must be returned to the factory within 30 days of receipt of replacement. Any unused parts returned to BEST POWER may be subject to the current restocking fee. In the absence of an applicable Service Agreement or Standard Limited Warranty, Batteries will be provided at BEST POWER's then applicable charges.

PAYMENT TERMS. All invoices are payable to BEST POWER within thirty (30) days of the date of the invoice. Customer shall make such arrangements for payment as BEST POWER may require, and BEST POWER may suspend service until such arrangements are made. Past due amounts shall be subject to an interest charge of one percent (1%) per month or the highest rate permitted by law plus all costs of collection, including attorneys fees. All sales, property, excise and other federal, state and other local taxes (other than those based upon BEST POWER's net income) shall be paid by Customer.

SUPERSEDING EFFECT. Any terms and provisions of Customer's order or other document which are inconsistent with any of the terms and conditions hereof are rejected, will not be binding on BEST POWER nor considered applicable to the Services ordered. Acceptance of these terms and conditions shall be conclusively indicated by issuance by Customer of any written or oral order or request for Service ("Service Order"). Except as set forth in an applicable Service Agreement, these terms and conditions constitute the entire Agreement between the parties and replace any prior understandings, proposals or other communication with respect to this subject matter.

LIMITED WARRANTY. This Limited Warranty applies to all Services rendered by BEST POWER or its authorized representatives. (The standard Limited Warranty applicable to a Product shall apply to any sale of new Products.) BEST POWER warrants that the Services that the Customer has received or will receive ...EST POWER or its authorized representative pursuant to the terms of a Service Order shall be p... properly and/or any parts supplied by BEST POWER under this Service Order shall be free fro... ...s in materials and workmanship under normal use for a period of thirty (30) days. This warranty, however, extends only to the Customer. It cannot be transferred to anyone who subsequently purchases the product from the Customer.

EXCEPT AS EXPRESSLY SET FORTH IN THIS WARRANTY BEST POWER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BEST POWER EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED IN THIS LIMITED WARRANTY. WITH RESPECT TO INTERMITTENT PROBLEMS, COMPLEX PROBLEMS THAT INVOLVE SITE SPECIFIC ISSUES OR ANY NON-COVERED REPAIR, BEST POWER MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE SERVICES SHALL FULLY RESOLVE ALL PROBLEMS OR ISSUES.

BEST POWER IS NOT LIABLE FOR ANY DAMAGES CAUSED BY (I) THE PRODUCT OR PARTS USED BY IT OR THE SERVICES RENDERED BY IT OR (II) THE FAILURE OF THE PRODUCT OR PARTS TO PERFORM OR (III) THE FAILURE OF ANY SERVICES RENDERED TO HAVE BEEN PROPERLY RENDERED, INCLUDING, BUT NOT LIMITED TO, ANY LOST PROFITS, LOST SAVINGS, INCIDENTAL DAMAGES, OR CONSEQUENTIAL DAMAGES. THIS LIMITATION OF LIABILITY WILL BE EFFECTIVE EVEN IF THE CUSTOMER HAS ADVISED BEST POWER, OR AN AUTHORIZED REPRESENTATIVE OF BEST POWER, OF THE POSSIBILITY OF SUCH DAMAGES. THE LIMITATIONS CONTAINED HEREIN MAY NOT BE WAIVED OR ALTERED BY ANY PERSON.

FURTHERMORE, THE CUSTOMER'S ONLY REMEDY IS TO HAVE BEST POWER REPLACE ANY PARTS OR REDO THE SERVICES RENDERED. IF BEST POWER IS UNABLE TO REPAIR OR REPLACE THE PRODUCT OR PARTS OR CORRECT THE SERVICES TO CONFORM TO THIS WARRANTY AFTER A REASONABLE NUMBER OF ATTEMPTS, THEN BEST POWER WILL REFUND THE CHARGE FOR THE DEFICIENT SERVICE. REMEDIES UNDER THIS WARRANTY ARE EXPRESSLY LIMITED TO THOSE SPECIFIED ABOVE.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages for consumer products. In such states, if the Service should be deemed a consumer product, the exclusions or limitations of this Limited Warranty may not apply to the Customer. This Limited Warranty gives the Customer specific legal rights. However, the Customer may also have other rights that may vary from state to state. The Customer is advised to consult applicable state laws to ascertain the full extent of his rights.

6. **GOVERNING LAW.** The terms of this Agreement shall be governed by the laws of the State of Wisconsin exclusive of conflict of laws rules.

7. **LIABILITY AND CLAIMS.** Liability of BEST POWER on any claim of any kind, including claims for negligence or other torts, or for any loss or damage, arising out of, or connection with, or resulting *from, any Service, or from ~~the manufacture, sale~~, delivery, resale, repair or use of any products covered* by, or furnished under, such an order, shall in no case exceed the price allocable to the product, service or part thereof which gives rise to the claim. In no event shall BEST POWER be liable for any special, incidental, consequential or exemplary damages. Any claims against BEST POWER for shortages by it in making shipments shall be made in writing to BEST POWER within fifteen (15) days after receipt of shipment.

The fulfillment of any Service Order is subject to strikes, labor disputes, lockouts, accidents, fires, delays in manufacture or in transportation or delivery of material, floods, severe weather or other acts of God, embargoes, governmental actions, or any other cause beyond the reasonable control of BEST POWER, whether similar to, or different from, the causes above enumerated, whether affecting BEST POWER or BEST POWER's supplier or subcontractor, and any such causes shall absolve BEST POWER from any liability to Customer.

8. **CHANGES.** BEST POWER may, at any time, without notice, make changes (whether in design, materials, the addition of improvements, or otherwise) in any product, and may discontinue the manufacture of any product, all in its sole discretion, without incurring any obligations of any kind as a result thereof, whether for failure to fill an order accepted by BEST POWER or otherwise. In performing Services, BEST POWER may use factory reconditioned parts or product. BEST POWER may subcontract with others to perform Services without Customer's prior consent, but BEST POWER shall remain responsible for performing the Service.

9. **EXCLUSIONS.** In no event shall BEST POWER have any obligation to identify, correct, abate, cleanup, control or remove any defective premises electrical equipment or wiring or any code violation or any toxic or hazardous material in Customer's premises.

10. **LIMITATION OF ACTIONS.** No action, regardless of form or basis, arising out of transactions related to a Service Order or the Services performed or to be performed may be brought by either party more than two (2) years after the cause of action has accrued.

[redacted]

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

TIP605
2345
June 24, 1996

FERRUPS® Scheduled Maintenance and Service Call Report Form For ME, QME, FD, QFD, FE and QFE Models

Please check one: ☐ Maintenance ☐ Service Service Order Number ______________________

Technician ______________________ Technician ID Number- ______________________

LOCATION OF SYSTEM: Model Number ______________________ Serial Number ______________________

Company Name, Address and Phone Number ______________________

____

work Instructions ______________________

Bypass Type: ☐ BBM ☐ MBB Date and Time of service ______________________

1. Name and signature of contact person who authorized the maintenance and UPS test. ______________________

____

2. Comments or problems regarding the UPS ______________________

____

3. Is the UPS environment clean and free from dust and dirt? Yes☐ No ☐ **If not, correct the problem at this time.**

YOU MUST EITHER BYPASS THE UPS OR SHUT DOWN THE LOAD EQUIPMENT FOR STEPS 4, 5, AND 6.

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6. FD and FE 4.3 KVA - 18 KVA models only - Are there open fuses or physical damage on the Spike Suppression Board?
Yes☐ No☐ ☐ **If yes, correct the problem at this time.**

1. List the five most recent inverter and alarm log events

Inverter Log	1	____	____	____	____	**Alarm Log**	1	____	____	____	____
	2	____	____	____	____		2	____	____	____	____
	3	____	____	____	____		3	____	____	____	____
	4	____	____	____	____		4	____	____	____	____
	5	____	____	____	____		5	____	____	____	____

8. Is there anything in the logs that implies the UPS will **not** sustain the equipment during an outage? Notify the site that you arc going to perform a battery load test and that in the unlikely event of a problem, all equipment should be prepared for a power outage.

FOR BEST RESULTS APPLY AT LEAST 50% OF FULL LOAD FOR THE FOLLOWING TESTS

9. Is customer using UPS contacts for a communications link? Take the necessary precautions so that this contact closure will not cause a premature **shutdown. For ME or FD models:** Perform a battery test by pressing [CONTROL] [77] [ENTER] [ENTER]. **For FE models:** Perform a system test by pressing [CONTROL] [7] [ENTER] [ENTER].

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REP: ...e charge for any repairs not covered by a Service Agreement (a "Non-covered Repair") id any re... made in the absence of a Service Agreement will be invoiced to the Customer at BEST OWER's standard rates. A Non-Covered Repair includes, but is not limited to, repairs or replacements ncluding all parts and labor) due to damage, unreasonable use or other cause and include, without mitation, all damage from road hazards, accident, fire or other casualty, misuse or misapplication, gligence, premises wiring, load equipment, high temperature, dirty or dusty environments, and any use installation not in conformity with instructions furnished, as well as any repairs ~~or replacements needed~~ ie to unauthorized modifications to the equipment or related software or the use of parts not authorized supplied by BEST POWER, or multiple trips including trips due to denied access to the equipment.

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LIMITED WARRANTY. This Limited Warranty applies to all Services rendered by BEST POWER s authorized representatives. (The standard Limited Warranty applicable to a Product shall apply to sale of new Products.) BEST POWER warrants that the Services that the Customer has received or receiv... BEST POWER or its authorized representative pursuant to the terms of a Service Order l be p... l properly and/or any parts supplied by BEST POWER under this Service Order shall ree fro... in materials and workmanship under normal use for a period of thirty (30) days. This ranty, however, extends only to the Customer. It cannot be transferred to anyone who subsequently chases the product from the Customer.

CEPT AS EXPRESSLY SET FORTH IN THIS WARRANTY BEST POWER MAKES NO OTHER RRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED RRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BEST WER EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED IN THIS LIMITED RRANTY. WITH RESPECT TO INTERMITTENT PROBLEMS, COMPLEX PROBLEMS THAT OLVE SITE SPECIFIC ISSUES OR ANY NON-COVERED REPAIR, BEST POWER MAKES NO RRANTY, EXPRESS OR IMPLIED, THAT THE SERVICES SHALL FULLY RESOLVE ALL BLEMS OR ISSUES.

T POWER IS NOT LIABLE FOR ANY DAMAGES CAUSED BY (I) THE PRODUCT OR PARTS D BY IT OR THE SERVICES RENDERED BY IT OR (II) THE FAILURE OF THE PRODUCT OR TS TO PERFORM OR (III) THE FAILURE OF ANY SERVICES RENDERED TO HAVE BEEN PERLY RENDERED, INCLUDING, BUT NOT LIMITED TO, ANY LOST PROFITS, LOST INGS, INCIDENTAL DAMAGES, OR CONSEQUENTIAL DAMAGES. THIS LIMITATION OF BILITY WILL BE EFFECTIVE EVEN IF THE CUSTOMER HAS ADVISED BEST POWER, OR AN HORIZED REPRESENTATIVE OF BEST POWER, OF THE POSSIBILITY OF SUCH DAMAGES. LIMITATIONS CONTAINED HEREIN MAY NOT BE WAIVED OR ALTERED BY ANY PERSON.

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states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation cidental or consequential damages for consumer products. In such states, if the Service should be ed a consumer product, the exclusions or limitations of this Limited Warranty may not apply to the omer. This Limited Warranty gives the Customer specific legal rights. However, the Customer may have other rights that may vary from state to state. The Customer is advised to consult applicable laws to ascertain the full extent of his rights.

6. **GOVERNING LAW.** The terms of this Agreement shall be governed by the laws of the State of Wisconsin exclusive of conflict of laws rules.

7. **LIABILITY AND CLAIMS.** Liability of BEST POWER on any claim of any kind, including claims for negligence or other torts, or for any loss or damage, arising out of, or connection with, or resulting from, any Service, or from the manufacture, sale, delivery, resale, repair or use of any products covered by, or furnished under, such an order, shall in no case exceed the price allocable to the product, service or part thereof which gives rise to the claim. In no event shall BEST POWER be liable for any special, incidental, consequential or exemplary damages. Any claims against BEST POWER for shortages by it in making shipments shall be made in writing to BEST POWER within fifteen (15) days after receipt of shipment.

The fulfillment of any Service Order is subject to strikes, labor disputes, lockouts, accidents, fires, delays in manufacture or in transportation or delivery of material, floods, severe weather or other acts of God, embargoes, governmental actions, or any other cause beyond the reasonable control of BEST POWER, whether similar to, or different from, the causes above enumerated, whether affecting BEST POWER or BEST POWER's supplier or subcontractor, and any such causes shall absolve BEST POWER from any liability to Customer.

8. **CHANGES.** BEST POWER may, at any time, without notice, make changes (whether in design, materials, the addition of improvements, or otherwise) in any product, and may discontinue the manufacture of any product, all in its sole discretion, without incurring any obligations of any kind as a result thereof, whether for failure to fill an order accepted by BEST POWER or otherwise. In performing Services, BEST POWER may use factory reconditioned parts or product. BEST POWER may subcontract with others to perform Services without Customer's prior consent, but BEST POWER shall remain responsible for performing the Service.

9. **EXCLUSIONS.** In no event shall BEST POWER have any obligation to identify, correct, abate, cleanup, control or remove any defective premises electrical equipment or wiring or any code violation or any toxic or hazardous material in Customer's premises.

10. **LIMITATION OF ACTIONS.** No action, regardless of form or basis, arising out of transactions related to a Service Order or the Services performed or to be performed may be brought by either party more than two (2) years after the cause of action has accrued.

SECTION 100

SECTION 100

101 General Information

This *Service Manual* supplements the *FERRUPS User Manual you* received with your unit. You should **be** familiar with the User Manual before you use this Service Manual. If the User Manual is lost or misplaced, please contact Best Power Worldwide Service for a replacement.

This manual explains how the following FERRUPS models operate and how to maintain and repair them:

60 *Hertz*	***50 Hertz***
FE500VA	QFE500VA
FE700VA	QFE700VA
FE850VA	QFE850VA
FE1.15KVA	QFE1.15KVA
FE1.4KVA	QFE1.4KVA

50 Hz model numbers start with a "Q" (such as QFE1.4KVA). AU ten (10) models have serial numbers in this format:

FE*s*K*nnnnn* or QFE*s*K*nnnnn*

In these examples, *s* = the unit size (500, 700, or 850 VA or 1.15 or 1.4 KVA), and ***nnnnn*** = the unit's unique serial number.

This manual describes all units with the 8.0 1, 8.02, 8.03, 8.04, 8.05, 8.06, or 8.07 software **versions.**

In versions 8.01-8.05, parameter 120 shows your unit's software version; you can display tbis parameter by pressing [*DISPLAY*] [I] [2] [0] [ENTER].

If parameter 120 **is not** "SW Ver," **your unit has 8.06 or higher** software; to display the software version, display parameter 137 by pressing [DISPLAY] **[1] [3] [7]** [ENTER].

From a terminal connected to the RS232 port, you can display the software version by typing d **swv** <ENTER>, d 120 <ENTER>, or d 137 <ENTER>.

This manual does not cover available options, Customer Purchase **Options (CPOs),** or changes that were made in the FERRUPS product after this manual was published. If you have any questions, please call Best Power Worldwide Service (See Section 102 below.)

102 Worldwide Service

Best Power has an outstanding Worldwide Service center. Please write or call if you have a FERRUPS problem or question. When you call Worldwide Service, have the FERRUPS serial number (see the label on the back of the unit or inside the front door). Best Power tiles all service records and system modifications by serial number.

You can contact Best Power by phone, fax, TELEX, Bulletin Board Service, or CompuServ. The Worldwide Service center is open every business day from 7:00 am to 11:00 pm Central Time, but takes calls 24 hours each day. Customers outside the United States may wish to use the TELEX number. If you need to send drawings or diagrams, you can use our fax number. If you have a sales inquiry, you may call Sales toll-free in the U.S.A. and Canada, (For other countries, see the addresses and telephone numbers on the back cover of this manual.) Through CompuServ, you can ask any questions you may have about the FERRUPS or its applications.

Worldwide Service:	I-800-356-5737 (U.S.A. and Canada) or I-608-565-2100
Worldwide Service Fax:	I-608-565-2509 (U.S.A.) or I-608-565-2799 **(International)**
General Fax:	I-608-565-2221
TELEX	701934
Sales:	I-800-356-5794 (U.S.A. and Canada)
General Office:	l-608-565-7200
BBS:	l-608-565-7424
CompuServ:	Go BEST at any ! prompt.
World Wide Web Site:	http://www.bestpower.com.
e-mail address:	best.power@bestpower.gensig.com

Mailing Address:
Best Power
Worldwide Service
P.O. Box 11
Necedah, WI *54646*

A variety of technical services are available from Best Power Worldwide Service

Telephone Support: If you have a question about a FERRUPS, call Worldwide Service. at l-800-356-5737 or l-608-565-2100. The Best Power Worldwide Service hotline is available 24 hours each day to help customers with any type of FERRUPS problem.

Field Support: In the unlikely event that your FERRUPS system should fail, you can arrange to have your system repaired by a Best Power factory-trained technician. Call Worldwide Service for price and scheduling information.

Service Training: If you would like to arrange training for your in-house service. technicians, call 1-800-356-5794 (in the U.S.A. or Canada) or l-608-565-7200 for pricing and workshop information.

103 Warranty Information

As stated in the Limited Two-Year Warranty in the *User Manual*, **the warranty** period is two (2) years from the date of initial retail purchase or delivery, whichever is earlier. If you return a defective FERRUPS system, system component (fuses, transformer, etc.), or circuit board to Best Power Worldwide Service within the warranty period, Beat Power will repair or replace it free of charge. (Make sure you call for a Return Material Authorization or RMA number first; see Section 104 below,) The customer is responsible for all freight charges.

Customers who purchase the Customer Protection Plan (CPP) or Site Warranty Plan (SWP) receive on-site service and extended warranty coverage. Contact Best Power Worldwide Service for detailed information on warranty enhancement plans.

104 Ordering Exchange Parts

Best Power products are warranted for two years; see the Limited Two-Year Warranty in the User Manual for details. If a product fails while it is under warranty, you may order replacement parts for exchange or you may send in the failed part for repair; you may be liable for shipping costs. After the warranty has expired, you may order exchange parts or send in the failed parts for repair, but in either case the failed part must be repairable to qualify for the Non-Warranty Exchange Parts pricing.

To order exchange parts, call Best Power Worldwide Service at l-800-356-5737 or l-608-565-2100 (or call the nearest Best Power office). Worldwide Service will determine which parts you need and tell you the cost of the parts. You must then fax or mail a Purchase Order or Mastercard or Visa number or accept COD delivery, even if the parts to be replaced may be under warranty. Best Power will then ship you the new exchange parts with an invoice. After your unit has been repaired, return the old parts for exchange. You will receive credit for returning the old parts if the parts are repairable, and Best Power will send you a new invoice showing that credit.

The exchange parts procedure can vary; please call Best Power Worldwide Service for more information,

105 FERRUPS Specifications, Standard 50 Hertz Models

Model	QFESOOVA	QFE700VA	QFE850VA	QFE1.15KVA	QFE1.4KVA
AC Input Voltage[1]/ Input Current	220 VAC/2.6 amps 230 VAC/2.5 amps 240 VAC/2.4 amps	220 VACR.9 amps 230 VAC/3.8 amps 240 VAC/3.5 amps	220 VAC/4.4 amps 230 VAC/4.2 amps 240 VAC/4.0 amps	220 VAC/4.9 amps 230 VAC14.6 amps 240 VAC14.4 amps	220 VAC/5.7 amps 230 VAC15.4 amps 240 VAC/5.2 amps
AC Output Voltage[3]/Output Current	220 VAC/2.2 amps 230 VAC/2.2 amps 240 VAC/2.1 amps	220 VAC/3.2 amps 230 VAC/3.1 amps 240 VAC/2.9 amps	220 VACi3.8 amps 230 VAC/3.6 amps 240 VAC13.5 amps	220 VAC/5.0 amps 230 VAC/4.8 amps 240 VAC14.6 amps	220 VAC/6.4 amps 230 VAC/6.2 amps 240 VAC15.9 amps
Audible Noise	≤41 dB	≤41 dB	147 dB	≤49 dB	s49 dB
DC Amps Maximum (Nominal Battery)	47	58	71	95	136
DC Voltage (Nominal)	12	12	12	12	12
Efficiency (Line)	≥85%	≥86%	≥85%	≥88%	288%
Frequency (Line)	50 Hz, ±0.01-3 Hz	50 Hz, ±0.01-3 Hz	50 Hz, ±0.01-3 Hz	50 Hz, ±0.01-3 Hz	50 Hz, ±0.01-3 Hz
Total Harmonic Distortion (THD)	5% or less THD	5% or less THD	5% or less THD	5% or less THD	5% or less THD
Heat Dissipation: BTU/hour: KW/hour:	210 0.062	277 0.081	361 0.106	372 0.109	465 0.136
Isolation	Q pF	Q pF	<2 pF	<2 pF	Q pF
Noise Rejection-Common Mode Transverse (Normal) Mode	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB
Operating Temperature	O-IO" c 32-104" F	O-40" c 32-104° F	0 to 40° C 32-104° F	0 to 40° C 32-104" F	0 to 40° C 32-104° F
Relative Humidity	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing
Output Power	500VA or 350 W	700 VA or 500 W	850 VA or 600 W	1.15 kVA or 800 W	1.4 kVA or 1 kW
Overload Capability	150% surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% Surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% Surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% Surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)
Runtime Min. Full Load (Half)[4]	9 Min. (25)	14 Min. (35)	11 Min. (28)	12 Min. (29)	14 Min. (37)
Unit Woiaht: with w/ Standard Battery: Battery:	22.2 28 kg. kg.	36.3 25 kg. kg.	27.7 39 kg. kg.	41.7 59.9 kgs. kgs.	45.4 69.9 kgs.
Load Regulation	• 3%	± 3%	± 3%	± 3%	± 3%

[1] 110, 115, 120, and 200 VAC input is also available.

[2] For units with a standard charger; values increase for 15-amp chargers. See the *Installation Manual*. The input current shown is for the unit itself, without a bypass switch and with the charger at maximum capacity. For other circumstances, see the ***Installation Manual.***

[3] 100, 110, 115, 120, and 200 VAC output is also available.

[4] Standard runtimes; longer runtimes are available as options.

106 FERRUPS Specifications, Standard 60 Hertz Models

Model	FESOOVA	FE700VA	FE850VA	FE1.15KVA	FE1.4KVA
AC Input Voltage[1]/ Input Current	120 VAC/4.6 amps 208 VAC/2.4 amps 240 VAC/2.1 amps	120 VAC/5.6 amps 208 VAC/2.8 amps 240 VAC/2.5 amps	120 VAC/6.6 amps 208 VAC/3.7 amps 240 VAC/3.2 Amp	120 VAC/8.9 amps 208 VAC/5.0 amps 240 VAC/ 4.2 amps	120 VAC/11 amp 208 VAC/6.0 amp 240 VAC15.3 amp
AC Output Voltage[3]/Output Current	120 VAC/4.1 amps 208 VAC/2.3 amps 240 VAC/2.1 amps	120 VAC/5.9 amps 208 VAC/3.3 amps 240 VAC/2.8 amps	120 VAC/7.0 amps 208 VAC/4.0 amps 240 VAC/3.4 amps	120 VAC/9.3 amps 208 VAC/5.3 amps 240 VAC/4.7 amps	120 VAC/12 amp 208 VAC/6.5 amp 240 VAC15.6 amp
Audible Noise	≤41 dB	≤41 dB	≤47 dB	≤49 dB	≤49 dB
DC Amps Maximum (Nominal Battery)	44	66	81	104	144
DC Voltage (Nominal)	12	12	12	12	12
Efficiency (Line)	≥85%	≥86%	≥85%	≥88%	≥88%
Frequency (Line)	60 Hz, ±0.01-3 Hz	60 Hz, ±0.01-3 Hz	60 Hz, ±0.01-3 Hz	60 Hz, ±0.01-3 Hz	60 Hz, ±0.01-3 H
Total Harmonic Distortion (THD)	5% or less THD	5% or less THD	5% or less THD	5% or less THD	5% or less THTJ
Heat Dissipation BTU/hour: KW/hour:	210 0.062	277 0.081	361 0.106	372 0.109	465 0.136
Isolation	<2 pF	<2 pF	Q pF	<2 pF	<2 pF
Noise Rejection-Common Mode Transverse (Normal) Mode	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB
Operating Temperature	0-40° C 32-104° F	0-40° C 32-104° F	0-40° C 32-104° F	0-40° C 32-104° F	0-40° C 32-104° F
Relative Humidity	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing	0-95% non-condensing
Output Power	500 VA or 350 W	700 VA or 500 W	850 VA or 600 W	1.15 kVA or 800 W	1.4 kVA or 1 kW
Overload Capability	150% surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150%Surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)	150% surge 125% IO Min. (Line) 110% 10 Min. (Inverter)	150% surge 125% 10 Min. (Line) 110% 10 Min. (Inverter)
Runtime Min. Full Load (Half)[4]	9 Min. (25)	14 Min. (35)	11 Min. (28)	12 Min. (29)	14 Min. (37)
Unit Weight without Battery: w/ Standard Battery:	45 Ibs. 58 Ibs.	51 lbs. 76 Ibs.	57 Ibs. 82 Ibs.	86 Ibs. 126 Ibs.	94 lbs. 148 Ibs.
Voltage Regulation (Nominal)	± 3%	± 3%	• 3%	13%	± 3%

[1] These input voltages arc also available: 200 and 220 VAC
[2] For units with a standard charger; values increase for 15 amp chargers. See the *Installation* Manual. The input current shown is for the unit itself, without a bypass switch and with the charger at maximum capacity. For other circumstances, see the *Installation Manual.*
[3] These output voltages are also available: 100, 200, 220, and 277 VAC.
[4] Standard runtimes; longer runtimes are available as options.

SECTION 200

SECTION 200

201 FERRUPS System Description

FERRUPS protects sensitive electronic equipment from blackouts, brownouts, spikes, noise, and frequency shifts while it provides constant computer-grade power. FERRUPS is a line-interactive uninterruptible power system. Each FERRUPS unit includes a microprocessor that lets you control, monitor, meter, and diagnose conditions. You can do this from a remote control panel, terminal, computer, or modem connected to the unit's ES232 serial data port. The FERRUPS is easy to install and the microprocessor makes each unit easy to operate and maintain.

Best Power chose the FERRUPS name because of the unique ferroresonant transformer the unit uses to provide uninterruptible power. In the normal operating mode, the ferroresonant transformer filters line power and protects the critical load from spikes, sags, surges, noise and brownouts (see Figure 1). The ferroresonant transformer stores energy in its magnetic field and capacitor circuit, and when line power fails (Figure 2), the transformer continues to provide power to the load until the inverter turns on. This "flywheel effect" can supply power to the loads for eight to sixteen milliseconds.

On Line

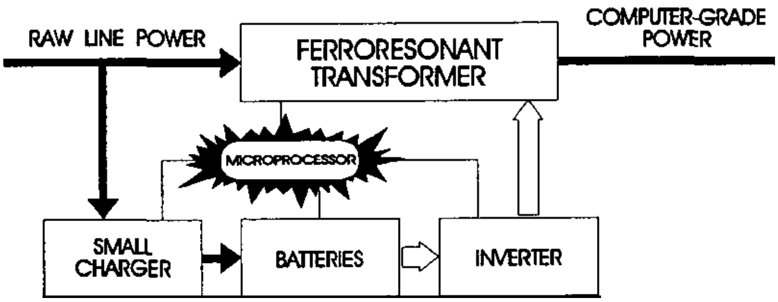


Figure 1

On Inverter

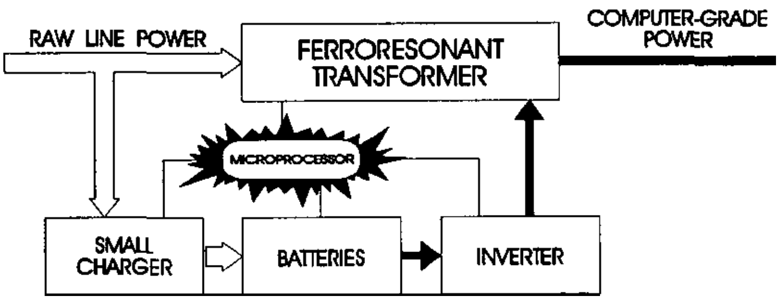


Figure 2

If AC line fails or line frequency is too high, too low, or unstable, the FERRUPS microprocessor detects the problem in as little as 260 microseconds. FERRUPS then switches off the AC line input and turns on the inverter in phase. The inverter converts DC power from the batteries into pulse-width modulated DC and supplies it to the ferroresonant transformer. The ferroresonant transformer takes the pulsed DC and waveshapes it into computer-grade AC. Because of the "flywheel effect," there is no break in output power.

When input power returns to normal, the microprocessor matches the inverter output phase to the phase of the incoming line. The. microprocessor checks line voltage quality and stability. If line voltage is acceptable, the inverter turns off and AC line is switched to the ferroresonant transformer. This transfer occurs almost instantly, and, with help from the "flywheel effect," provides continuous AC output.

Sample of an AC Line Loss and FERRUPS' Response

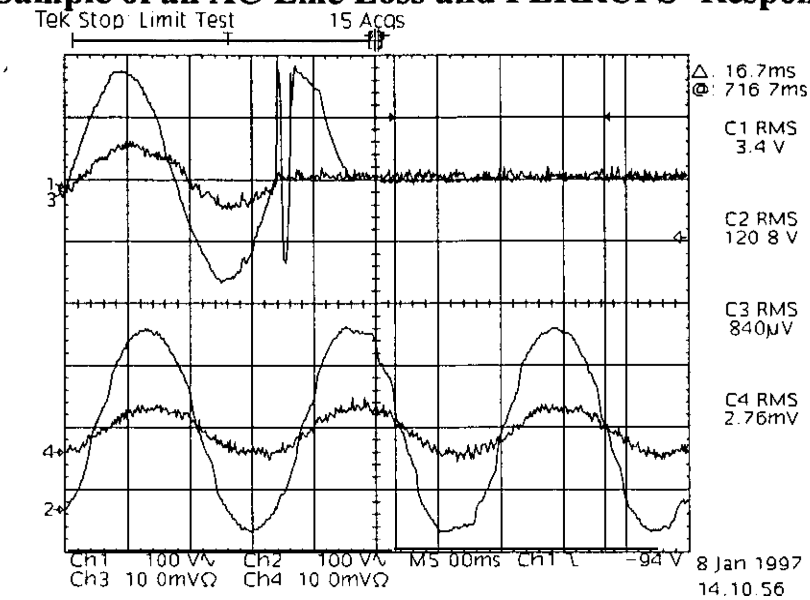


Figure 3

In Figure 3, the upper waveform shows the AC line failing (a power outage). The bottom waveform shows the UPS Output during the AC line loss. Notice that although the input failed, UPS output was not lost. The ferroresonant transformer's "flywheel effect" lets FERRUF'S provide true uninterruptible power, but keeps the inverter off until it is needed.

202 System Theory of Operation

Note: The theory of operation is the same for 500VA, 700VA, 850 VA, 1.15 KVA and 1.4KVA units. Most hardware in the five (5) models is the same, but some components, subassemblies, and part locations are different. Only the logic board can be used for all five (5) models — and then **only** if you recalibrate the system and reprogram the logic board for the model it is installed in.

The FERRUF'S uses four (4) system modes: "Auto," which is for normal operation, "Inverter" and "Line Condition," which you can select from the control panel for testing, and "Off," which turns the FERRUPS off. Section 300 explains these modes in more detail.

In the Auto mode, the FERRUPS normally uses AC utility power to operate the loads. See Figure 4 on the next page for a block diagram of the FERRUF'S during normal AC line operation. AC line is applied to the ferroresonant transformer's AC line primary, and the transformer's secondary provides power to the loads. The transformer filters and regulates utility AC, and the control electronics work with the microprocessor to continuously monitor AC line voltage.

-The FERRUPS during normal AC Line operation:

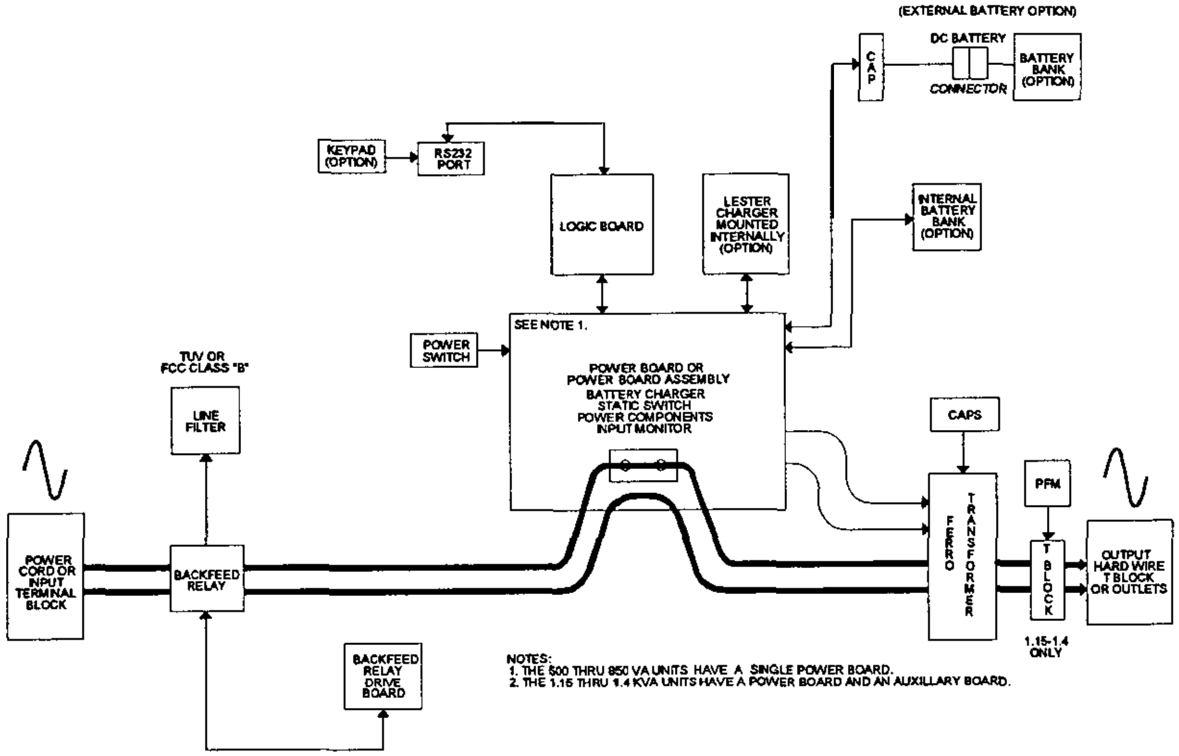


Figure 4

See Figure 5 on the next page for a diagram of the FERRUF'S during an AC utility line loss (power outage). When there is a power outage, or when AC line does not meet the minimum requirements set by FERRUPS parameters, the control electronics turn off the static switch. This removes AC line from the transformer's AC line primary. Before output voltage begins to decay, the inverter provides pulse-width modulated DC to the ferroresonant transformer's inverter winding. The ferroresonant transformer transforms the pulsed DC into a high-quality sine-wave output. The transfer process is complete within two (2) milliseconds or less, during which time the energy stored in the ferroresonant tank circuit supplies the full rated output power to the load.

The FERRUPS during AC Line loss:

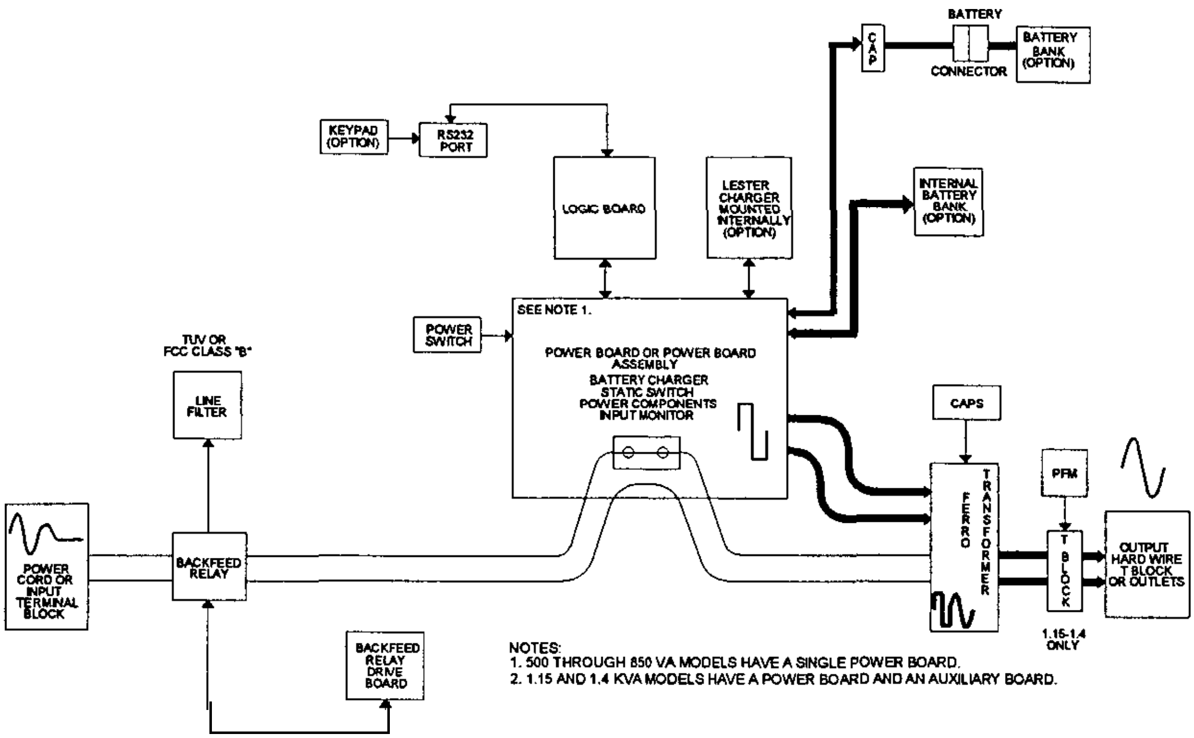


Figure 5

While the FERRUPS runs on inverter, the microprocessor continues to monitor all parameters, and it generates an audible tone every two (2) seconds to let you know the FERRUPS is on inverter. The microprocessor monitors the battery current and battery voltage. Using these values plus stored battery capacity and the measured VA load, the microprocessor estimates the runtime remaining. You can see this runtime by displaying parameter 9, either on the control panel or on a terminal connected to the RS232 port. When estimated runtime falls to five (5) minutes (or the value you have programmed into parameter 68), the FERRUPS sounds a Low Runtime alarm. If the batteries continue to discharge, and the battery voltage falls to 11 volts (or the value in parameter 66), the alarm changes to Near Low Battery. If the battery voltage then drops to 10.5 volts (or the value in parameter 65), the alarm changes to Low Battery, and FERRUF'S shuts itself down to prevent deep discharge damage to the batteries. When AC line returns, the FERRUF'S restarts automatically, unless you have changed parameter 77 (Auto Restart). The FERRUPS runs in the Line Condition System Mode until the batteries recharge; then, the mode changes to Auto.

While the FERRUPS runs on inverter in the Auto system mode, the microprocessor continues to monitor the incoming AC line. After the AC line returns, the system matches the inverter phase and frequency to the incoming AC line using a phase-locked-loop circuit. The microprocessor continues to monitor the AC line for a period of time to ensure that the AC line is stable; this time is normally one (1) second, but you can adjust it using parameter 58. The microprocessor then transfers the system back to line by turning off the inverter and closing the AC static switch, The ferroresonant tank circuit once again powers the load during this brief transition and the loads are now back on AC line.

The microprocessor also monitors AC output voltage and current, battery voltage and current, ambient temperature, heatsii temperature, Power Factor Module temperature, and transformer temperature. The microprocessor compares monitored parameters to preset parameters and makes real-time decisions based on these comparisons.

If any of these parameters go beyond preset limits, the FERRUPS alarms with an audible Morse Code and enters the cause of the alarm condition into an internal log, which is stored for future **reference.** If certain values go beyond preset limits, the FERRUPS may actually shut itself down to protect the loads or the FERRUPS unit from damage.

The battery charger circuitry monitors battery voltage, and automatically charges the batteries as necessary

Section 203 below breaks the system down into its major components and explains the functions of these components. This section should help you understand the System Theory of Operation better.

203 Major System Components

The basic system is composed of:

1) three (3) major assemblies,
2) batteries,
3) supporting circuitry,
4) interconnect wiring, and
5) the cabinet.

The three (3) major assemblies arc the logic hoard, the power board assembly, and the ferroresonant transformer. The subsections below describe the major assemblies and their subassemblies or circuits.

203-l The Logic Board

The logic board controls all of the functions in the FERRUPS and enables the battery charger. The heart of the logic board is the 16-bit microprocessor. The control program — the software program that is in an EPROM (permanent memory) — is on this board. In addition, there are many subsystems on this board that make up the control and monitoring circuitry. In all system modes, the monitoring circuitry receives its conditioned and scaled signals from the power board, the current transformers, or the DC shunt.

203-1.1 Logic Board Subsystem Functions

Fast-Acquisition A/D Converter: The logic board uses monitored signals (along with preset parameters and external commands) to make decisions for controlling the FERRUPS' operation. By itself, the microprocessor could not monitor all of these signals for two (2) reasons:

1) the microprocessor has a limited number of port connections, and
2) the voltage and current signals are analog, not digital.

The fast-acquisition A/D (analog-to-digital) converter solves the first problem by sampling the signals on a time shared basis. The converter solves the second problem by constantly converting the analog voltage and current signals to digital signals that the microprocessor can accept. To do this, the fast-acquisition A/D converter uses calibration factors in stored memory to offset the actual voltage and current reading. These calibration factors are necessary because components used in manufacturing normally have slightly different values; the calibration factors only change when the unit is recalibrated. (See Section 403.) You can display the calibration factors from an optional control panel or through the RS232 port by displaying parameters 110-121. (See Section 308.)

Phase-Locked-Loop: The phase-locked-loop (PLL) circuit enables the FERRUPS to switch from AC line to inverter and back to line smoothly and in phase. The PLL does this by changing the phase of the FERRUPS' internal variable frequency to make it match the phase of the AC line frequency. (When you manually change the system mode from Inverter On to Auto, you can actually hear the PLL shift or slew the phase.) You can accelerate the rate of phase shift or "slew rate" by changing parameter 53. This change is usually made to accommodate an unstable source. of AC input (such as a generator).

Snubber Circuit: When the system switches to inverter operation, the logic board disables the charger by switching the Charger Enable signal from low to a high state The fly-back voltage from the transformer charges a capacitor through two (2) steering diodes attached to the wings of the inverter winding. When the voltage across the capacitor reaches approximately 3 1.4 volts, the charger circuit is enabled in constant current only and drains the energy in the capacitor back to the battery.

Communication Interface: The communication interface circuitry is on the logic board. This circuitry lets you enter commands on a control panel or terminal connected to the RS232 port. The **RS232** pat at the back of the FERRUPS is connected to the logic board by a ribbon cable.

Power Supplies: The. logic board operates on +12 volts supplied from one of the power board's three (3) 12-volt regulators to create +5 and -9 volts for use on the logic board. The logic board also contains a three (3)-volt lithium battery to back up volatile RAM when the DC supply is off.

Miscellaneous: The logic board also includes an audio beeper and a pair of relays for dry contacts. These contacts provide inverter on and alarm signals at the RS232 port.

203-1.2 Monitoring Functions

AC Line Voltage: This is a scaled value. representation of the incoming lime. This value originates at the input step-down monitor transformer (separate from the board), passes through the power board (which provides spike protection), and enters the logic board for signal conditioning. This then becomes the AC sensing signal for the lime detect circuitry and for monitoring of the AC line voltage. The High AC Input alarm is based on this level. This signal also lights the AC LINE LED on the FERRUPS front panel and is available as a true RMS display on the control panel or a terminal connected to the RS232 port. (See parameter 1 in Section 308.)

AC Output Voltage: The output voltage from the ferroresonant transformer is fed to the power board, where it is scaled (stepped-down) through the output monitor transformer. This voltageenters the logic board and is used to determine actual output voltage. Low and High AC Out alarms are based on this level. The V Out parameter (2) is used to calculate the VA out, watts, and power factor, and it is available for true RMS display on the control panel or a terminal connected to the RS232 port. (See parameter 2 in Section 308.)

AC Amps Out: A current toroid on the power board is used to sense output current. The AC output current passes through this coil and generates the AC Amps Output signal. This signal passes through the power board or power board assembly for spike protection and scaling and then passes to the logic board. This true RMS signal is used to calculate the VA out, watts, power factor,and crest factor, and it is available for display on a control panel or terminal connected to the RS232 port. (See parameter 4 in Section 308.)

Battery Current: This signal originates *on* the power board or power board assembly at the DC current shunt on the power board. The shunt, a precision resistor, generates a voltage proportional to the current that passes through it. This voltage is passed from the power board to the logic board. When the FERRUPS is in the Auto mode using AC line, the battery charger current passes through the shunt. When the FERRUPS is running on battery power, FERRUPS uses this DC current signal with DC voltage, battery capacity, and VA load to calculate the runtime remaining, to detect transformer saturation, and to protect the inverter switching devices by current limiting. You can display battery current on a control panel or a terminal connected to the RS232 port. (See parameter 6 in Section 308.)

Battery Voltage: This battery reference voltage is a scaled proportional voltage that originates on the power board. It is used for calculating runtime while the FERRUPS is running on battery power and for determining Low Battery and Near Low Battery alarms and for battery charging voltage levels. You can display battery voltage on a control panel or a terminal connected to the RS232 port. (See parameter 7 in Section 308.)

Temperature: FERRUPS also monitors the ambient temperature, heatsink temperature, and Power Factor Module temperature; 1.15 KVA and 1.4 KVA models also monitor transformer temperature.

- FERRUPS monitors *ambient temperature* **directly from** a negative temperature-**coefficient** thermistor **connected** to the logic board.

- *Heatsink* ***temperature,*** which originates from another negative temperature **coefficient** thermistor on the **heatsink** (which is mounted on the power board), provides a signal that passes through the power board.

- ***Power Factor Module temperature*** originates from a **negative-temperature-coefficient** thermistor mounted on the Power Factor Module.

- **FE 1.15 KVA and 1.4 KVA models monitor** ***the transformer temperature*** **from** a negative **temperature coefficient** thermistor **mounted** on **the** shelf above the transformer.

FERRUPS monitors these signals and compares them to **stored** parameter settings to determine a possible alarm condition. You can display these **temperatures** on a control panel or **terminal** connected to the RS232 port. **(See** parameters 11, **12, 14, 76, 80, 81, 82, 83, 84, 85, 86,** and 87 in Section 308.)

203-1.3 Control Signals

The logic board uses the monitored signals to generate appropriate FERRUPS responses and to control FERRUPS operation. The control signals all originate on the logic board (except for the battery charger) but are conditioned or amplified on the power board (or power board assembly). The paragraphs below explain these signals:

Relay **Drive (500-850 VA): The** relay drive is used in 500,700, and 850 VA units. When the FERRUPS is in Auto or Line Condition mode, AC line is applied to the **ferroresonant** transformer's AC primary **winding** by **means** of a relay on the power board. This relay is controlled by the relay drive signal **from** the logic board. When the relay drive signal is low, the relay is closed, allowing line to the transformer. When the relay drive signal is high, the relay is open, removing **line from** the transformer.

Static Switch Drive (1.15-1.4 KVA): The static switch drive signal is used in 1.15 and 1.4 KVA units. When the FERRUPS is in Auto or Line Condition mode, AC line is applied to the ferroresonant transformer's AC primary winding by means of two (2) **SCRs** placed back-tc-back on the **auxiliary** power board. The two (2) **SCRs** are called the static switch; **they** are controlled by the static switch drive signal from the logic board. When this signal is low, the static switch is on, allowing line to the transformer. When this signal is high, the static switch is off, removing line from the transformer.

Inverter Gate Drive: When FERRUPS is operating normally in the Auto mode with AC line applied, the inverter section of the system is not operating. When the FERRUPS must transfer to inverter, a gate drive signal is required to control the power devices on the power board. The gate drive signal originates on the logic board and actually consists of two (2) timed signals, A and B drive, corresponding to the two "sides" of the inverter. The basic frequency of these signals is 60 Hz or 50 Hz; the frequency is derived from the clock on the microprocessor. Signals A and B are applied to the gates of the switching MOSFETs.

Battery Charger Enable: The actual control circuitry for the battery charger is within the battery charger section of the power board or power board assembly. The battery charger could operate independently of logic board control. There are times, however, when intervention from the logic board is desirable. Because of these times, the logic board sends a battery charger enable signal to allow the battery charger to operate. If, for instance, a High Battery alarm occurs, the logic board disables the battery charger to prevent damage to the batteries.

203-2 The Power Board/Power Board Assembly

500,700, and 850 VA models have a *power board*. 1.15 and 1.4 KVA models have a *power board assembly* made up of a *power board* and an auxiliary *board* mounted on the same bracket and connected in parallel. The power board in the 500-850VA and the power board assembly in the 1.15-1.4 KVA perform the same functions.

Figure 6 below shows the 500-850 VA power board; figure 7 below shows the 1.15-1.4 KVA power board assembly.

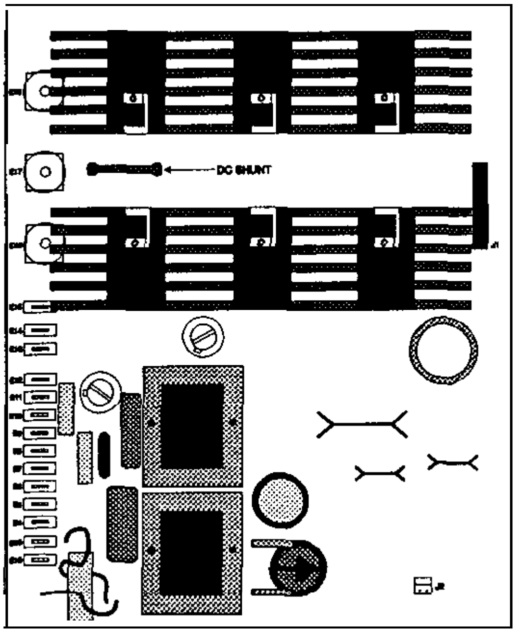
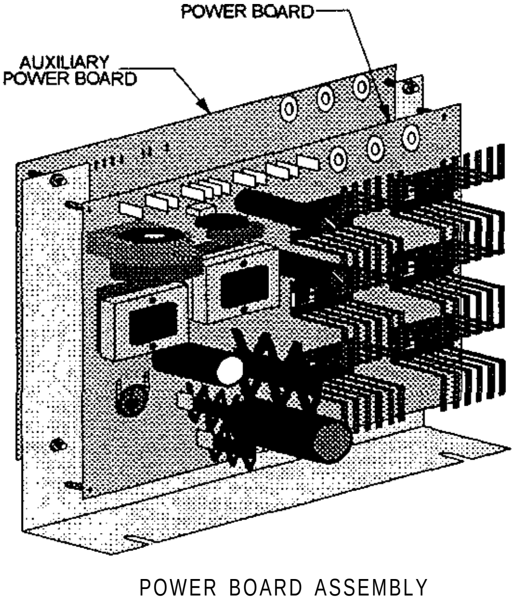


Figure 6



POWER BOARD ASSEMBLY

Figure 7

203-2.1 Power Board Subsystem Functions

Fail Safe (1.15-1.4 KVA only): Normally, the power board assembly receives DC power from the batteries. However, when the batteries are low or battery power is not available, the Fail Safe circuit on the power board (or the assembly) derives DC from the AC input monitor transformer; the circuit then makes this DC power available to the power board (or assembly).

This circuit provides two (2) benefits:

1) it lets the FERRUF'S continue to supply output power and charge the batteries as long as AC line is available; and
2) it lets you start the unit when the batteries are low.

Since the Fail Safe circuit uses AC line power to provide DC, it can only operate if AC line is available. If the unit was in the Auto mode when DC was lost, it sounds an alarm. 500,700, and 850 VA models do not have the Fail Safe function.

Static Switch Drive and Soft-start (1.15-1.4 KVA only): The logic board generates a static switch drive signal (low for on, high for off) that is passed through the power board, then to the static switch driver board, and then to the static switch. When the FERRUF'S is initially turned on, the inrush current to the ferroresonant transformer could exceed the input breaker requirements because the tank circuit can store a large amount of energy. To eliminate any problem with this inrush, the logic board software includes a "soft-start." Instead of allowing the gate signal to fully turn on the static switch at zero cross, the FERRUF'S software changes the signal phase so the static switch first comes on very late in the half cycle. After the tank circuit is energized, the signal goes back to switching near zero cross.

Inverter Gate Drive: These signals (A and B drive) from the logic board are amplified and pulse-width modulated.

12-volt DC Power Supply: The power board/power board assembly produces the main 12-volt DC power supply for the logic board.

Battery Charger: The power board (or power board assembly) contains the battery charger and control circuitry. The charger is a float charger with current limit. It is controlled by a DC-to-DC converter chip. The charger limits the current to approximately 2.5 amps; it floats the battery at a voltage level that is adjustable by a potentiometer on the power board. The charger receives its power from the inverter winding and is rectified by the body diodes in the inverter MOSFETs.

Inverter: The inverter consists of MOSFETs located on the power board (and the auxiliary board for 1.15 and 1.4 KVA models). These devices are the power MOSFETs, the snubber SCR, and a temperature sensor. In 500 VA-l.4 KVA models, the fan runs continuously whenever the system provides output voltage.

203-2.2 Signal Conditioning

The power board (or power board assembly) conditions these signals:

AC Input Voltage: This signal comes from the terminal block. It is fused on the power board by F5, a five (5)-amp fuse, and is stepped down by transformer T2, then passed to the logic board.

AC Output Voltage: This signal comes from the terminal block. It is fused on the power board by F1, a five (5)-amp fuse, and it is stepped down by transformer T1. Then, it is passed to the logic board.

AC Amps Out: This signal is generated by a current transformer below the terminal block, and passes to the logic board through the power board (or power board assembly).

I Battery: This signal, which comes from the DC shunt on the power board (or power board assembly), is passed to the logic board unchanged (except for providing test points).

DC Voltage: This signal, which comes from the battery, is scaled and provided to the logic board.

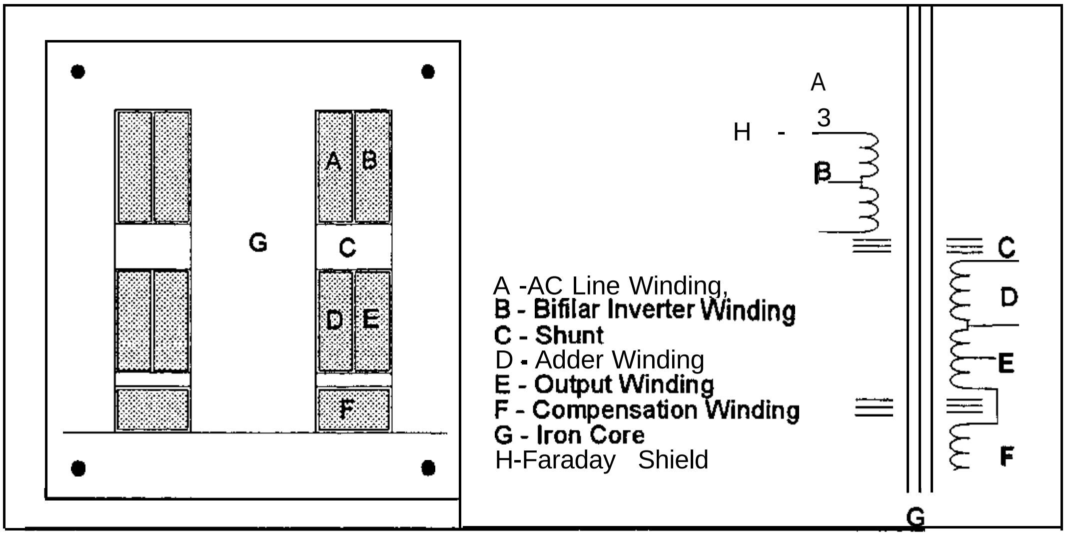
203-3 The Ferroresonant Transformer

The ferroresonant transformer is a non-linear transformer with live (5) windings, wound in three (3) different groups. Each group is separated from the others by stacks of metal plates called shunts. The shunts help to isolate one group from another and to channel the magnetic field within the transformer's iron core. Please refer to **Figure** 8 on the next page for a cut-away view and diagram of the ferroresonant transformer.

The first group of windings includes two (2) primary windings. One (1) of the primary windings is for AC line input. This winding is tapped for multiple AC input voltages. The other primary winding is bifilar-wound for 12 volts pulse-width modulated DC from the inverter; when the unit is using AC input (utility) power, this winding is also used as an AC voltage source. for the battery charger.These two (2) windings are connected magnetically. This group of windings also includes a Faraday shield for increased transient reduction.

The second group of windings includes an output winding and a voltage adder. The output winding is tapped for multiple AC output voltages. This winding provides the output voltages to the load equipment. The voltage adder is connected in series between the output winding and the third group of windings.

The third secondary winding (F in Figure 8 on the next page) is the compensation winding. The compensation winding helps to provide a computer-grade sine wave by canceling harmonics. This winding is connected in series with the other secondary windings. It compensates for variations in the voltage applied to the AC line winding.



igure 8

In addition to the specially designed iron core and windings, one (1) more component is needed to complete a ferroresonant transformer. This component is a capacitor or bank of capacitors. The capacitance is connected across the three (3) series-connected windings of the secondary. This forms an energy storage bank, which provides the energy needed for the "flywheel effect" and supplies the current required to saturate the load tiding window in the transformer.

The ferroresonant transformer gives you many benefits through its design characteristics: lightning and surge protection, isolation and noise rejection, voltage regulation, power factor correction, no-break power, sine-wave power, and system protection.

203-4 The Battery Bank

The standard battery bank includes one (1) 12-volt battery for a nominal voltage of 12 VDC. The battery is sealed, non-gassing, non-spillable lead-calcium batteries with a pressure relief of 5 P.S.I. In a standard system, the battery is mounted inside the UPS. A DC protection fuse is mounted inside the FERRUPS. Optional battery banks can increase the battery runtime by using batteries with a higher amp-hour rating or by paralleling multiple strings of batteries. These may be mounted inside the UPS or in an external battery cabinet. Please refer to TIP 218 in Section 700 or to the Parts List in Section 600 for information on available batteries.

203-S The Backfeed Relay

This electromechanical relay is used to prevent any AC power from backfeeding the AC distribution system if the AC static switch fails (shorts) and the unit operates on battery power. This circuit includes a relay and a backfeed relay control board. The relay is installed between the AC input to the FERRUPS and the static switch. When the coil on the relay is energized, the relay contacts close and AC power is applied. When the relay coil is de-energized, the contacts open and no AC power can pass either way, preventing any feedback.

The control board monitors the AC line. In the normal operating mode, the control board sees the input AC sine wave, and it energizes the coil and allows AC to pass to the FERRUPS. If the FERRUPS static switch or AC line fails and the FERRUPS goes to inverter, the control board senses pulse-width modulated DC on the AC input winding from the current flow through the inverter windings. The control board then de-energizes the coil winding and prevents any feedback from the FERRUPS.

203-6 The Power Factor Module

The Power Factor Module provides additional voltage regulation for the UPS AC output. It is standard on all FE series models to prevent oscillations between a PFC Power Supply and the ferroresonant transformer.

203-7 The Line Filter Board (TÜV Models)

The Line Filter board provides filtering for conducted electromagnetic interference (EMI) and radio frequency interference (RFI).

In newer 500,700, and 850 VA models, this board has been replaced by a capacitor on the power board.

SECTION 300

SECTION 300

Section 300 System Operation, Communication, and Software Information

NOTE: This chapter provides a basic review of startup and a thorough description of FERRUPS operation. The *FERRUPS FE/QFE User Manual* provides a more thorough startup procedure and basic operation information. .

301 Startup

For complete. startup procedures, please *see the FERRUPS FE/QFE* User Manual. This section supplements the procedures in the User *Manual.*

If the FERRUPS has been operating, startup is very easy. Apply AC line (input power) and tom the On/Off switch "On."

302 DC Disconnect

Some UPS models have external batteries (batteries in a separate cabinet). For these models, there may be either:

1) a DC Disconnect switch on the cabinet, or
2) a plastic connector between the UPS and battery cabinet that serves as a DC disconnect.

Before you operate the FERRUPS in Auto Mode (the normal operating mode), you must start the UPS on DC; to do this, make sure the DC switch at an optional battery cabinet is on or the plastic connector is connected to the UPS.

303 On/Off Switch

The On/Off switch is on the FERRUPS back panel. The "Off" position means the FERRUPS is not ready to provide backup power when it is needed, and the logic board is not operating. In the "On" position, the logic board is operating and, depending on the system mode, the FERRUF'S may be ready to provide backup power when it is needed.

304 System Modes

The system modes control the FERRUPS' operating state. The modes tell both the software and the operator how the unit responds to a change in commercial (AC input) power. Using a FERRUPS control panel, a VT- 100 style terminal, or a computer running terminal emulation software connected to the RS232 port, you can put the UPS into four (4) system modes: Off, Auto, Line Condition, and Inverter On. The following paragraphs explain each system mode. To use the control panel, see Section 305.

System Mode Off

The unit is off The main ferroresonant transformer is not energized. There is no output from the FERRUPS. AC and DC voltages may still be present in the FERRUPS cabinet.

System Mode Auto

The FERRUPS is in the automatic mode (the normal FERRUPS operating mode). The FERRUPS operates on AC line or the inverter as needed. AC line is conditioned by the fcrroresonant transformer and is supplied to the load. If AC line fails, the inverter takes over to supply power to the loads. Some FERRUPS alarm conditions may cause the FERRUPS to go to System Mode Auto/Not Ready. When this happens, the READY front panel LED is not on, but the ALARM LED is; the FERRUPS may operate as it would in the Off or Line Condition system modes.

System Mode Line Condition

The FERRUPS is in a line conditioning mode. In this mode, the ferroresonant transformer conditions AC line and supplies AC power to the load. The inverter is inhibited; if AC line (input power) fails, the inverter does not turn on and power to the load is lost. You can use the Line Condition system mode for testing, troubleshooting, recharging the batteries, and verifying AC generator frequency. The FERRUPS does not switch back to the Auto mode; you must manually change the mode from a control panel or a terminal connected to the RS232 port on the back of the UPS.

System Mode Inverter On

This is a manual inverter run In this mode, the inverter runs until you change the mode manually or until the battery is exhausted. The FERRUPS continues to provide power to the loads as if there had been an actual power failure. The FERRUPS does not switch back to the Auto mode unless you change the mode manually from the control panel.

305 The Optional Control Panel

You can connect an optional control panel to the RS232 port on the back panel of the FERRUPS by using the six (6)-foot (1.8-meter) cable that comes with the control panel. The control panel is powered by the FERRUF'S.

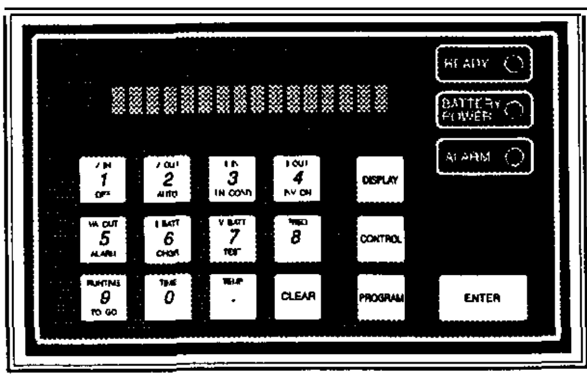


Figure 7

When you connect the control panel to the RS232 port, it displays the BEST logo. Once you press [ENTER], the control panel automatically establishes communication with the FERRUPS (unless you have turned this feature off in the control panel's Configuration Menu-see TIP 407). Then, the control panel should scroll the following:

FERRUPS by BEST
Mode: Auto
Charger: Off
Beeper: Enabled

305-l Control Panel Keys (Buttons)

Key Name	Description
DISPLAY (GREEN)	Use this key before you enter a parameter number you wish to display. You do not need a password to display parameters 0 through 122. The names of the first 11 parameters appear in green letters on keys O-9 and the [ ] key. Once you've displayed a parameter, you can scroll forward through the parameters by pressing [ENTER], and you can scroll backward by pressing [.].
CONTROL (RED)	Using this key you can change system modes, disable alarms, start the User Test alarm, disable the charger, and start the FERRUPS system test. See Control Key Functions, Section 305-Z.
PROGRAM (ORANGE)	Using this key, you can enter passwords or change parameter values. To enter passwords, press [PROGRAM], then enter the password. (See Section 305-3.) To change a parameter, display it, then press [PROGRAM], and enter the new value. You need a password to change parameters; see section 305-3.
ENTER (BLUE)	This key records or enters a task you perform using the [DISPLAY], [CONTROL], and [PROGRAM] keys. If you are displaying a parameter, press this key to display the next parameter. You can also use tbe [ENTER] key to move through the entries in the alarm or inverter logs.
CLEAR (BLUE)	This key clears the last command or value you entered. You can also use this key to return to the normal scrolling display after you display or change a parameter. In software version 8.06 sad higher, you can use this key to acknowledge an alarm. To clear a password, press this key twice.

305-2 Control Key Functions

The table below shows what you can do using the Control key with other control panel keys.

Press These Keys:	To do This:
[CONTROL] [1] [ENTER] [ENTER]	Puts the FERRUPS in the Off mode. (See Section 304.)
[CONTROL] [2] [ENTER] [ENTER]	Puts the FERRUPS in the Auto mode. (See Section 304.)
[CONTROL] [3] [ENTER] [ENTER]	Puts the FERRUPS in the Line Condition mode. (See Section 304.)
[CONTROL] [4] [ENTER] [ENTER]	Puts the FERRUPS in the Inverter mode. (See Section 304.)
[CONTROL] [5] [ENTER] [ENTER]	Silences or enables the FERRUPS' audible beeper. The FERRUPS uses the beeper when it sounds alarms and when it is running on inverter.
[CONTROL] [6] [ENTER] [ENTER]	Enables or disables the FERRUPS' battery charger.
[CONTROL] [7] [ENTER] [ENTER]	Starts a FERRUPS system test. See Section 308-2.
[CONTROL] [8] [ENTER] [ENTER]	Starts or stops a User Test alarm (alarm J). You can use this feature to test the alarm beeper and the alarm relay contacts.

Press These Keys:	To do This:
[CONTROL] [9] [ENTER] [ENTER]	This function requires a Factory password. Clears the alarm and inverter logs.
[CONTROL] [0] [ENTER] [ENTER]	Clean all alms without changing the system mode. If the alarm condition still exists, the alarms start again after the alarm debounce time.
[CONTROL] [D] [ENTER] [ENTER]	Continuously scrolls through parameters O-10, displaying each parameter for two (2) seconds You can exit this mode by pressing my key.
[CONTROL] [C] [ENTER] [ENTER]	This function requires a Service password. Starts a transfer test; the FERRUPS transfers to inverter briefly.
[CONTROL] [ ] [ENTER] [ENTER]	This function requires a Factory password. This function resets (restarts) the FERRUPS unit. If the unit is providing power to the load, output power is temporarily broken.

305-3 Passwords

Before you can change parameter values, you must enter the appropriate password. (No password is required to display parameters 0- 122.)

User Password: 377
Service Password: 2639
Factory Password: 18473

Parameter changes require the passwords shown in the table below.

Note: To change a parameter, you can enter a password level that is higher than the level required. For example, if you need to change parameter 0, which requires a User password, you can enter a Service or Factory password instead of the User password.

Password Level to Change Parameter Setting	Parameter Numbers
User Password	0, 10, 39, 63, 68, 71-73, 79
Service Password	1-2,4,6-7, 15, 29-38, 50-62, 64-67, 69-70, 74-75, 77-78, 80-108, 122, 124-127
Factory Password	20-23, 28, 40-47, 49, 109-121, 123, 128-129, 137-139
No Change Allowed	3, 5, 8-9, 11-14, 16-19, 24-27, 48, 76, 130-136

306 LEDs (Lights) on the FERRUPS and the Control Panel

The table on the next page explains the LEDs on the FERRUPS front panel and on the control panel. The READY, BATTERY POWER, and ALARM LEDs arc on both the FERRUPS and an optional control panel. The AC LINE and CHARGING LEDs arc only on the FERRUPS.

LED (Light)	Function
AC LINE (Green)	This LED is only on when AC line (input) is present.
READY (Green)	When this LED is on, the FERRUPS can support the load when there is a power outage.
CHARGING (Green)	When this LED is on, the FERRUF'S is charging the batteries. When this light is off, the batteries are charged or charging is inhibited.
BATTERY POWER (Yellow)	When this LED is on, the FERRUPS is running on inverter/battery power.
ALARM (Red)	When this LED is on, there is a FERRUPS alarm condition. See **Section 504.**

307 Communication via the RS232 Port

Note: This section describes communication with the FERRUPS through a PC, laptop, or a VT-100 style terminal only. See Section 305 for control panel communication.

307-l Hardware Connection

A DB25S (female) connector is provided on the FERRUPS' back panel. Using this connector, the user can communicate directly with the FERRUPS microprocessor to access information or control operation. To communicate directly, you need a terminal or a computer that can emulate a terminal. The FERRUPS' DB25 is wired DCE (Data Communications Equipment), unlike most terminals, which are wired DTE (Data Terminal Equipment). A DTE can plug directly into a DCE. If your computer has a DB25 serial port, it is typically wired DTE like a terminal. However, if it uses a DB9 serial port, it is wired DCE. If this is the case, you must use a null-modem cable or a cable that has transmit and receive (pins 2 and 3) reversed.

CAUTION! Never connect pin 1, chassis ground, between the FERRUPS and the terminal if pin 1 and pin 7 (signal ground) might be connected together in the terminal device. Doing so can cause damage to the interface electronics.

TIP 503 in Section 700 provides more information on establishing communication, enabling hardware handshaking, using the FERRUPS commands, and programming the RelayMask and Emergency Shut Down [Emergency Power Off] parameters. The User *Manual* provides basic information on setting up communication.

307-2 Commands

The table below and on the following pages lists the. FERRUPS commands and explains what they do. Notice that the table includes a "Short Form" column. If you do not want to enter the whole command, you can enter the short form; you can also use another abbreviation of the command as long as your abbreviation includes the letters in the short form. You can enter more than one. (1) command on a line if you put a semi-colon between the commands.

Note: You must enter a password before you can use some commands. See the "Password" column in the table.

Command	Short Form	Password	Function
123dcp	123dcp	None	Configures the RS232 port on the back of the FERRUPS to operate with a FERRUPS control panel. In this mode, the FERRUPS sends special command characters that update the control panel's LEDs and beeper, if you enter this command from a terminal, the display shows the characters that the FERRUPS would normally send to a control panel. To exit this mode from a terminal, press <BACKSPACE>, then press <SHIFT><CTRL><C>.
alarmshelp	ah	None	Shows a list of all possible alarm messages, the audio code and letter for each alarm, and whether the alarm is active. See TIP 503 for more information.
alarmlog	al	None	Displays Alarm Log. See Section 308-1.
alarmtest	at	None	Allows you to test the alarm function. **Alarmtest** sounds the User Test alarm (J). You can also start an alarm test from the control panel; see Section 305-2.
alarmtest cancel	at c		Turns the User Test alarm off.
chargermode	chm	User	Shows the FERRUPS' battery charger mode. By entering a mode after the **chargermode** command, you can change the charger mode: **chargermode off (chm f) or chargermode disable (chm d)** = charger off; **chargermode on (chm o)** or **chargermode enable (chm e)** = charger on; **chargermode auto (chm a)** = charger enabled if AC input voltage and battery voltage are acceptable.
clearalarms	ca	None	Clears all active alarms. If the condition that caused the alarm has not been solved, the alarm starts again.
clearhistory	ch	None	Clears the minimum and maximum values stored in parameters 30-37. These parameters show the minimum and maximum AC Volts In, AC Volts Out, DC Volts, and VA Out. You can access the values stored in these parameters using the **extendedhistory** command.
clearlogs	cl	Service	Clears the entries in both the inverter and alarm logs.
clearpassword	cp	None	Clears the current password.
commands	cm	None	Displays a list of all valid commands. The letters that are capitalized in each command are the short form of the command.

Command	Short Form	Password	Function
contdisplay	cd	Depends on parameter password	Continuously displays the parameter that you are currently displaying. You can specify other parameters for the continuous display by entering the name or number of each parameter after the **contdisplay** command. To stop the display, press any key. Some terminals display the parameter(s) in the upper left comer and update that display; other terminals scroll the display. Some terminals cannot update the display.
contstatus	cs	None	Continuouslv displays the Status information. (See the status command.) See TIP 503 for more information. Some terminals display the information in the upper left comer and update that display; other terminals scroll the information. Some terminals cannot update the information.
date	da	None	Displays system time and date. To set the date, enter **date [month]/[day]/[year]**.
delay	dl	None	When you enter more than one (1) command on the same line, you may want to put a delay before the second (or third, etc.) command. You can do this by entering **delay** between the commands. Remember to put a semi-colon after each command. If you enter **delay** alone, the delay time is one (1) second. If you enter a number after **delay**, the delay time is that number x 2.5 milliseconds. **delay 1** would cause a 2.5-mS delay. For a one (1)-second delay, you can also enter **delay 400.**
display	d	Depends on parameter password	Displays the values of one or "lore parameters. (See the parameter table in Section 308.) If you have already displayed a parameter: **display** alone displays the next parameter. Format: display [parameter # or name] [parameter # or name] Example: **d 1 fullload ol** will display the values of parameters 1, 16 and 2 1.
extendedhistory	xh	None	Disolavs the minimum and maximum values for AC Volts In, AC Volts Out, DC Volts, and VA Out. These values are displayed in parameters 30-37; they are the minimum and maximum values of parameters 1 (AC Volts In), 2 (AC Volts Out), 7 (DC Volts) and 5 (VA Out). Once the terminal displays these values, the values are cleared. See the parameter table in Section 308.
format	f	None	Displays an SO-character line containing information on the FERRUPS' status. CheckUPS and other UPS monitoring software use this data. See TIP 503 for more information.
help	? or he	None	Shows a list of terminal/computer commands; the list explains what the commands do.
history	h	None	Displays the minimum and maximum values of parameter 1 (AC Volts I"); the command the" clears the minimum and maximum values. The values are stored in parameters 32 and 33.
identify	i	None	Shows Best Power's address and telephone numbers, the unit's model and serial numbers, the Unit ID (from parameter 15), the software version, and the release date.
inverterlog	il	None	Displays the inverter log. See Section 308-l.
logs	l	None	Displays both alarm and inverter logs. See Section 308-l.

Command	Short Form	Password	Function
message "[message]"	m	None	Displays a message (up to 16 characters) on the control panel. The control panel continues to display the message until a control panel key is pressed. This is useful for sending messages from a remote terminal to a user at tile UPS.
off [time]	o [time]	User	Shuts down FERRUPS in a given number of seconds. The READY LED blinks until the UPS shuts down, and the UPS beeps five (5) seconds before shutdown. Example: OFF 60 shuts down the unit in 60 seconds.
off [time] autostart	o [time] a	User	Shuts down FERRUPS in a given number of seconds (see above) and restarts the UPS shortly after power returns.
off cancel	o c	User	Cancels timed shutdown.
parameters	p	Depends on parameter password	Shows a list of system parameters. See Section 308. You can also display a range of parameters by entering the starting and ending parameter number or name after the command. Example: **parameters 1 10** will display parameters 1 through 10.
paramkeywords	pk	Depends on parameter password	Displays all parameters and their keywords (the parameter names you can use with commands). You can also display a range of parameters by entering the numbers or names of the stating and ending parameters.
password	pw	None	Allows you to enter a password (User, Service, or Factory). Typing **password** alone clears the current password. Example: **password 377** enters the User password. (The Service password is 2639, and the Factory password is 18473.)
print	pn	None	When you enter this command alone, the UPS alternates between sending a <CTRL><R> and a <CTRL><T>. These commands toggle on and off a special pass-through mode to the printer port on some terminals, which lets you print out communications as long as proper hardware is available. **This does not allow connection between the FERRUPS RS232 port and a printer!**
program	pr	Depends on parameter password	Lets you set the value of any parameter. You must enter the appropriate password before you reset the value. See the **password** command above. Format: PR [parameter # or name] [newvalue] Example: **PR 0 815 resets the time** (parameter 0) to 8:15 a.m. See TIP 503 for more information.
remote	rm	None	Configures the RS232 port so the connected terminal works like a control panel. Unlike the 123DCP command, this command does not cause the UPS to send update codes for the control panel beeper and LED. The command simply lets you use the terminal as you would use a control panel.
reset	reset	Service	Restarts the UPS. UPS output **shuts down while the unit is restarting!**
shutdown or shutdown autostart	sd sd a	User	Shuts down the UPS output in 60 seconds (if you enter shutdown alone) or the number of seconds you specify after the command. The READY LED blinks until the UPS shuts down. If you specify **autostart,** the UPS restarts shortly after power returns.
shutdown cancel	sd c		Cancels a shutdown started **with the shutdown** command.

Command	Short Form	Password	Function
shutup	sh	None	Silences the audible alarm.
status	s	None	Shows date, time, system status, present system mode, active alarms, and the value of various system parameters. See TIP 503 for more information.
systemmode _	sm	User	Typing systemmode alone displays which system mode is now active. You can use systemmode with A, F, I, or L to enter one of the modes below.
systemmode auto	sm a		Enters the Auto mode. This is the normal FERRUPS mode. In this mode, FERRUPS is conditioning AC input power for your equipment; if there is a power outage, FERRUPS is ready to switch to battery power.
systemmode off	sm f		Enters the Off mode. In this mode, FERRUPS is not providing power to your equipment, but you can still use FERRUPS' control panel.
systemmode inverter	sm i		Enters the Inverter mode. In this mode; FERRUPS is converting DC battery power to AC power for your equipment.
systemmode linecondition	sm l		Enters the Line Condition mode. In this mode, FERRUPS is conditioning AC input power for your equipment, but it does not switch to battery power (inverter) if there is a power outage; instead, FERRUPS sounds a Low AC Out alarm.
systemtest	stst	User	Starts a system test of the logic, inverter, and battery. See Section 308-2 for more information. The results of the last system test are stored in parameter 26.
time	t	None	Shows the current UPS time. To set the time. enter [hour]: [minutes] after the command.
unshutup	u	None	Turns the audible alarm back on.

308 System Parameters

FERRUPS' system parameters provide comparison setpoints that the software reads and compares to values acquired in real-time. These values are loaded either at the factory or in the field by qualified field service personnel. FERRUF'S uses the parameters for meters, counters, alarm setpoints, acceptable power quality limits, operation limits, or communication. Many parameters require a password to change; the password level is directly related to the sensitivity of the parameter. The lowest password is User, followed by Service, and Factory. (See Section 305-3.) The table on the following pages lists the parameter number, parameter name, a sample display (including the standard setting or a typical display), the password required to change, the adjustable range, and an explanation.

NOTE: The sample display shows a typical value for a 1.15 KVA FERRUPS; the values vary *from model* to model. "Change Not Allowed" means that the parameter value cannot be changed. Numbers in parentheses indicate the software version when a parameter was added or a change made in the parameter in different software versions.

The parameter name is an abbreviation; it is shown here as it actually appears on an optional FERRUPS control panel or a terminal.

lumber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
0	time (t)	00 Time 07:04:00	User	00:00:00-23:59:59	Time. FERRUPS uses the time to record alarms and inverter runs. When the DC power has been off and you restart the unit, the time shown is the last recorded time before shutdown. Reset the time when DC power has been off.
1	acvoltsin (vi)	01 V In 123.4	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The input voltage FERRUPS is receiving. When this value drops below the brownout voltage, FERRUPS switches to inverter. Programming this parameter changes CFACVIN (110) and CFACVID (111) below.
2	acvoltsout (vo)	02 V Out 123.4	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The voltage FERRUPS is providing to your equipment. Programming this parameter changes CFACVON (112) and CFACVOD (113) below.
3	Reserved	03 --Reserved--	—	—	—
4	acampsiout (o)	04 I Out 0.2	Service	0.0-220.0	The current your equipment is drawing from FERRUPS. Programming this parameter changes CFACAON (114) and CFACAOD (115) below.
5	vaout (va)	05 VA Out 25	Change Not Allowed	0-27000	The total "apparent power" (volt-amp) your equipment is drawing from FERRUPS. This value is parameter 2 multiplied by parameter 4, and should be less than or equal to VALimit, parameter 19.
6	ibatt (ib)	06 I Batt 0.9	Service	0.0-200.0	The amount of current (in amps) the batteries are supplying to FERRUPS when it runs on battery power. Programming this parameter changes CFDCAN (118) and CFDCAD (119) below.
7	vbatt (vb)	07 V Batt 13.15	Service	0.00-175.00	Battery voltage. FERRUPS sounds an alarm if this value is too low. Programming this parameter changes CFDCVN (116) and CFDCVD (117) below.
8	frequency (f)	08 Freq 60.02 Hz	Change Not Allowed	47.00-63.00	During normal operation, this is the frequency of the AC input power FERRUPS is receiving. If this value falls outside preset limits, FERRUPS switches to battery power. When FERRUPS is using battery power, this is the frequency FERRUF'S is supplying to your equipment.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
9	runtime (rt)	09 RunTime 12m	Change Not Allowed	0-9999	The estimated amount of time FERRUPS can continue to support your equipment when FERRUPS is running on battery power. FERRUPS alarms when this value falls below a preset limit.
10	date (d)	10 Date 06/01/96	User	01/01/1988-12/31/2166	Date. FERRUPS uses the date to record alarms and inverter runs. When DC paver or the power switch has been off and you restart the unit, this parameter shows the last recorded date before shutdown. Reset the date when you restart the wit.
. or 11[1]	ambtemp (@ .	1 I Amb Temp 23c	Change Not Allowed	-63 to 193	The temperature (ii Celsius) inside the unit. FERRUPS alarms and shuts down if this value is too high.
12	heatsinktemp (st)	12 SinkTemp 23c	Change Not Allowed	-63 to 193	The temperature of the heatsink on FERRUPS' power board. FERRUPS alarms if this value is too high
13	Reserved	13 --Reserved--	—	—	—
14	xfmrtemp (xt)	14 XfmrTemp 23c	Change Not Allowed	-63 to 193	Transformer temperature. FERRUPS alarms if this value is too high, and it may shut down
15	unitident (id)	15 Unit ID Network #1 UPS	Service	Not Applicable	Unit ID. An identification string that you can configure for use with your network.
16	fullload (l)	16 FullLoad% 090	Change Not Allowed	O-150	Percent of Full Load. The percentage of FERRUPS' total capacity that is actually being used by your equipment.
17	watts (w)	17 watts 20	Change Not Allowed	o- 15000	The total "real power" your equipment is drawing from FERRUPS. The value is AC Volts Out multiplied by AC Amps Out, then multiplied by the power factor (parameter 18).
18	powerfact (pf)	18 PF 0.73 Dist	Change Not Allowed	0.00-1.00	The power factor of your equipment; the difference in the way it draws voltage and current. Power factor is equal to Watts Out (parameter 17) divided by VA Out (parameter 5). This parameter also tells whether the power factor is leading (Lead), lagging (Lag), or distorting (Dist).

[1] If you are using a control panel, you can display this parameter by pressing [DISPLAY] [ ] [ENTER] or [DISPLAY] [1] [1] [ENTER].

lumber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
19	valimit (val)	19 VALimit 800	Change Not Allowed	350-18000	The maximum volt-amps FERRUPS can supply to your equipment at the present power factor. FERRUPS alarms when VA Out (parameter 5) is higher than this value.
20	powerout (po) (In 8.06 and higher software, the short form is pwro)	20 #PwrOut 1 20 #PWROut 1	Factory	O-65535	The number of times there has been a loss of input power since you started FERRUPS.
21	overloads (ol)	2 1 #OvrLds 0	Factory	O-65535	The number of times FERRUPS has been overloaded; that is, the number of times VA Out has been greater than VA Limit.
12	syshours (sh)	22 sys Hrs 00000	Factory	O-65535	The total number of hours FERRUF'S has been operating, regardless of mode. This number does not increase while the On/Off switch is turned Off.
23	invmin (im)	23 InvMin 0000.0	Factory	0000.0-6553.5	The total number of minutes the inverter has run since startup.
24	inverterlog (il)	24 Inverter Log LO3192127 1215	Change Not Allowed	Not Applicable	A record of the reason, date, time, and duration for the last 20 inverter (battery power) runs. (See Section 308-I .)
25	alarmlog (al)	25 Alarm Log A03192127 1215	Change Not Allowed	Not Applicable	A record of the reason, date, time, and duration for the last 20 alarms. (See Section 308-l.)
26	testresults (tr)	26 Test Results (See the Explanation column.)	Change Not Allowed	Not Applicable	This parameter records the results of the last system test. The parameter display includes the time and date of the test and the results of each part of the system test. (See the User Manual and Section 308-Z.)
27	crestfact (cf)	27 Crest 1.4 1	Change Not Allowed	0.00-5.00	Crest factor. This value is peak AC amps out divided by RMS AC amps out.
28	brownlevel (bl)	28 BrnLvl 75.0	Factory	74.4-192.0	The AC input voltage at which FERRUPS switches to inverter (battery power). If extended brownout (parameter 63) is set tc "Yes," this varies from 62% of nominal AC Volts in at no load to 80% at full load. If parameter 63 is set to "No," this is fixed at 80% of nominal AC volts in. See parameter 64.
29	beepfreq (bf)	29 BeepFreq 1320	Service	o-9999	This parameter sets the pitch of the beeper Smaller numbers set the pitch higher; larger numbers set the pitch lower.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
30	mindcv (mind)	30 MinDCV 11.95	Service	0.00-200.00	The minimum battery voltage measured since you started FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
31	maxdcv (maxd)	31 MaxDCV 13.50	Service	0.00-200.00	The maximum battery voltage measured since you started FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
32	minacvi (minvi)	32 MinACVI 0.2	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC input voltage measured since you started FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
33	maxacvi (maxvi)	33 MaxACVI 123.4	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC input voltage measured since you started FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
34	minacvo (minvo)	34 MinACVO 0.2	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC output voltage measured since you stated FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
35	maxacvo (maxvo)	35 MaxACVO 123.6	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC output voltage measured since you started FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
36	minva (minva)	36 Min VA 0.0	Service	0-20000	The minimum volt-amp output measured since you stated FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer
37	maxva (maxva)	37 Max VA 787	Service	0-30000	The maximum volt-amp output measured since you stated FERRUPS or since the last time you entered the extendedhistory command from a terminal or computer.
38	badpassword (bp)	38 #Bad PW 0	Service	O-65535	The number of times an invalid password was entered
39	ctrlpw (cp)	39 Ctrl PW 0)No	User	0)No-1)Yes	If this is set to 1)Yes, you need a User Password (or higher) to use the Control key functions on your FERRUPS' control panel. If this is set to 0)No, you do not need a password to use these functions.
40	serialnumber (sn)	40 Serial Number FE1.15K12345	Factory	Not Applicable	This is FERRUPS' factory serial number; it is wed to identify your FERRUPS.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
41	modelindex (mi)	41 ModelIndex 1 4: FE1.15KVA	Factory	1:FE500VA-14:FE18KVA	Your FERRUPS' size and model number. Programming this parameter changes the settings for Rated VA (45), Rated Watts (46), Battery AH (69), Runtime Constant (70), Maximum Inverter Test Amps, Low Runtime Alarm (68), ILimit Amps (48), and Overlap. See Section 308-3.
42	nomfreq (nf)	42 NomFrq 1)60Hz	Factory	0)50Hz-1)60Hz	Nominal frequency of AC input and output voltages. Do not **change this** fmm the factory **setting!**
43	nomvin (nvi)	43 NomVIn 120.0	Factory	60.0-500.0 (In 8.01 software, 100.0-300.0)	Nominal AC input voltage to FERRUPS. Programming this parameter changes Brownout Level (28). Brownout Voltage (64), and the AC input voltage charger enable setpoint.
44	nomvout (nvo)	44 NomVOut 120.0	Factory	60.0-500.0 (In 8.01 software, 75.0-500.0)	Nominal AC output voltage from FERRUPS. Programming this parameter changes Low Volts Out Alarm (59), Low Volts Out Shut-down (60), and High Volts Out Alarm (61).
45	ratedva (rva)	45 RatedVA 1150	Factory	100-30000	The maximum rated volt-amps FERRUPS may deliver to your protected equipment without sounding an Overload alarm.
46	ratedwatts (rw)	46 RatedW 800	Factory	100-30000	The maximum rated watts that FERRUPS may provide to your protected equipment without sounding an Overload alarm.
47	ilimitlevel (ill)	47 ILimitLvl 246	Factory	10-253	The level at which FERRUPS' inverter limits current drawn from the batteries.
48	ilimitamps (ila)	48 ILimitAmp 424	Change Not Allowed	0-600	The approximate level (in amps) at which FERRUPS' inverter limits current drawn from the batteries.
49	rackmount (rm)	49 Rackmnt 0)No	Factory	0)No-1)Yes	This parameter indicates whether your FERRUPS is a rackmount model or a standard model.
50	startup (sta)	50 Startup 1)On	Service	0)Off-1)On	This parameter determines whether the FERRUPS is in the Auto mode when you turn the On/Off switch on. If this is set to 0)Off, FERRUPS stays in the Off mode when you turn the switch on until you manually put it into Auto mode. If tbis is set to 1)On, FERRUPS goes into Auto mode when you switch on the On/Off switch.
51	lowfreq (lf)	LowFreq 57.00	Service	45.00-65.00	The low AC input frequency at which FERRUPS switches to inverter (battery power). FERRUPS continues to use battery power until frequency rises above this point again.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
52	highfreq (hf)	52 HiFreq 63.00	Service	45.00-65.00	The high AC input frequency at which FERRUPS switches to inverter (battery power). FERRUPS continues to use battery power until frequency drops below this point again.
53	slewrate (sr)	53 SlewRate 100	Service	5-500	The rate at which FERRUPS tracks AC input voltage. Generators or other sources may require higher settings. 25 = about 2 Hz/Sec.
54	phaselock (pl)	54 PhaseLk 500	Service	50-5000	Controls how closely the UPS tracks AC input power while on inverter. Larger values increase the allowable inverter/line phase difference. Generators or other unstable sources may require a higher setting.
55	freqglitchcnt (fgc)	55 FreqGlCnt 3	Service	1-60	The number of cycles that AC input frequency must be outside of the range set by parameters 51 and 52 before FERRUPS switches to inverter (battery power).
56	lineglitchcnt (lgc)	56 LineGlCnt 3	service	1-20	The number of AC input glitches in a row that must happen before FERRUPS switches to inverter (battery power).
57	linedelta (lid)	57 LineDelta 80	service	1-512	This parameter helps FERRUPS determine what qualifies as an AC input glitch.
58	xferdelay (xd)	58 XferDly 1.0s	Service	0.0-999.9	The minimum time (ii seconds) FERRUPS continues to run 00 inverter (battery power) after AC input has retuned to acceptable levels.
59	lowvoutalarm (lvoa)	59 LVOAlrm 108.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which FERRUPS sounds a Low AC Output alarm. See the *User Manual*. This default setting is 90% of the nominal AC output Voltage (parameter 44).
60	lowvoutshutdn (lvos)	60 LVOShdn 102.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The point at which FERRUPS shuts down because of low output voltage. The default setting is 85% of the nominal AC Output Voltage (parameter 44).
61	hivoutalarm (hvoa)	61 HVOAlrm 129.6	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which FERRUPS sounds a High AC Output alarm. (See the *User Manual*.) The default setting is 108% of the nominal AC Output Voltage (parameter 44).
62	hivinalarm (hvia)	62 HVIAlrm 138.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The input voltage at which FERRUPS sounds a High AC Input alarm. (See the User *Manual*.) The default setting is 115% of the nominal AC Input Voltage (parameter 43).

nber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
63	extbrnout (ebo)	63 ExBrOut 1)Yes	User	0)No-1)Yes	This parameter enables or disables extended brownout. If this is set to "Yes," then the Brownout setpoint (28) varies from 62% of nominal AC Volts In at no load to 80% of nominal AC Volts In at full load. If this is set to "No," the Brownout setpoint (parameter 28) stays at 80%. (See parameter 64.)
64	brownoutv (bv)	64 BrnOutV 96.0	Service	50.0-500.0	When parameter 63 is set to 0)No, this parameter determines when there is a brownout condition. When AC input voltage falls below this setpoint, FERRUPS switches to battery power. See parameter 63.
65	lowbattv (lb)	65 LoBatV 10.50	Service	6.00-175.00	The DC voltage at which FERRUPS shuts down because of a low battery condition. FERRUPS remains off until you switch it off and on again. Low Battery Voltage = 10.5 volts per battery. (See parameter 7.)
66	nearlowbattv (nlb)	66 NLBatV 11.00	Service	6.00-175.00	The battery voltage at which FERRUPS sounds a Near Low Battery alarm. (See the *User Manual* and Section 504.) Near Low Battery Voltage = 11 volts per battery. See parameter 7, V Batt.
67	highbattv (hb)	67 HiBatV 14.90	Service	6.00-200.00	The battery voltage at which FERRUPS sounds a High Battery alarm. (See the *User Manual*.) High Battery Voltage = 15 volts per battery. See parameter 7, V Batt.
68	lowruntime (lr)	68 LowRunTm 5m		0-999	When runtime (parameter 9) drops to this point, FERRUPS sounds a Low Runtime alarm. (See the *User Manual* and Section 504.)
69	battamphours (bah)	69 Batt AH 55	Service	5-20000	The amp-how capacity of the FERRUPS' batteries.
70	runtimek (k)	70 RuntimeK 62	Service	1-200	A constant that FERRUPS uses to calculate runtime.
71	testlevel (tl)	71 Test Level 3	User	0-3	This determines which parts of the Automatic System Test FERRUPS does. See the *User Manual* and Section 308-2 for more information. 0 = No Test; 1 = Logic Test; 2 = Logic and Inverter Tests; 3 = Logic, Inverter, and Battery Tests.
72	testint (tei)	72 TestInt 7dy	User	0 (Off)-366	The number of days between Automatic System Tests. (See the *User Manual* and Section 308-2 for more information on the test.)

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
73	testtime (tt)	73 Test@ 1:00:00	User	00:00:00-23:59:59	The time of day (in 24-hour time) when FERRUPS does the Automatic System Test. See Section 308-2.
74	nomilimit (nil)	74 NomILimit 360	Service	10-999	The maximum current FERRUPS can draw from its batteries when it runs on battery power.
75	batttesttime (btt)	75 BT Time 60s	Service	0-999	The number of seconds FERRUPS must run on battery power during the battery test before it compares calculated runtime to the Low Runtime alarm setpoint.
76	pfmtemp (pt)	76 PFM Temp 24c	Change Not Allowed	-63 to 193	The temperature of the Power Factor Module.
77	autorestart (ar)	77 AutoRst 60s	Service	0-9999	When you have shut down FERRUPS using an **off** or **shutdown** command, or when a nonlatching alarm has shut down FERRUPS, this is the minimum number of seconds FERRUPS remains off before it can restart automatically. To disable the automatic restart, set this to 0. (See Section 307-2.)
78	alarmsenable (ae)	78 AlmEnbl 1)Yes	Service	0)No-1)Yes	This parameter enables or disables FERRUPS' ability to sense an alarm.
79	consolemode (cm)	79 Console Mode	User	1-4	This parameter helps make FERRUPS compatible with CheckUPS. (See section 30% 4.) The setting affects parameter 97. 1 = UPS sends inverter/alarm messages. 2 = Suppress inverter/alarm messages. 3 = No echo back of commands. 4 = The "F" string is sent every 15 seconds. (See TIP 503.)
80	ambtempalarm (ata)	80 AT Alarm 60c	Service	0-200	The point at which FERRUPS sounds a High Ambient Temperature alarm. (See the *User Manual* and Section 504.)
81	ambtempshutdn (ats)	81 AT Shdn 70c	Service	0-200	The point at which FERRUPS shuts down because of a High Ambient Temperature.
82	hstempalarm (hta)	82 HT Alarm 95c	Service	0-200	The point at which FERRUPS sounds a High Heatsink Temperature alarm. (See the *User Manual* and Section 504.)
83	hstempshutdn (hts)	83 HT Shdn 105c	Service	0-200	The point at which FERRUPS shuts down because of a High Heatsink Temperature.
84	xtempalarm (xta)	84 XT Alarm 75c	Service	0-200	The point at which FERRUPS sounds a High Transformer Temperature alarm. (See the *User Manual* and Section 504.)

umber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
85	xtempshutdn (xts)	85 XT Shdn 85c	Service	0-200	The point at which FERRUPS shuts down because of a High Transformer Temperature.
86	pfmtempalarm (pta)	86 PF Alarm 80c	Service	0-200	The point at which FERRUPS sounds a High Power Factor Module Temperature alarm. (See the *User Manual* and Section 504.)
87	pfmtempshtdn (pts)	87 PF Shdn 90c	Service	0-200	The point at which FERRUPS shuts down because of a High Power Factor Module Temperature alarm.
88	acvofault (vof)	88 VOutFlt 24.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The point at which FERRUPS shuts down because of output power problems.
89	invrelaydelay (ird)	89 IRlyDly 0s (Reserved in 8.01 software)	Service	0-9999	When FERRUPS starts running on inverter (battery power), this is the number of seconds FERRUPS delays before it activates the inverter relay contacts at the DB25 port.
90	remotebaudrate (rb)	90 Rem Baud 7 [07]: 1200 baud	Service	[0]: 50- [15]: 38400	This parameter sets the baud rate of the logic board's RJ-11 (phone jack) connector. If you have a device connected to the port, changing the baud rate could cause communication problems. Settings: [0]: 50, [I]: 75, [2]: 11 [3]: 135, [4]: 150, [S]: 300. [6] 600, [7]: 1208 [8]: 1800, [9]: 2400, [10]: 3600, [11]: 4800, [12]: 7200, [13]: 9600, [14]: 19200, [IS]: 38400.
91	remotewordfmt (rwf)	91 RemWordFmt 0 [00]: 8N1	service	o-7	This parameter sets the word format of the logic board's RJ-11 (phone jack) connector. Settings are: [0]: 8N1, [1]: 8N2, [2]: 7N1, [3]: 7N2, [4]: 7E1, [5]: 7E2, [6]: 701, and [7]: 702. If you have communication established, changing this may cause communication problems See Section 308-6 for more information.
92	remotehandshake (rh)	92 Rem HndShk 1 S SRx|STx|CTS|RTS	Service	0-IS	This parameter enables or disables hardware and software handshaking of the logic board's RJ-11 (phone jack) connector. Call Best Power Worldwide Service for more information.
93	remotercp (rrcp)	93 Rem RCP 1)Yes	Service	0)No-1)Yes	When this is set to 1)Yes, the control panel's RJ-11 (phone jack) connector is set up to communicate with the logic board. When it is set to 0)No, the RJ-11 connector acts as an RS232 communication port.
94	remotectrl (rc)	94 Rem Ctrl IS Eco|Err|Msg|P=>	Service	0-15	This parameter enables or disables messaging and echoback on the logic board's RJ-11 connector. See Section 308-S for more information.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
95	consolebaudrate (cb)	95 Con Baud 7 [07]: 1200 baud	Service	[0]: 50- [15]: 38400 (See Explanation column.)	This parameter sets the baud rate of FERRUPS' RS232 communication port. If you have a device connected to the RS232 port, changing the baud rate could cause communication problems. Settings: [0]: 50, [1]: 75, [2]: 110, [3]: 135, [4]: 150, [5]: 300, [6]: 600, [7]: 1200, [8]: 1800. [9]: 2400, [IO]: 3600, [1 l]: 4800, [12]: 7200, [13]: 9600, [14]: 19200, [15]: 38400.
96	consolewrdfmt (cw)	96 ConWordFmt 0 [00]: 8N1	Service	o-7	This parameter sets the word format of the RS232 communication port. Settings are: [0]: 8N1, [I]: 8N2, [2]: 7N1, [3]: 7N2, [4]: 7E1, [5]: 7E2, [6]: 701, and [7]: 702. Changing the setting could cause communication problems. See Section 308-6 for more information.
97	consolehandshake (ch)	97 Con HndShk 12 SRx|STx| |	Service	o-15	This parameter enables and disables hard-ware and software handshaking at the RS232 communication port.
98	consolercp (crcp)	98 Con RCP 0)No	Service	0)No-1)Yes	When this is set to 1)Yes, FERRUPS' communication port is set up to communicate with a control panel. When this is set to 0)No, the communication port acts as an RS232 port.
99	consolectrl (cc)	99 Con Ctrl 15 Eco|Err|Msg|P=>	Service	o-15	This parameter enables and disables UPS messaging and echoback of FERRUPS' RS232 communication port (on back panel). See Section 308-S for more information
100	search1 (s1)	100 Search #1	Service	Not Applicable	To enable the UPS to automatically log onto the host system that it is connected to, you can use this parameter to enter the string the host system uses to search for a UPS. When the UPS receives this search string, it will respond with the string you enter in parameter 102. See parameters 101-103.
101	search2 (s2)	101 Search #2	Service	Not Applicable	When the UPS receives this search string, it executes the command you enter in parameter 103.
102	response1 (r1)	102 Response #1	Service	Not Applicable	See parameter 100. When the UPS receives the search string you enter in parameter 100, it responds to your host system with the string you enter for this parameter (102).
103	response2 (r2)	103 Response #2	Service	Not Applicable	See parameter 10 1. When the UPS receives the search string you enter in parameter 101, it executes the command you enter in this parameter (103).

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Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
104	relaymask1 (rm1)	104 RMask1 65535 PONMLKJIHGFEDC BA	Service	O-65535	This parameter determines which of alarms A-P activates the alarm relay contact at FERRUPS' RS232 port (on the back panel). (See TIP 503 to program this parameter.)
105	relaymask2 (rm2)	105 RMask2 65535 543210ZYXWVUTS RQ	Service	O-65535	This parameter determines which of alarms Q-T activates the alarm relay contact at FERRUPS' RS232 port (on the back panel). (See TIP 503 to program this parameter.)
106	epomode (em)	106 EPO Mode 0	service	0-16	This parameter selects the Remote Emergency Shut Down [Remote Emergency Power Off] Mode. (See TIP 503 for more information.)
107	epodebounce (edb)	107 EPODbc 0.3s	Service	0.0-999.9	The length of Remote Emergency Shut Down [Remote Emergency Power Off] signal that FERRUPS requires. (See TIP 503 for more information.)
108	epodelay (edl)	108 EPODly 0.1s	Service	0.0-999.9	The amount of time FERRUPS delays a Remote Emergency Shut Down [Remote Emergency Power Off] shutdown after it receives the signal. (See TIP 503.)
109	pabase (pab)	109 PABase 3560	(Factory	O-20000	This parameter affects FERRUPS transfers.
110	cfacvin (cfvin)	110 CFACVIN 1191	Factory	0-32767 (In 8.01 software, 0-3000)	The calibration factor numerator for AC input voltage. Changing parameter 1 (V In) affects this parameter.
111	cfacvid (cvid)	111 CFACVID 521	Factory	1-1023	The calibration factor denominator for AC input voltage. Changing parameter 1 (V In) affects this parameter.
112	cfacvon (cvon)	112 CFACVON 1191	Factory	O-32767 (In 8.01 software, O-3000)	The calibration factor numerator for AC output voltage. Changing parameter 2 (V Out) affects this parameter.
113	cfacvod (cvod)	113 CFACVOD 608	Factory	1-1023	The calibration factor denominator for AC output voltage. Changing parameter 2 (V Out) affects this parameter.
114	cfacaon (caon)	114 CFACAON 62	Factory	0-32767 (In 8.01 software, 0-2200)	The calibration factor numerator for AC output current. Changing parameter 4 (I Out) affects this parameter.
115	cfacaod (caod)	115 CFACAOD 317	Factory	1-1023	The calibration factor denominator for AC output current. Changing parameter 4 (I Out) affects this parameter.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
116	cfdcvn (cdvn)	116 CFDCVN 1326	Factory	0-32767 (In 8.01 software, 0-17500)	The calibration factor numerator for DC voltage. Changing parameter 7 (V Batt) affects this parameter.
117	cfdcvd (cdvd)	117 CFDCVD 779	Factory	1-1023	The calibration factor denominator for DC voltage. Changing parameter 7 (V Batt) affects this parameter.
118	cfdcan (cdan)	118 CFDCAN 795	Factory	0-32767 (In 8.01 software, 0-2000)	The calibration factor numerator for DC current. Changing parameter 6 (I Batt) affects this parameter.
119	cfdcad (cdad)	119 CFDCAD 185	Factory	1-1023	The calibration factor denominator for DC current. Changing parameter 6 (I Batt) affects this parameter.
120 8.01-8.05 software)	softwver (sv)	120 SW Ver 8.02	Factory	00.00-99.99	The FERRUPS software version for units with 8.01-8.05 software versions. See parameter 137 for higher software versions.
(8.06 and higher software)	cfchgn (ccn)	120 CFCHGN 1000	Factory	0-32767	The calibration factor denominator for DC current when the battery charger is on.
121 8.01-8.05 software)	nvchecksum (c)	121 Chksum 1CF8h	Factory	0000h-FFFFh	Nonvolatile RAM Checksum for units with 8.01-8.05 software versions. See parameter 138 for higher software versions.
(8.06 and higher software)	cfchgd (ccd)	121 CFCHGD 1023	Factory	1-1023	The calibration *factor* denominator *for DC* amps (charging current) when the battery charger is on.
122 8.01-8.05 software)	romchecksum (KS)	122 ROMChk 41B7h	Factory	0000h-FFFFh	EPROM Checksum for units with 8.01-8.05 software versions. See parameter 139 for higher software versions.
(8.06 and higher software)	chargertype (ct)	122 Chgr Type 0	Service	0-3	This parameter displays the type of charger installed on your FERRUPS unit: 0=Hardware float charger 1 =Software-controlled float charger 2=Software-controlled hysteresis charger 3=Disabled; independent external charger **CAUTION! If the charger type is set incorrectly, the charger may be damaged.**
123 (8.06 and higher software)	maxchargeamp	123 MaxChgA 20.0	Factory	1.0-99.9	If parameter 122 is set to "1" or "2," parameter 123 is the continuous rated charger current. The average charger current cannot exceed this value. If parameter 122 is set to "0," parameter 123 is not effective.

lumber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
124 (8.06 and higher software)	lowchargerv (lcv)	124 LoCV 13.00	service	0.0-200.0	When parameter 122 is set to "2," this parameter is the low charging voltage setpoint. The charger is started when DC volts fall below this value.
125 (8.06 and higher software)	floatchargerv (fcv)	125 FltCV 13.60	Service	0.0-200.0	When parameter 122 is set to "1," this parameter is the float charger voltage level. The FERRUPS maintains the battery voltage at this level if possible.
126 (8.06 and higher software)	highchargerv (hcv)	126 HiCV 14.40	Service	0.0-200.0	When parameter 122 is set to "2," this parameter is the high charging voltage setpoint. The charger is turned off when DC volts rise above this value.
127 (8.06 and higher software)	equalizechargerv (ecv)	127 EqlCV 12.60	Service	0.0-200.0	When parameter 122 is set to "2" or "3," this parameter is the equalize charging voltage setpoint. When battery voltage is below this point, the charger equalizes the batteries.
128 (8.06 and higher software)	chargerondelay (cod)	128 ChOnDly 240s	Change Not Allowed	2-9999	The amount of time (in seconds) that the FERRUPS delays before starting the charger after startup or after an inverter run.
129 (8.06 and higher software)	lowacdelay (lacd)	129 LoACDly	Factory	1-255	Once the FERRUPS senses a low AC output, this parameter determines the number of seconds the unit waits before causing a Low AC Output alarm shutdown.
130 (8.06 and higher software)	Reserved	130 --Reserved--	-		—
131 (8.06 and higher software)	Reserved	131 --Reserved--	—	—	—
132 (8.06 and higher software)	Reserved	132 --Reserved--	-		—
133 (8.06 and higher software)	Reserved	133 --Reserved--			—
134 (8.06 and higher software)	Reserved	134 --Reserved--	-	—	

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
135 (8.06 and higher software)	Reserved	135 --Reserved--	-	—	—
136 (8.06 and higher software)	Reserved	136 --Reserved--	-	—	—
137 (8.06 and higher software)	softwver (sv)	137 SW Ver 8.07	Change Not Allowed	00.00-99.99	The FERRUPS software version for units with 8.06 and higher versions. See parameter 120 for earlier software versions.
138 (8.06 and higher software)	nvchecksum (c)	138 Chksum 1CF8h	Change Not Allowed	0000h-FFFFh	Nonvolatile RAM Checksum for units with 8.06 and higher software versions. See parameter 12 1 for earlier software versions.
139 (8.06 and higher software)	romchecksum (rcs)	139 ROMChk 41B7h	Change Not Allowed	0000h-FFFFh	EPROM Checksum for units with 8.06 and higher software versions. See parameter 122 for earlier software versions.

308-l Logs (Parameters 24 and 25)

Inverter Log (Parameter 24):

Tbe inverter log records the last 20 times the inverter has run; this record includes the reason the inverter ran, the date it started running, the time it started, and the length of time it ran. You CM use a **clearlogs (cl)** command to clear the inverter and alarm logs; these logs are also cleared when there is a Memory Check alarm. When you display parameter 24 on a FERRUPS control panel or a terminal, each log entry should look something like this:

L 0205 1415 0015

L = Reason for inverter run. (Line loss; see the table of inverter codes on the next page,) An asterisk (*) after the letter means the inverter is still running.
0205 = Date the inverter started running (February 5).
1415 = Time the inverter started running (2: 15 p.m.).
00 15 = Length of time the inverter ran (0 hours and 15 minutes).

Tbe letter code in the beginning of the log entry shows why the inverter ran. This code may be a T, B, L, M, F, or R. The table on the next page shows what each code means.

Code	Reason for Inverter Run	
T	System Test. FERRUPS tested batteries as part of the system test. (See the *User Manual* and Section 308-2.)	
B	***Brownout.***	AC line (input) voltage was too low.
L	***Line Loss.***	AC line (input) power was lost. This is FERRUPS' normal response to line loss when it is in the Auto mode.
M	*Manual.*	The UPS was manually put in Inverter On mode by a [CONTROL][4] at a control panel or an **sm i** command from a terminal.
F	***Frequency.***	AC line frequency is outside of tolerance set by FERRUF'S' parameters.
R	DC Reset.	The DC breaker was turned off and then on again.

On a terminal, you can also display the **inverter log using the inverterlog (il) or logs (I)** command. The terminal displays the log entries in this format:

Active	EventDate	EventTime	Duration	Code/Event
No	08/25/1993	11:25:32	00:00:45	M-Manual turnon
No	08/24/1993	12:13:18	00:01:08	L-Line fault

Alarm Log (Parameter 25)

The alarm log records the 20 most recent FERRUPS alarms; this record includes the alarm letter, the date the alarm started, the time, and the length of the alarm. You can clear this log and the inverter log using the clearlogs (cl) command; a Memory Check alarm also clears the log. When you display parameter 25 on the control panel or a terminal, each entry is similar to this:

B 0205 1017 0005

B = Alarm letter. See the table below.
0205 = Date alarm started (February 5).
1017 = Time alarm started (10:17 a.m.).
0005 = Length of alarm (0 hours, 5 minutes).

Reason for Alarm:								
A	• —	Low Battery	H	• • • •	High Ambient Temp	O	— — —	Memory Check
B	— • • •	Near Low Battery	I	• •	High Heatsink Temp	P	• — — •	Emergency Power Off
C	— • — •	High Battery	J	• — — —	User Test Alarm	Q	— — • —	High PFM Temp
D	— • •	Low Runtime Left	K	— • —	High Transformer Temp	R	• — •	Probe Missing
E	•	Low AC Output	L	•— • •	Check Charger	S	• • •	High AC Input
F	• • — •	High AC Output	M	— —	Check Battery	T	—	Call Service
G	— — •	Output Overload	N	— •	Check Inverter			

On a terminal, you can also display the alarm log using the **alarmlog** (al) or logs (I) command. The terminal displays the log entries in this format:

Active	EventDate	EventTime	Duration	Code/Event
No	0812511993	11:25:32	00:00:45	J-User Test Alarm
No	08/24/1993	12:13:18	00:01:08	A-Low Battery
No	08/24/1993	12:05:07	00:08:11	B-Near Low Battery

308-2 Test Results (Parameter 26)

This parameter records the results of the last system test. (See the User Manual.) The system test is done automatically every seven (7) days (or the interval you set in parameter 72). You can also start a system test manually by **using the systemtest (stst)** command.

The system test tests the FERRUPS' logic first, then the inverter, and then the batteries. (Parameter 71 controls which parts of tbe test the FERRUPS does.) If the FERRUPS fails any part of the test, it does not do the next part of the test. The following paragraphs provide more information on each part of the test.

Logic Test: This test makes sore the memory and the central processing unit are operating correctly. To do this, the FERRUPS computes the additive checksum of the ROM and the nonvolatile battery-backed section of RAM; then, it compares the values to parameters 121 and 122. If the values do not match the parameter values, the FERRUPS fails the logic test, cancels the inverter and battery tests, and starts a Memory Check alarm.

Inverter **Test:** This test makes sure both inverter gates draw the correct current. To do this, the FERRUPS fires the left gate and then the right gate and monitors the peak current draw from the batteries. The FERRUPS then compares the current peaks to I/2 of parameter 74 (NomILimit). If either gate draws less than 1/2 NomILimit, the FERRUPS fails the inverter test, cancels the battery test, and starts a Check Inverter alarm,

Battery **Test:** This test makes sore the batteries can supply enough power to run the load longer than the number of minutes set in parameter 68 (LowRuntime). To do this, the FERRUPS runs the UPS on inverter for the number of seconds specified in parameter 75; it then compares the estimated runtime shown in parameter 9 to the LowRuntime setpoint in parameter 68. If parameter 9 is less than parameter 68, the FERRUPS fails the battery test and starts a Check Battery alarm.

Parameter 26 displays the time and date of the test and the results of each part of the test. For example, the display might look like this:

26 Test Results	
14:34 05/23/93	(24-hour time and date of last test)
Logic: PASSED	(Results of logic test)
RA=FA41 RO=13D6	(ROM/nonvolatile RAM checksums)
Inverter: PASSED	(Results of inverter test)
Gate L=341/R=345	(Left/right inverter gate peak current draw)
Battery: FAILED	(Results of battery test)
RT=--2/DC=12.76	(Runtime/DC voltage at end of battery test)

For each part of the test, the display shows "PASSED, " "FAILED," or "NotDone." Parameter 7 1 controls which parts of the test are done, Parameter 72 controls how often the automatic system test is done, parameter 73 controls the time of day.

The teat cannot run if the battery voltage is below 12.8 volts per battery (12-volt batteries) or below 6.4 volts per battery (6-volt batteries).

308-3 Model Index (Parameter 41)

This is a factory-set parameter that establishes initial parameters for the software, depending on the unit size. Examples are:

Model Number	Unit Size
1	500 VA
2	700 VA
3	850 VA
4	1.15 KVA
5	1.4 KVA

This parameter always defaults to a 9 (4.3 KVA) when a NOVRAM rewrite is performed.

308-4 Console Mode (Parameter 79)

This parameter helps make the FERRUPS compatible with CheckUPS software. The settings are:

1 (Norm): UPS automatically sends inverter/alarm messages through the RS232 **port.**
2 (NoAM): Inverter/alarm messages are suppressed.
3 (NoEB): No echo back of commands.
4 (SndF): The F string is sent automatically every 15 seconds. This is used mainly by customers who would like to log the command status sting.

Note: The setting of this parameter affects parameter 97.

308-5 Remote Control and Console Control (Parameters 94 and 99)

Both parameters enable or disable messaging and echo back. Parameter 94 is for the RJ- 11 (Remote) connector on the FERRUPS logic board, this connector can be used for RS232 communication. Parameter 99 is for the RS232 (Console) port on the back of the FERRUPS.

The default setting for each parameter is "15." You should also see another display that shows "Eco|Err|Msg|P=>"; this means that all four (4) features (Eco, Err, Msg, and **P=>) are** on.

Eco: Echo back. When this feature is on, FERRUPS echos back characters that you type at a control panel, terminal, or computer connected to the port. This means the characters are displayed on your control panel or terminal or computer screen. When this feature is off, you cannot see the characters on the screen.

Err: Error messages. When this feature is on, FERRUPS can send error messages to your control panel, terminal, or computer when it does not recognize the command you entered. When this feature is off, FERRUPS cannot send the error messages.

Msg: Messaging. When this feature is on, FERRUPS can send unsolicited messages to a control panel, terminal, or computer whenever 1) the inverter turns on or off or 2) there is an alarm.

P=>: Prompt. When this feature is on, you can see the => prompt on a computer screen, which tells you that you have established communication with the FERRUPS. When this feature is off, you cannot see the prompt. (On a control panel, you can see the prompt when you are not in the remote ["123dcp"] mode.)

For the parameter setting, Eco = 8, Err = 4, Msg = 2, and P=> = 1. To change the setting, add the values for each feature you want on. Use the total as your new parameter setting.

308-6 Remote Word Format and Console Word Format (Parameters 91 and 96)

Parameters 9 1 and 96 set the word format at the FERRUPS ports. 9 1 is for the RJ- 11 (Remote) connector on the logic board; 96 is for the RS232 (Console) port on the back of the UPS.

The default setting for this parameter is "0;" you should also see another display that shows "[00]: 8N1."

The first number in this display (8 in the default setting) designates the number of data bits; this can be 7 or 8. The letter (N in the default setting) shows the parity; this can be None (N), Even (E), or Odd (0). The last number (1 in the default setting) shows the number of stop bits; this can be 1 or 2.

These settings are available:

[0]: 8N1	[3]: 7N2	[6]: 701
[1]: 8N2	[4]: 7E1	[7]: 702
[2]: 7N1	[5]: 7E2	

308-7 Remote Emergency Shut Down [Emergency Power Off] (Parameters 106,107, and 108)

Computer rooms often have an emergency shutdown switch; this switch shuts off the power that runs the equipment in the computer room. If FERRUPS is connected to the switch the switch shuts off the input power to the UPS; however, FERRUPS continues to provide output power to the equipment it protects until its batteries run down. To make sure your emergency shutdown switch can shut off FERRUPS' output power, you can use FERRUPS' Remote Emergency Shut Down [Emergency Power Off] feature.

The computer room's emergency shutdown switch has a set of contacts that apply to FERRUPS' +12 VDC on pin 6 to FERRUPS' pin 21. (Or pin 18 instead of pin 6; **pin 14 must never be used.)** Use a shielded, single twisted pair cable to connect the switch to FERRUPS' pins. A connection between pins 6 and 21 (or 18 and 21) shuts down FERRUPS' output power to the protected equipment. When FERRUPS' Remote Emergency Shut Down [Emergency Power Off] feature is activated, FERRUPS is in the Off Mode, and the Emergency Shut Down [Emergency Power On] Alarm sounds. A control panel or a terminal connected to the FERRUPS displays "Emergency PwrOff." To restart the UPS, break the connection between pins 6 and 21 (or between pins 18 and 21) at FERRUPS' RS232 port. Then, follow the steps in the Startup section for your model (202 or 203). Note that the 12-volt level on pin 6 or pin 18 is only available when FERRUPS is operating.

You can change the type of Emergency Shut Down [Emergency Power Off] signal that FERRUPS responds to and how quickly FERRUPS responds. You can also set up FERRUPS to restart automatically when the Emergency Shut Down [Emergency Power Off] signal stops. See TIP 503 or call Best Power Worldwide Service for more information.

SECTION 400

SECTION 400

CAUTION! Only a qualified technician should service this equipment.

For years of built-in FERRUPS reliability, you must follow proper maintenance procedures. Scheduled maintenance is the only way to ensure continued reliability. Unscheduled maintenance procedures may be necessary when batteries, parts, or components must be replaced.

401 Scheduled Maintenance

A qualified technician should perform scheduled maintenance *at least* once a year to make sure the FERRUPS operates properly. You can fmd the scheduled maintenance procedure in TIPs 604 and 605 in Section 700. TIP 604 provides written step-by-step instructions for scheduled maintenance. TIP 605 asks you important questions about the system and provides blanks so you can record the answers.

TIPs 604 and 605 include an outage and load test to make sure the FERRUPS can provide power to the loads during a power outage. This test also helps tbe technician identify batteries that may need replacing.

Scheduled maintenance expands on the automatic system test that FERRUPS performs once a month. (See Section 308-2.) FERRUPS automatically tests the memory and central processing unit, the **inverter,** and the **battery,** and if there may be a problem, the FERRUPS generates an alarm.

402 Cover Removal and Replacement

Tools and Material Required: Phillips Screwdriver

Removal:

1. **Remove the # 1** Phillips screw on the top of the UPS.
2. Next, find the sticker in the lower right corner of the **front panel** with the BEST logo. Remove and save the sticker and loosen the screw behind the sticker by turning it counter-clockwise for several turns.
3. Slide the cover forward until it is completely off the UPS.

Replacement:

1. Slide the outer shell on the unit using the rails on each side of the unit. Tighten the screw in the lower right comer of the front panel and put the sticker you removed over the top of it.
2. Reinstall the # 1 Phillips screw at the top center rear of the unit.

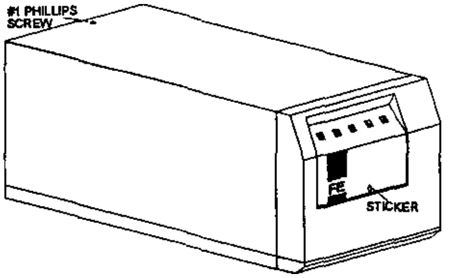


Figure 1 500-850 VA

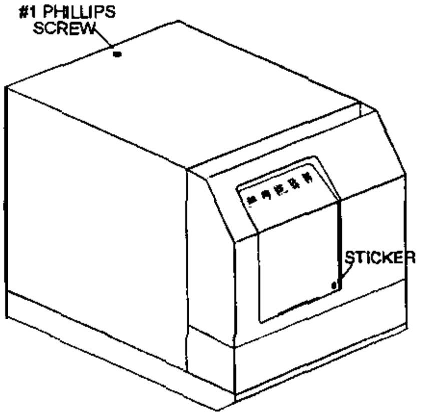


Figure 2 1 .15 and 1.4 KVA

403 Inspecting and Cleaning the Unit

Periodic inspections and cleaning of the unit is strongly recommended for the most efficient operation of your UPS and for longer service life.

1. Shut down the UPS. Remove AC and DC power.

2. Inspect the UPS for cracked, frayed, burnt, or damaged components. Replace any components that are in poor condition.

3. Carefully clean dirt and dust that has built up in the unit

404 System Calibration Using a Control Panel

Any parts you receive for the repair or upgrade of your unit are calibrated before they are shipped However, after replacing a board, you should check to make sure the calibrations are correct. You must also check the parameters for the unit's serial number, model size, and battery amp-hour. For calibration you need a true RMS digital multimeter and a clamp-on AC current probe. We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-4 10 AC/DC current probe or their equivalents. If you do not have these probes or their equivalents, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office.

To perform the calibration commands in this section, you need a hand held Remote Control Panel. Go to Section 404 if you are using a terminal or a computer connected to the FERRUPS RS232 port. Refer to TIP 407 (Remote Control Panel Options) or TIP 503 (The FE Series RS232 Communication Port) in Section 700. If you have any questions or problems during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office.

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms, or shut down, for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

I. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I)

2. Connect the Remote Control Panel to the RS232 port on the back of the FERRUPS. You will use the Remote Control Panel to enter commands and parameter changes in the following steps.

3. Enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

4. Apply the load to the UPS. Make sore the load is more than 50% of full load

5. First, check the serial number programmed into the software. To do this, display parameter 40 (Serial Number) by pressing [DISPLAY] [4] [0] [ENTER]. Compare the display to the serial number on your unit's ID label (on the right side of the unit when you face the front). If the parameter 40 display is correct, go on to step 405. If it is not correct, follow these steps to enter the correct serial number:

   a. Press [CLEAR] to return to the normal display.

b. Before you can enter the new serial number, you most enter the Factory password. To do this, press [PROGRAM] [I] [8] [4] [7] [3] [ENTER].

c. Now, display parameter 40 again by pressing [DISPLAY] [4] [0] [ENTER].

d. Press [PROGRAM]

e. Since the serial number includes letters as well as numbers, you must go into the message editor to enter the new serial number. To do this, press [DISPLAY] and [PROGRAM] **at the same time. The display** shows "Message Editor," then a period.

f. Enter the correct serial number:

Whenever you need to type a letter, press [.] and **[3] together; then,** press [DISPLAY] to scroll through the. alphabet until you reach the letter you need. Once you reach the correct letter, press [PROGRAM] to go to the next character.

Whenever you need to type a number, press [.] and **[2] together; then,** press [DISPLAY] to scroll through the numbers until you reach the one you need. Once you reach the correct number, press [PROGRAM] to go to the next character.

When you have entered the complete serial number, press [ENTER]. The new serial number will scroll across the display. Press [ENTER] again to go back to the parameter display.

Table 1: Using the Message Editor

To do this in the message editor...	. ..do this.
Enter the message editor.	Press [DISPLAY] and [PROGRAM] **together.**
Type a letter.	Press [.] and [3] **together,** then press [DISPLAY] until you reach the correct letter.
Type a number.	Press [.] and [2] **together,** then press [DISPLAY] until you reach the correct number.
Save a character and go to the next character.	Press [PROGRAM].
Save the serial number and exit the message editor.	Press [ENTER], check the scrolling display, and press ENTER] again.
Reverse letters or numbers.	Press [CONTROL].

6. Next, you most set the unit's model size. To do this, display parameter 41 (Model Index). Compare the display to the model number shown on your unit's ID label. If the display shows the correct model number, go on to step 406. If **not,** press [PROGRAM], enter the setting for your model's size, and press [ENTER]:

1 = FE500VA 2 = FE700VA 3 = FE850VA 4 = FE1.15KVA 5=FE1.4KVA

The prefix for the SO Hz models is "QFF' in the model index.

7. Now, you must enter the amp-hour rating for **your** unit's batteries. To determine the amp-hour rating, look for a battery part number **(BAT-*XXXX*)** on a label on your batteries and use Table 2 to determine the amp-hour rating. If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do **not have** a part number, call Best Power Worldwide Service at 1-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your nearest Best Power office for more information.

   Now, display parameter 69 (Batt AH). If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 407. If **not,** press [PROGRAM], enter the correct amp-hour rating, and press [ENTER].

Table 2: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0053	31AH
BAT-0046	75 AH	BAT-0058	17AH
BAT-0047	75 AH	BAT-0065	33AH
BAT-0048	100 AH	BAT-0071	26AH
BAT-0049	100 AH	BAT-0103	75AH
BAT-0050	2ooAH	BAT-0122	100 AH
BAT-0051	200 AH		

8. Display parameter 122 by pressing [DISPLAY] [1] [2] [2] [ENTER] to display the charger type used on the FERRUPS unit. The display should read "0." If your unit does not display the proper charger, change the setting to the correct charger by pressing [PROGRAM] [0] [ENTER].

CAUTION! **Failure to select the proper charger setting for your unit's power board listed above** can cause an incorrect **operation of the charger and possible system damage.**

9. Measure the input AC voltage

For linecord units, measure AC input voltage between backfeed relay terminals 2 and 8. (See Figure 4.)

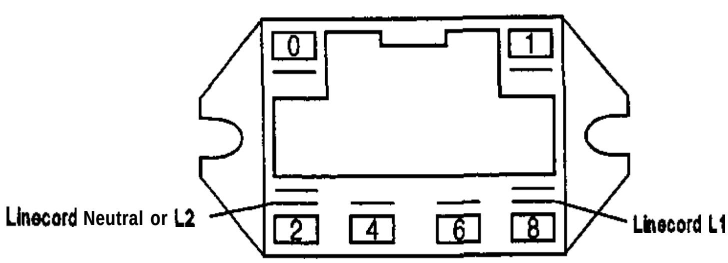


Figure 4

For hardwired units, find the terminal block inside the unit. Measure the input AC voltage at the terminal block with the digital multimeter.

For 1.15 and 1.4 KVA models with 208 or 240 VAC, measure at "L2in" and "Llin" of the input terminal. (See Figure 5 on the next page.)

For all other models, measure at "Nin" and "Lin" of the input terminal. (See Figure 6.)

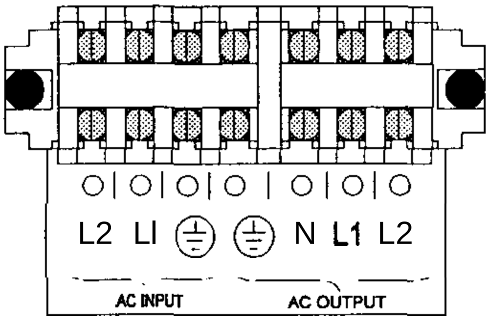


Figure 5

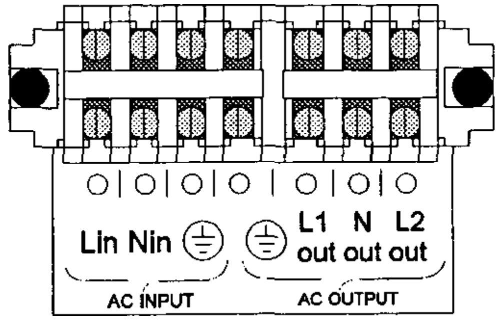


Figure 6

Table 3: Terminal Points to Measure AC In

Nominal INPUT Voltage	Measure INPUT Voltage between these Terminals:
120 VAC	L2 IN to L1 IN
208 VAC	L2 IN to L1 IN
240 VAC (60 Hz)	L2 IN to L1 IN
220 VAC (50 Hz)	N in to L in
230 VAC (SO Hz)	N in to L in
240 VAC (SO Hz)	N in to L in

10. Display parameter 1 (V In) on the control panel by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value by pressing [PROGRAM], entering your voltage measurement, and pressing [ENTER].

11. Display parameter 44 (NomVOut) by pressing [DISPLAY] [4] [4] [ENTER] to check the nominal output voltage. The nominal output voltage determines where you will measure output voltage in step 12.

Note: In 60 Hz units, the default output voltage is 120 VAC even if you are using 208 or 240 VAC output. Parameter 2 monitors the 120 VAC output.

12. Witb the digital multimeter, measure the output AC voltage.

For linecord units, measure at the output receptacle on the back of the unit.

For hardwired units, measure at the AC output terminal block points for the nominal output voltage. (See Figures 7 and 8 and Table 4 on the next page.)

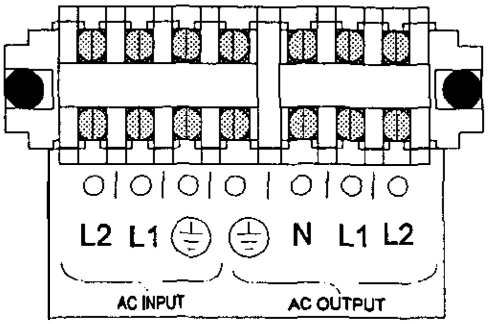


Figure 7

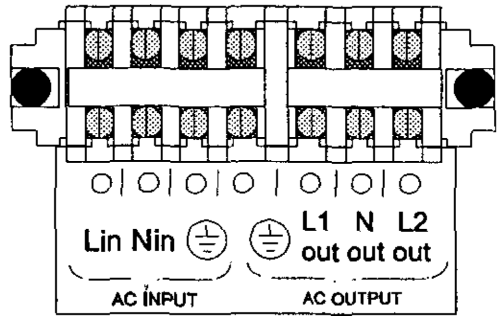


Figure 8

Table 4 Terminal Block Points to Measure Output Voltage

Nominal OUTPUT Voltage		Measure OUTPUT Voltage between terminals:
60 *Hz*	120VAC	N_{OUT} to L_{OUT} or $L2_{OUT}$
	208VAC	L_{OUT} to $L1_{OUT}$
	240VAC	L_{OUT} to $L2_{OUT}$
50 Hz	220VAC	L_{OUT} to N_{OUT}
	230VAC	L_{OUT} to $N2_{OUT}$
	240VAC	L_{OUT} to $N3_{OUT}$

13. Display parameter 2 (V Out) by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value by pressing [PROGRAM], entering your voltage measurement, and pressing [ENTER]. Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you displayed in parameter 44.

14. Next, calibrate output current. Display parameter 4 (I Out) by pressing [DISPLAY] [4] [ENTER]. Then, measure the output current at the wires that run out of "L1out" on the output terminal with the amp meter. If the display does not match your measurement, change parameter 4 by pressing [PROGRAM], entering your AC output current measurement, and pressing [ENTER].

15. The next two (2) measurements must be done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

16. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by pressing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by pressing [PROGRAM], entering your DC voltage measurement, and pressing [ENTER].

17. To measure DC current, you must use a Fluke 80i-410 DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service at 1-800-356-5737. Set the meter for DC mV, attach the Fluke 80i-410 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current should equal one (1) amp per DC mV measured.

18. Display parameter 6 (I Batt) by pressing [DISPLAY] [6] [ENTER]. Using the clamp-on AC/DC probe, set the digital multimeter for DC mV. Measure at the positive (+) battery cable with the probe The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 9.) If the result is different from the value displayed for parameter 6, change the value of parameter 6 by pressing [PROGRAM], entering your measured value, and pressing [ENTER].

19. Clear the Service Password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

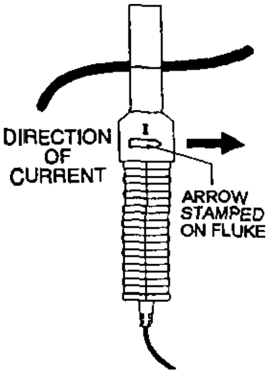


Figure 9

405 System Calibration Using a Terminal or Computer

Any parts you receive for the repair or upgrade of your unit are calibrated before they are shipped. However, after replacing a board, you should check to make sore the calibrations are correct. You most also check the parameters for the unit's serial number, model size, and battery amp-hour. For calibration you need a true RMS digital multimeter and a clamp-on AC current probe. We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-410 AC current probe or their equivalents. If you do not have these probes or their equivalents, call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only) or I-608-565-2100, or call your nearest Best Power office.

This procedure is for calibrating the FERRUPS using a VT-100 style terminal or a computer running terminal emulation software connected to the FERRUPS RS232 port. Refer to TIP 407 (Remote Control Panel Options) or TIP 503 (The FE Series RS232 Communication Port) in Section 700. If you have any questions or problems during this procedure, call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office.

a

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could caose alarms, or shut down, for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

In this procedure, you may need to change parameters. To make sure you are able to enter commands, clear the screen now by pressing the <ENTER> key until the => prompt appears. Then, go on to the steps below; if you need to change parameters, the steps tell you what commands to enter. For more information on communication, see TIP 503 in Section 700.

1. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I).

2. Connect your terminal or computer to the RS232 port on the back of the FERRUPS. You will use the terminal or computer to enter commands and parameter changes in the following steps.

3. Enter the Service password by typing pw 2639 and pressing <ENTER>. The prompt should change to "Service=>" to let you know you have entered the password.

4. Apply the load to the UPS. Make sure the load is 50% or more of the UPS' KW rating.

5. First, check the serial number programmed into the software. To do this, display parameter 40 (Serial Number) by **typing d 40 and** pressing <ENTER>. Compare the display to the serial number on your unit's ID label (on the right side of the unit when you face the front). If the parameter 40 display is correct, go on to step 405. If it is not correct, enter the correct serial number by typing **pr** at the "Service+" prompt and pressing <ENTER>. The screen then shows a "=>" prompt. You must enter the Factory password to change the serial number. At the "=>" prompt, type **pw** 18472 and pressing <ENTER>. Type **pr** at the "Factory=>" prompt and press <ENTER>. A "=>" prompt should appear for the new value. Type in the correct serial number and press <ENTER>.

6. Next, you must set the unit's model size. To do this, display parameter 41 (Model Index) by typing **d 41 and** pressing <ENTER>. Compare the display to the model number shown on your unit's ID label. If the display shows the correct model number, go on to step 406. If **not, type pr** at the "Service=>" prompt, enter the setting for your model's size at the "=>" prompt, and press <ENTER>:

   1 = FE500VA   2 = FE700VA   3 = FE850VA   4 = FE1.15KVA   5 = FE1.4KVA

   The prefix for the 50 Hz models is "QFE" in the model index

7. Now, you must enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 5 to determine the amp-hour rating. If you have more than one (1) string of batteries, add the amp-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service at 1-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your nearest Best Power office for more information.

   Now, display parameter 69 (Batt AH) by typing **d** 69 and pressing <ENTER>. If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 407. If not, type **pr** at the "Service=>" prompt, enter the correct amp-hour rating at the "=>" prompt, and press <ENTER>.

Table 5: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55AH	BAT-0053	31 AH
BAT-0046	75 AH	BAT-0058	17 AH
BAT-0047	75 AH	BAT-0065	33 AH
BAT-0048	100 AH	BAT-0071	26 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH
BAT-0051	200 AH		

8. Display parameter 122 by typing **d 122** and pressing <ENTER> to display the charger type used on the FERRUPS unit. The parameter should be set to "0.". If your unit does not display "0," type **pr** at the "Service=>" prompt, enter "0," and press <ENTER>.

CAUTION! **Failure to select the proper charger setting for your unit's power board listed above can cause an incorrect operation of the charger and possible system damage.**

9. Measure the input AC voltage.

For linecord units, measure AC input voltage **between backfeed** relay terminals 2 and 8. (See Figure 10.)

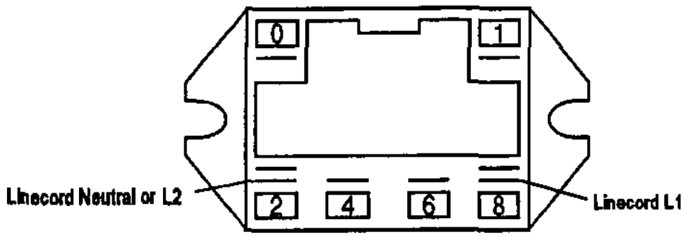


Figure 10

For hardwired units, find the terminal block inside the **unit**. Measure the input AC voltage at the terminal block with the digital **multimeter.**

For 1.15 and 1.4 KVA models with 208 or 240 VAC, measure at **"L2in"** and **"L1in"** of the input terminal. (See Figure **11.)**

For **all** other models, **measure** at **"Nin"** and "Lid' of the input terminal. (See Figure 12.)

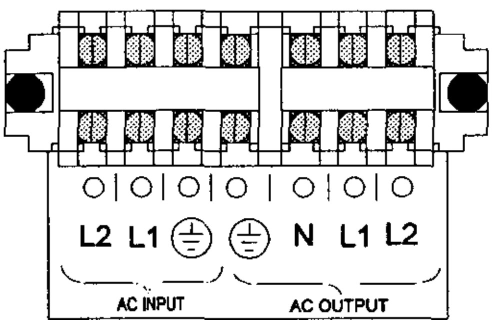


Figure 11

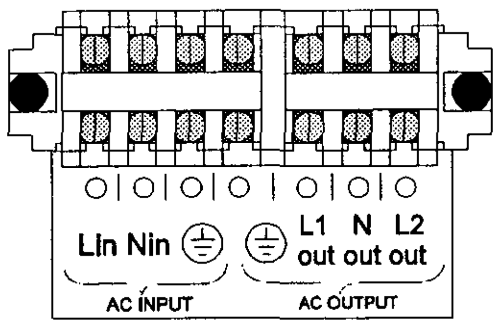


Figure 12

Table 6: Terminal Points to Measure AC In

Nominal INPUT Voltage	Measure INPUT Voltage between these Terminals:
120 VAC	L2 IN to L1 IN
208 VAC	L2 IN to L1 IN
240 VAC (60 Hz)	L2 IN to L1 IN
220 VAC (50 Hz)	N in to L in
230 VAC (50 Hz)	N in to L in
240 VAC (50 Hz)	N in to L in

10. Display parameter 1 **(V In)** on the. control panel by typing **d 1** and pressing <ENTER>. If your **measurement** does not **match the value** displayed for parameter 1, change the **parameter** value by typing **pr** at the "Service=>" **prompt,** entering **your** voltage measurement at the **"=>"** prompt, and pressing <ENTER>.

11. Display parameter 44 (NomVOut) by typing **d** 44 and pressing <ENTER> to check the nominal output voltage. The nominal output voltage determines where you will measure output voltage in step 12.

Note: In 60 Hz units, the default output voltage is 120 VAC **even** if you are using 208 or 240 VAC output. **Parameter** 2 monitors the 120 VAC output.

12. With the digital **multimeter,** measure the output AC voltage

For linecord units, measure at the output **receptacle** on the back of the unit.

For hardwired units, measure at the AC output terminal block points for the nominal output voltage. (See Figures 13 and 14 and Table 7 below.)

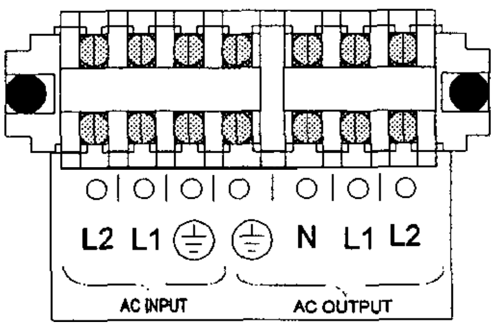


Figure 13

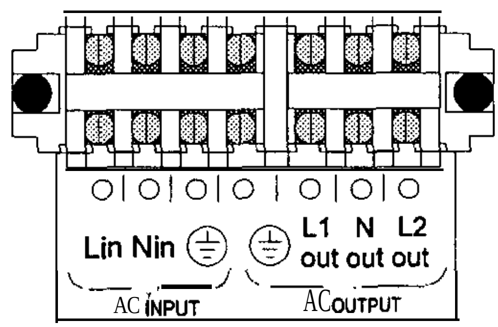


Figure 14

Table 7: Terminal Block Points to Measure Output Voltage

Nominal OUTPUT Voltage		**Measure OUTPUT Voltage between terminals:**
60 *Hz*	120VAC	N_{OUT} to L_{OUT} or $L2_{OUT}$
	208VAC	L_{OUT} to $L1_{OUT}$
	240VAC	L_{OUT} to $L2_{OUT}$
50 Hz	220VAC	L_{OUT} to N_{OUT}
	230VAC	L_{OUT} to $N2_{OUT}$
	240VAC	L_{OUT} to $N3_{OUT}$

13. Display parameter 2 (V Out) by typing d 2 and pressing <ENTER>. If your measurement does not match the value displayed for parameter 2, change the parameter value by typing **pr** at the "Service=>" prompt, entering your voltage measurement at the "=>" prompt, and pressing <ENTER>. **Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you displayed in parameter 44.**

14. Next, calibrate output current. Display parameter 4 (I Out) by typing **d** 4 and pressing <ENTER>. Then, measure the output current at the wires that run out of "L1out" on the output terminal with the amp meter. If the display does not match your measurement, change parameter 4 by typing pr at the "Service=>" prompt, entering your AC output current measurement at the "=>" prompt, and pressing <ENTER>.

15. **The next two (2)** measurements must be done while the UPS is running on **inverter.** Remove AC input power and let the **unit** run for approximately one (1) minute before you go on.

16. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by typing d 7 and pressing <ENTER>. If your measurement does not match the. value displayed for parameter 7, change the parameter to the value of your measurement by typing **pr** at the "Service =>" prompt, entering your DC voltage measurement at the "=>" prompt, and pressing <ENTER>.

17. To measure DC current, you must use a Fluke 80i-410 DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service at I-800-356-5737. Set the meter for DC mV, attach the Fluke 80i-4 10 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current should equal one (1) amp per DC mV measured.

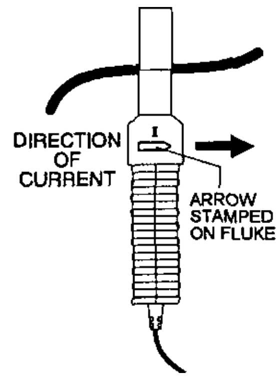


Figure 15

18. Display parameter 6 (I Batt) by typing **d** 6 and pressing <ENTER>. Using the clamp-on AC/DC probe, set the digital multimeter for DC mV. Measure at the positive (+) battery cable **with the** probe. **The arrows stamped on the current probe must match the flow of current you are measuring.** (See Figure 15.) If the result is different from the value displayed for parameter 6, change the value of parameter 6 by typing **pr** at the "Service=>" prompt, entering your measured **value** at the "=>" prompt, and pressing <ENTER>.

20. Clear the Service Password by typing **pw** and pressing <ENTER>. The prompt should change back to "=>."

406 System Test

FERRUPS automatically does a system test every seven (7) days (or the interval you set in parameter 72). If you need to start the test manually, you can start it from a control panel or a terminal connected to the FERRUPS RS232 port.

To start the test from a control panel: Press [CONTROL] [7] [ENTER] [ENTER].

To start the test from a terminal: Enter the **systemtest** command. (See Section 307-2.)

The FERRUPS tests the logic first, then the inverter, and then the batteries. (Parameter 71 controls which parts of the test the FERRUPS does.) If the FERRUPS fails any part of the test, the unit does not do the next part of the test. The paragraphs below describe each part of the test.

Logic Test: This part of the test makes sure the memory and the central processing unit are operating correctly. To do this, the FERRUPS computes the additive checksum of the ROM and the nonvolatile battery-backed section of RAM; then, it compares the values to parameters 12 1 and 122. If the computed values do not match the parameter values, the FERRUPS fails the logic test, cancels the inverter and battery tests, and starts a Memory Check alarm.

Inverter Test: The Inverter Test makes sure both inverter gates draw the correct current, To do this, the FERRUPS fires the left gate and then the right gate and monitors the peak current draw from the batteries. The FERRUPS then compares the current peaks to 1/2 of parameter 74 (NomILimit). If either gate draws less than 1/2 NomILimit, the FERRUPS fails the inverter test, cancels the battery test, and starts a Check Inverter alarm.

Battery Test: The Battery Test makes sure the batteries can supply enough power to run the load longer than the number of minutes set in parameter 68 (Low Runtime). To do this, the. FERRUPS runs the UPS on inverter for the number of seconds specified in parameter 75; it then compares the estimated runtime shown in parameter 9 to the Low Runtime setpoint in parameter 68. If parameter 9 is less than parameter 68, the FERRUPS fails the battery test and starts a Check Battery alarm.

Parameter 26 displays the results of the last system test. See Section 308-2 for a sample parameter 26 display,

You can program how often the FERRUPS does a system test (parameter 72), which parts of the test the FERRUPS performs (parameter 71), and the time of day the FERRUPS performs the test (parameter 73).

SECTION 500

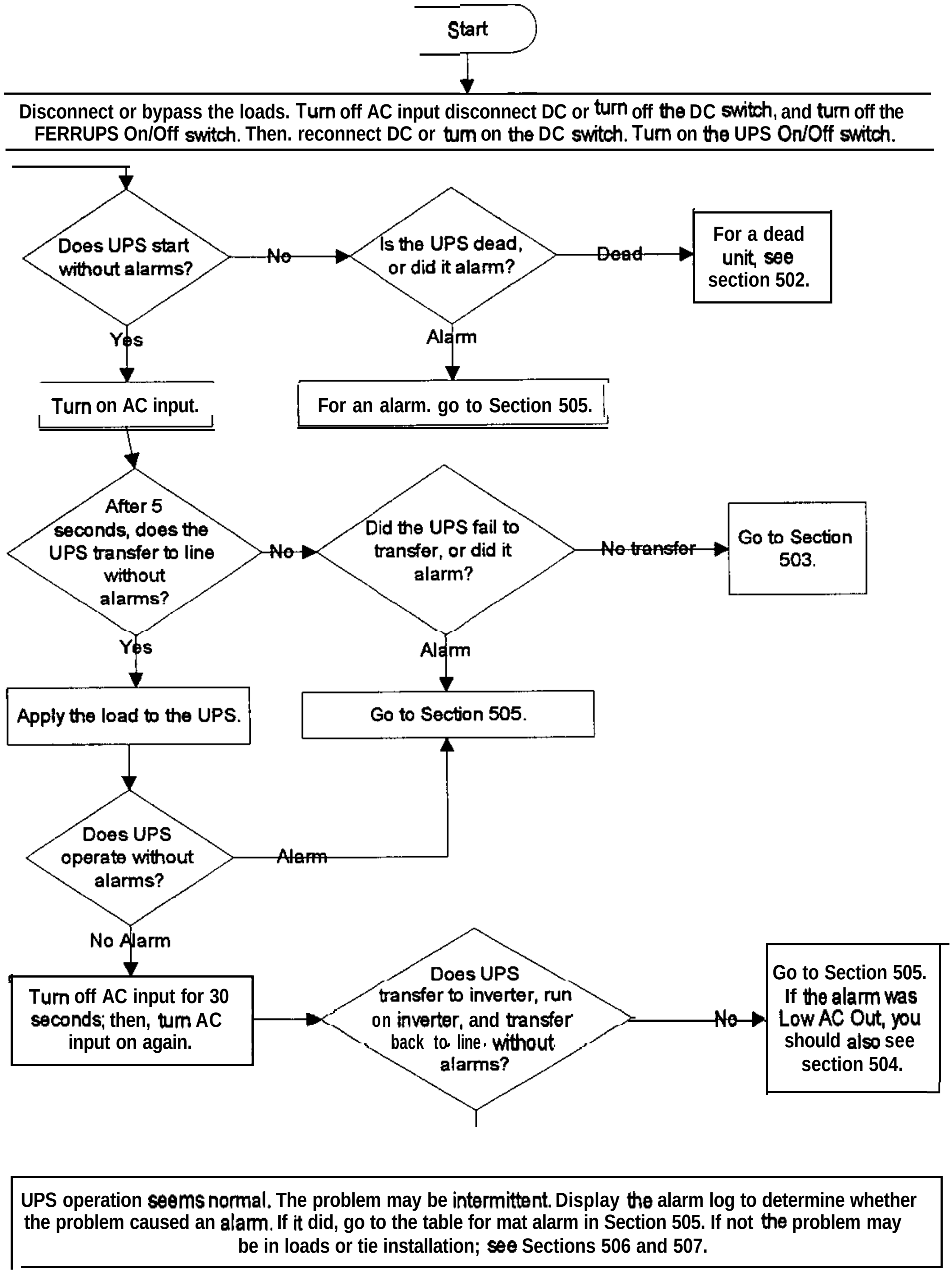
SECTION 500

This section explains how to troubleshoot FERRUPS problems. It begins with a basic troubleshooting **flowchart that helps** you identify the problem; then, it includes troubleshooting tables for dead units, **units** that will not **run** on **line** or on **inverter, units** that are sounding alarms, problems outside the UPS, and installation errors. Use the **contents** below to fmd **the** troubleshooting table you need

Note: You **must** have either a control panel, a VT-100 style terminal, or a computer running terminal emulation software connected to the FERRUPS' RS232 port for some of these procedures.

If this section does not describe your FEBRUPS problem, use the schematic diagrams in Section 800 to troubleshoot the problem. If you cannot find the cause of the problem, call Best Power Worldwide Service or your local Best Power office.

501 Basic Troubleshooting



502 Dead Units (Units that Will Not Operate)

Step #	Possible Cause	How to Correct the Problem
1	The On/Off switch on the back may be off or broken.	Turn the switch on and make sure the loads are running.
2	The On/Off switch wire may be disconnected from the power board.	Check J2 on the power board. If there is no wire attached, find the wire attached to the On/Off switch and attach the other end to J2 on the power board.
2	The logic board may have shut down because of low (or no) DC voltage and no AC voltage.	1. Check for AC and DC voltage. If both AC and DC have been off but AC voltage has returned, the Fail Safe circuit turns the logic board back on. FERRUPS remains in Line Condition mode if DC is still low. 2. Recharge the battery and troubleshoot any alarms. If the battery voltage is less than 6 VDC you must use an external charger After recharging, run the UPS on inverter with a 50% load applied and measure the voltage. If the battery drops below 11 .5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out. 3. If steps 1 and 2 do not solve the problem, use the system schematics (Section 800) to check for open fuses, bad wires, or loose or bad connectors on the logic board and power board.
3	The logic board may have failed, or the power board or power board assembly has failed	On the logic board, measure from the cathode of D27 to the TP2 pad. Your measurement should be+12 VDC. Incorrect voltage: 500-850 VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4 KVA: Replace the power board assembly, see TIP 73 1 in Section 700. Correct voltage: Replace the logic board, see TIP 732 in Section 700.

503 Units that Will Not Accept AC Line

Step #	Possible Cause	How to Correct the Problem
1	AC input to the UPS might be unstable, especially if an AC generator is the source.	Check the incoming frequency to make sure it is between parameters 5 1 and 52. To see the settings for your UPS, connect a control panel or terminal to the FERRUPS RS232 port and display parameters 5 1 and 52. The default settings are: 51 (LowFreq): 57.00 (FE) or 47.00 (QFE) 52 (HiFreq): 63.00 (FE) or 53.00 (QFE) See TIP 708 (Section 700) to program FERRUPS models to accept generator power or less stable AC.
2	Incoming AC voltage may be low	Measure AC input at the terminal block inside the. UPS: 500-850VA, 120-volt 1.15-1.4KVA, and all 50 Hz: Measure from "A" to "B" ("Line In" "N" to "L.") 60 Hz 1.15-1.4KVA with high VAC input and output: Measure from "L2in" to "Ll in." 60 Hz 1.15-1.4KVA with low VAC input and mixed output: Measure from "Nin" to "Lin." Your measurement must be greater than the value displayed in parameter 28 (if parameter 63 is "Yes") or 64 (if parameter 63 is "No").
3	Fammeters may be set incorrectly.	Verify the settings of these parameters: 1, 42, 43, 51, 52, 53, 54, 55, 56, 57, 58, 63, 64, and 75. To recalibrate parameter 1, see Section 403 or 404; use a true RMS multimeter to prevent false or premature alarms. 42: Nominal Frequency 43: Nominal Input Voltage 51: 57.00 (FE) or 47.00 (QFE) 52: 63.00 (FE) or 53.00 (QFE) 53: 100 54: 500 5s: 3 56: 3 57: 80 58: 1.0s 63: 1)Yes 64: 120 VAC input: 96 208 VAC input: 166.4 220 VAC input: 176 230 VAC input: 184 240 VAC input: I92 75: 60s

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Best Power

Step #	Possible Cause	How to Correct the Problem
	The backfeed relay or backfeed relay driver board may have failed.	If the AC LINE LED is on and parameter 1 shows the input voltage, both the backfeed relay and the driver board are good. If not, apply AC. Measure VAC between backfeed relay pins 0 and 1. This voltage is from the backfeed relay driver board (or power board). You should measure the following: Low-voltage units: 100-120 VAC High-voltage units: 200-240 VAC If your measurement is incorrect, replace both the relay and the driver board; see TIP 779 for the 500-850 VA or TIP 780 for the 1.15-1.4 KVA. Both TIPs are in Section 700. If your measurement is correct, measure VAC on the output pins of the backfeed relay. If the voltage is incorrect, replace the relay;see TIP 779 for the 500-850 VA or TIP 780 for the 1.15- 1.4 KVA. Both TIPs are in Section 700.
5	The logic board may have failed	At the logic board, measure from U18 pin 14 to the TP2 pad. You should measure 0 VDC on line or +12 VDC on inverter. If your measurement is incorrect, replace the logic board; see TIP 732 in Section 700.
6	In 1.15-1.4KVA models, the auxiliary power board may have failed.	Replace the power board assembly; see TIP 73 1 in Section 700.
	In 500-850VA models, the power board may have failed.	Replace the power board; see TIP 730 in Section 700.

504 Units that Will Not Run on Inverter

step #	Possible Cause	How to Correct the Problem
1	**The UPS may be in the Line. Condition mode.**	**Is the READY light on? If** not, **the unit is in Line Condition mode or the LED is burned out. Connect a control panel to the FERRUPS RS232 port. With the UPS** operating, check the scrolling display. If the display includes "Mode: Line Condition," change the mode to Auto by pressing [CONTROL] [2] [ENTER] [ENTER].
2	The UPS may have run on inverter for a long time, and the battery may need recharging. If battery voltage is 10.5 volts the inverter shots down. This is part of normal FERRUPS operation.	Let the UPS operate on AC line for 24 hours to charge the batteries. When the CHARGING LED goes out, the batteries are charged.
3	The battery may have failed	Recharge the battery and troubleshoot any alarms. If the battery voltage is less than 6 VDC you must use an external char&. After recharging, run the UPS on inverter with a load applied and measure the voltage. If the battery drops below 11.5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out.
4	Parameter 7 (battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate *parameter* **7. Use a true RMS digital multimeter to prevent false or premature alarms. You must connect a control** panel or terminal to the FERRUPS' RS232 port.
5	In the FERRUPS, the main DC fuse may have failed. If the UPS has a separate BEST battery cabinet, the battery cabinet fuse may have failed.	Check the main DC fuse in the UPS and F2 on the power board. If your UPS has a separate battery cabinet, check the battery cabinet fuse. If a DC fuse is open or has high resistance, replace it.
6	The logic board may have failed, or the power board assembly or heatsink assembly may have failed.	On the logic board, measure from the TP2 pad to pin 5 of U10. You should measure 5 VDC. **No or incorrect voltage:** Replace the logic board; see TIP 732 in Section 700. Correct voltage is present: 500-850VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4KVA: Replace. the power board assembly; see TIP 73 1 in Section 700.

505 Alarms

FERRUPS can sound 20 different alarms for problems inside and outside the UPS. When FERRUPS sounds an alarm, it lights the alarm LED, sounds the Morse Code for the alarm letter, and displays an alarm message. If you do not see an alarm message, press [CLEAR] until the control panel shows the scrolling display.

1. Identify the alarm by reading the message on the control panel or by listening to the Morse Code signal,

   If the alarm has sounded but has stopped, display the alarm log, either by displaying parameter 25 at the control panel or by typing al at a terminal connected to the RS232 port.

2. Go to the section that helps you troubleshoot the alarm (SOS-1 through 505-20). These sections explain what causes each alarm, how the FERRUPS reacts, and whether the alarm latches. They also help you troubleshoot the alarm.

Latching Alarms: Some alarms arc only warnings, but others latch; in other words, they do not clear themselves after the problem that caused the alarm has been solved. To clear a latching alarm, use one of these methods:

A) Connect a control panel to the FERRUPS' RS232 port and press [CONTROL] [0] [ENTER] [ENTER]. This clears alarms without changing the system mode.
B) Disconnect or bypass the loads. Then, turn the UPS off and on again.
C) Change the FERRUPS system mode at a control panel connected to the FERRUPS RS232 port. (See Sections 304 and 305-2.)

Restarting the UPS: To restart a unit that has shut down because of an alarm, disconnect or bypass the loads; then, turn the unit off and on again or change the system mode to any mode but Off.

505-l Low Battery (A) (• -)

Cause:	Battery voltage (parameter 7) ≤ Low Battery Voltage (parameter 65). The battery voltage signal comes from the batteries, is scaled at the power board assembly or heatsink assembly, and then goes to the logic board.
Latching?	**Yes.**
FERRUPS **Reaction:**	The UPS sounds the alarm, shuts down output power to the loads, turns off the READY LED, and clears Near Low Battery, High Battery, and Low Runtime alarms. The UPS can still communicate. If parameter 77 (AutoRst) = 0: The UPS does not restart when AC line power returns; the alarm stays on until you restart the UPS manually. If parameter 77 > 0: The UPS does restart when AC line returns, and the alarm clears. After the batteries recharge for a while, the READY LED lights.

Step #	Possible Cause	How to Correct the Problem
1	The UPS may have run on inverter for a long time. This alarm is normal at the end of the FERRUPS' runtime.	**Make sure** AC line has returned. Connect a control panel or terminal to the FERRUPS' RS232 port and put the UPS in the Auto mode. The batteries recharge as the UPS operates on line. When the CHARGING LED goes out, the batteries are charged.
2	The charger may be manually disabled, or it may have failed.	Connect a control panel to the FERRUPS' RS232 port. Check the scrolling display. If the display shows "Charger: Dsbl," the charger is disabled; enable it by pressing [CONTROL] [6] [ENTER] [ENTER]. If tbe display shows "Charger: Enbl," the charger is enabled. Disconnect or bypass the loads and shut down the UPS (see User Manual Section 308). Measure on both sides of F2 on the power board. You should measure the actual DC voltage for the UPS. If you only measure this voltage on one side, replace F2. Now, restart the UPS, and measure both sides of F2 again to make sure the charger is working. The voltage should be greater than your first measurement and should start rising slowly. If it does not, replace the following: 500-850VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4KVA: Replace the power board assembly; see TIP 731 in Section 700.

Continued Next Pa-e...

Best Power

Step #	Possible Cause	How to Correct the Problem
3	The battery may have failed.	**Recharge the battery and troubleshoot any alarms. If the battery voltage is less** than 6 VDC you must use an external charger. After recharging, run the UPS on **inverter with a load applied and measure. the voltage.** If the battery drops below 11.5 **VDC after the load is applied, replace the battery.** A severe discharge has worn the battery out.
4	If the UPS has external batteries, the DC disconnect may not be on.	If there is a DC connector between the battery cabinet and the UPS, make sure it is connected. If not, make sure the DC switch is on.
5	Parameter 7 (battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameter 7. **Use a true RMS digital multimeter to prevent false or premature alarms. If parameter 7** is incorrect and you cannot recalibrate it, see step 9 below.
6	Parameter 65 (Low Battery Voltage) may not be correct.	Connect a control panel or terminal to the FERRUPS' RS232 port. Display parameter 65 and check the setting. The default setting should be 10.5 VDC.
7	The DC fuse in the UPS may have failed. If the UPS has external batteries, the DC fuse in a BEST battery cabinet may have failed.	In the FERRUPS, check the main DC fuse and F2 on the power board. If the UPS has a separate Best Power battery cabinet, you must also check the battery cabinet's fuse. If a DC fuse is open or has high resistance, replace it,
8	DC may not be applied to the power board.	Check the DC cabling and F2 on the power board. When you measure between El5 and El 7 on the power board, the DC measurement should equal the actual battery voltage.
9	The logic board or power board may have failed.	On the logic board, measure from one side of R10 to the TP2 pad. You should measure approximately 1/4 of the actual battery voltage.* If your measurement is too high, or if it is correct but you cannot recalibrate parameter 7, replace the logic hoard, see TIP 732 in Section 700. If the measurement is too low and you cannot recalibrate parameter 7, replace the following: 500-850VA: Replace the power board; see TIP 730. 1.15-1.4KVA: Replace the power board assembly; see TIP 73 1. * For example, if the unit's battery voltage is 13 VDC, you should measure about 3 volts between R10 and TP2.

505-2 Near Low Battery (B) (– • • •)

Cause:	Battery voltage (parameter 7) ≤ Near Low Battery Voltage (parameter 66). The battery voltage signal comes from the batteries, is scaled at the power board assembly or heatsink assembly, and then goes to the logic board.
Latching:	No.
FERRUPS Reaction:	The UPS sounds the alarm and clears High Battery and Low Runtime alarms. If battery voltage rises above Near Low Battery Voltage (parameter 66), FERRUPS cancels the alarm. If battery voltage falls below Low Battery (parameter 65), the Low Battery Alarm starts, and the UPS clears the Near Low Battery alarm.

Step #	Possible Cause	How to Correct the Problem
1	FERRUPS may have run on inverter for a long time. This alarm is normal when FERRUPS is near the end of its runtime.	Make sure AC line has been restored. Connect a control panel or terminal to the FERRUPS RS232 port and put the UPS in the Auto mode. The batteries recharge as the UPS operates on line. When the CHARGING LED goes out, the batteries are charged.
2	The charger may be manually disabled, or it may have failed.	Connect a control panel to the FERRUPS' RS232 port. Check the scrolling display. If the display shows "Charger: Dsbl," the charger is disabled; enable it by pressing [CONTROL] [6] [ENTER] [ENTER]. If the display shows "Charger: Enbl," the charger is enabled. Disconnect or bypass the loads and shut down the UPS (see *User Manual* Section 308). Measure on both sides of F2 on the power board. You should measure the actual DC voltage for the UPS. If you only measure this voltage on one side, replace F2. Now, restart the UPS, and measure both sides of F2 again to make sure the charger is working. The voltage should be greater than your first measurement and should start rising slowly. If it does not, replace the following: 500-850VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4KVA: Replace the power board assembly; see TIP 731 in
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Step #	Possible Cause	How to Correct the Problem
3	The battery may have failed.	**Recharge the** battery **and troubleshoot any alarms. If the battery voltage is less than 6** VDC you must use an external charger. After recharging, run the UPS on inverter with a load applied and measure the voltage. If the battery drops below 11.5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out.
4	Parameter 7 (battery voltage) may be calibrated incorrectly.	See. Section 403 or 404 to recalibrate parameter 7. **Use a true RMS digital multimeter to prevent false or premature alarms. If** parameter 7 is incorrect and you cannot recalibrate it, see step 9 below.
5	Parameter 66 (Near Low Battery Voltage) may not be correct.	Display parameter 66 and check the setting. Tbe default setting should be 11 VDC.
6	The DC fuse in the UPS may have failed. If the UPS has external batteries, the DC fuse in a BEST battery cabinet may have failed.	In the FERRUPS, check the main DC fuse and F2 on the power board. If the UPS has a separate Best Power battery cabinet, you must also check the battery cabinet's fuse. If a DC fuse is open or has high resistance, replace it.
7	DC may not be applied to the power board.	Check the DC cabling and F2 on the power board. When you measure between El5 and El7 on the power board, the DC measurement should equal the actual battery voltage.
8	The logic board or power board may have failed.	On the logic board, measure from one side of R10 to the TP2 pad. You should measure approximately 1/4 of the actual battery voltage.* If your measurement is too bigb, or if it is correct but you cannot recalibrate parameter 7, replace the logic board; see TIP 732 in Section 700. If the measurement is too low and you cannot recalibrate parameter 7, replace the following: 500-850VA: Replace the power board; see TIP 730. 1.15-1.4KVA: Replace the power board assembly; see TIP 73 1. * For example, if the unit's battery voltage is 13 VDC, you should measure about 3 volts between R10 and TP2.

505-3 High Battery (C) (-• ~ ●)

Cause:	Battery voltage (parameter 7) ≥ **High** Battery Voltage (parameter 67). **The** battery voltage signal **comes from** the **batteries,** is scaled at the power board assembly or **heatsink** assembly, and **then goes** to **the** logic board.
Latching?	Yes.
FERRUPS Reaction:	**The** UPS sounds **the alarm** and shots off the battery charger. If the battery voltage **falls below Near Low** Batten, **(parameter** 66). **the** FERRUPS clears the **High Battery** alarm.

Step #	Possible Cause	How to Correct the Problem
1	Parameter 7 (battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate **parameter 7. Use a true RMS digital multimeter to prevent false or premature alarms. If parameter** 7 is **incorrect** and you cannot recalibrate it, see step 4 below.
2	**Parameter** 67 (High **Battery** Voltage) may not be correct.	Connect a control panel or t&al to the FERRUPS' RS232 port. **Display** parameter 67 and check the setting. The default setting should be 15 **VDC**.
3	The battery may have failed.	Recharge the **battery** and troubleshoot any alarms. If the battery voltage is less **than 6** VDC you must use an external charger. After recharging, **run the** UPS on **inverter** with a load applied and measure **the** voltage. If the battery drops below 11.5 VDC after **the** load is applied, replace the battery. A severe **discharge** has worn **the battery** out.
4	**The** logic board or power board may have failed.	**On the** logic board, measure **from** one side of **R10** to the TP2 pad. You should measure approximately **1/4** of the actual battery voltage.* **If your measurement** is too **high,** or **if it** is **correct** but you cannot recalibrate parameter 7, replace the logic board; **see** TIP 732 in Section 700. **If the** measurement is too low and you cannot recalibrate parameter 7, replace the following: **500-850VA:** Replace **the** power board; **see TIP** 730. **1.15-1.4KVA:** Replace the power board assembly; see TIP 731 * For example, if the unit's battery voltage is 13 VDC, you should measure about 3 volts between **R10** and TP2.

50?-4 Low Runtime (D) (-.)

Cause:	Estimated runtime remaining (parameter 9) ≤ Low Runtime (parameter 68).
Latching?	**No.**
FERRUPS **Reaction:**	The UPS sounds the alarm but takes no action. After it transfers to line, it clears the alarm, If FERRUPS continues to run on inverter, it eventually sounds Near Low Battery and Low Battery alarms and shut down its output.

Step #	Possible Cause	How to Correct the Problem
	FERRUPS may have run on inverter for a long time. This alarm is normal when FERRUPS is near the end of its runtime.	Make sure AC lime has returned. Then connect a control panel or terminal to the FERRUPS' RS232 port and put the UPS in the Auto mode. The batteries recharge as the UPS operates on line. When the CHARGING LED goes out, the batteries are charged.
	Parameters 2, (output voltage), 4 (output **current), 6** (battery current), and **7 mul**(battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameters **2, 4, 6,** and **7. Use a true RMS digital timeter to prevent false or premature alarms.**
	Parameter 68 (Low Runtime), 69 (Battery AH), or 70 (Runtime K) may not be correct.	Display each parameter and check the setting. The default settings are: 68: 5 min. (500VA and 1. 15KVA), 6 min. (850VA), 8 min. (700VA) or 9 min. (1.4KVA). 69: 31 (500-850VA), 55 or 75 (1.15KVA), or 75 (1.4KVA). 70: 57 (500VA), 100 (700VA), 100 (850VA), 62 (1.15KVA), or 31 (1.4KVA).
	The battery may have failed.	Recharge the battery and troubleshoot any alarms. If the battery voltage is less than 6 VDC you must use an external charger. After recharging, run the UPS on inverter with a load applied and measure the voltage. If the battery drops below 11.5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out.
	The charger may be manually disabled, or it may have failed.	Connect a control panel to the FERRUPS' RS232 port and check the scrolling display. If the display shows "Charger: Dsbl," the charger is disabled, enable it by pressing [CONTROL] [6] [ENTER] [ENTER]. If the display shows "Charger: Enbl," the charger is enabled. Disconnect or bypass the loads and shut the UPS down (see *User Manual* Section 308). Measure on both sides of F2 on the power board. You should measure approximately 13 VDC. If you only measure this voltage on one side, replace F2. Now, restart the UPS; and measure both sides of F2 again to make sure the charger is working. The voltage should be greater than 13 VDC and start rising slowly. If it does not, replace the power board.

505-5 Low AC Output (E) (•)

Cause:	**Output voltage (parameter 2) ≤ Low** Voltage Output (parameter 59). Output voltage comes from the transformer. It is sent to the power board, where it is stepped-down through the output monitor transformer; then, it is sent to the logic board.
Latching?	No if output voltage stays above the Low Voltage Output Shutdown setpoint (parameter 60). Do not **change parameter 60 to a low setting unless you contact Best Power.** Yes if output voltage is below the Low Voltage Output Shutdown setpoint (parameter 60).
FERRUPS Reaction:	If output voltage stays above the Low Voltage Output **Shutdown setpoint (parameter 60), the UPS sounds the alarm but takes no action.** If output voltage falls below the Low Voltage Output Shutdown setpoint (parameter 60), the UPS sounds the alarm, shuts down its output power, and turns off the READY LED, the UPS can still communicate. The UPS cannot restart until you turn it off and on again or change the system mode. Note: In 8.06 and higher software, parameter 129 (Low AC Delay) sets how many seconds the FERRUPS waits after sensing low voltage before it sounds the Low AC Output alarm. You can program this parameter with the factory password.

Step #	*Possible Cause*	**How to Correct the Problem**
1	If the UPS alarms on both AC line and inverter, go to step 2. If it alarms on line only, go to Section 503. If the UPS alarms on inverter only, go to Section 504.	
2	One or more loads may have failed, may be failing, or may need too much current to start or operate.	Disconnect each load, one at a time, and check to see if the alarm stops. If the alarm stops when one of the loads is disconnected, turn off all loads and try starting the problem load first; then, start the other loads. **(If the loads are in a rack, start each** piece of equipment one at a time instead of starting the whole rack at once.)
3	There may be errors in the load distribution wiring.	Make sure the installation meets the requirements in the Installation Manual shipped with the UPS. See Section 507 also.
4	Parameter 2 (output voltage) may not be calibrated correctly.	See Section 403 or 404 to recalibrate parameter **2. Use a true RMS digital multimeter to prevent false or premature alarms.**
5	Parameter 59 (Low Volts Out Alarm) may not be correct.	Display parameter 59. The default setting = 90% of nominal output voltage (parameter 44).
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Step #	Possible Cause	How to Correct the Problem
6	The logic board or power board may have failed.	On the logic board measure from the left side of R3 1 to the TP2 pad. If AC output is normal, you should measure approximately 12 VAC. Correct voltage: Replace the logic board; see TIP 732 in Section 700. Incorrect voltage: 500-850VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4KVA: Replace the power board assembly; see TIP 73 1 in Section 700.
7	The tank capacitor(s) may have failed, may be disconnected, or may be incorrectly connected. This can cause low capacitance or capacitance that is out of tolerance.	If the tank capacitor(s) are not connected correctly, reconnect them. If they are connected correctly, check the tank capacitors themselves; bad capacitors normally have oil leaking on them or around them. You can also measure across the capacitors to check them; you should measure 500-600 VAC. If the tank capacitors have failed, replace the failed tank capacitors.
8	The Power Factor Module may have failed.	Disconnect or bypass the loads and shut down the UPS. Disconnect E3 and E4 from the PFM circuit board. Restart the UPS. If the alarm does not sound, the PFM has caused the alarm. Replace the PFM circuit board; see TIP 721 for 500-850VA or TIP 722 for 1.15-1.4KVA models. Both TIPs are in Section 700.
9	The cooling fan may have failed.	Check to see if the fan is turning. If it is not turning, see TIP 771 (500-850VA) or TIP 772 (1.15-1.4KVA) in Section 700 to access the fan wires and measure AC voltage at the wires. If voltage is present but the fan is not turning, replace the fan according to the instructions in TIP 771 (500-850VA) or TIP 772 (1.15-1.4KVA).

505-6 High AC Output (F) (• • – •)

Cause:	Output voltage (parameter 2) ≥ High Voltage Output (parameter 61). Output voltage comes from the transformer. It is sent to the power board, where it is stepped-down through the output monitor transformer; then, it is sent to the logic board.
Latching?	**No.**
FERRUPS Reaction:	The UPS sounds the alarm but takes no action. If output voltage falls below the High Voltage Output setooint (parameter 61), FERRUPS clears the alarm.

Step #	Possible Cause	How to Correct the Problem
1	Parameter 2 (output voltage) may not be calibrated correctly.	See Section 403 or 404 to recalibrate parameter **2. Use a true RMS digital multimeter to prevent false or premature alarms.**
2	Parameter 61 (High Volts Out alarm) may not be set correctly.	Display parameter 61 and check the setting. The default value = 108% of nominal output voltage (parameter 44).
3	The problem may be caused by a load.	Disconnect each load, one at a time, and check to see if the alarm stops. If the alarm stops when one of the loads is disconnected, turn off all loads and try starting the problem load first; then, start the other loads. (If the loads are in a rack, start each piece of equipment one at a time instead of starting the whole rack **at once.)**
4	The logic board or power board may have failed.	On the logic board, measure from the left side of R3 1 to the TP2 pad. If AC output is normal, you should measure approximately 12 VAC. If the voltage is correct, replace the logic board; see TIP 732. If not, replace the following: 500-850VA: Replace the power board; see TIP 730. ~~1.15-1.4KVA: Replace the power board assembly; see TIP 731~~

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505-7 Output Overload (G) (- ▬ •)

Cause:	Volt-amps out (parameter 5) > VA Limit for your model at the current power factor (parameter 19). To calculate VA out, FERRUPS multiplies output voltage (parameter 2) by output current (parameter 4). Output voltage comes from the transformer. It is sent to the power board, where it is stepped-down through the output monitor transformer; then, it is sent to the logic board. Output current is sensed by a current toroid near the power board. The signal goes from the current toroid to the power board assembly or heatsink assembly for spike pro&ion&d scaling; then, it goes to the logic board.
Latching?	Before shutdown, the alarm does **not** latch. After shutdown, the alarm latches.
FERRUPS Reaction:	The UPS sounds an alarm. Eventually the UPS shuts down and turns the READY LED off. The time until shutdown depends on percent overload and whether FERRUPS is on line or inverter. On line with 101-125% load: 10 minutes On line with more than 125% load: 10 seconds On inverter with 101-110% load: 10 minutes On inverter with more than 110% load: 10 seconds If output volt-amps falls below VA Limit (parameter 19) **before the UPS shuts** down, it clears the alarm.

Step #	Possible Cause	How to Correct the Problem
1	The loads require too much power at the current power factor. This alarm could also be caused by a failed or cyclic load.	Display parameter 16 to see if the UPS is registering over 100% load. If so, disconnect less critical loads from the UPS. If you believe the problem has been caused by a particular load, try disconnecting just that load and restarting the UPS and the remaining loads. Note that loads with unity power factor or a lagging power factor may derate the UPS' KVA rating.
2	Parameter 2 (output voltage) or 4 (output current) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameters 2 and 4. Use a true RMS digital **multimeter to prevent false or premature alarms.** If you cannot calibrate parameter 2 correctly, follow the steps for the Low AC Output alarm (Section 505-5). If you cannot calibrate parameter 4 correctly, go to step 4.
3	Parameter 41 may show the wrong model index.	Display parameter 41. Thedefault setting is 1 (500VA), 2 (700VA), 3 (850VA), 4 (1.15KVA), or5 (1.4KVA).
4	The logic board or power board may have failed.	At the logic board, measure from the right side of R38 to the right side of R39. You should measure. approximately 0.05 mV AC per ampere drawn by the loads. Correct voltage: Replace the logic board; see TIP 732 in Section 700. Incorrect voltage: (500-850VA) Replace the power board; see TIP 730 in Section 700. (1.15-1.4KVA) Replace the power board assembly; see TIP 73 1 in Section 700.

505-8 High Ambient Temperature (H) (• • • ●)

Cause:	Ambient temperature (parameter 11) ≥ Ambient Temperature Alarm (parameter 80). The ambient temperature probe senses ambient temperature and sends a signal to the logic board; it is connected to J4 on the logic board.
Latching?	No if ambient temperature stays below the Ambient Temperature Shutdown setpoint (parameter 81). Yes if ambient temperature rises above the Ambient Temperature Shutdown setpoint (parameter 81).
FERRUPS Reaction:	As long as ambient temperature stays below parameter 8 1, FERRUPS sounds an alarm but takes no action. If ambient temperature falls below parameter 80, FERRUPS clears the alarm. If ambient temperature rises above the Ambient Temperature Shutdown setpoint (parameter 8 1), FERRUPS shuts down its output power and turns off the READY LED, the UPS can still communicate. At this point, the alarm latches; even if ambient temperature falls below parameter 80, the FERRUPS will not clear the alarm. To restart the UPS, bypass or disconnect the loads and turn the UPS off and on, or change the system mode to Auto.

step #	Possible Cause	How to Correct the Problem
1	The room temperature may be too high.	If the temperature in the room is above the recommended range in the User and *Installation Manuals*, lower the room temperature.
2	The High Ambient Temperature alarm or shutdown setpoint (parameters 80 and 8 1) may be incorrect.	Display parameters 80 and 8 1. The default settings are below. If the settings are incorrect, reprogram the parameters. 80: 60” C 81: 70” C
3	The FERRUPS air inlets or outlets are blocked or there is not enough clearance around the UPS for ventilation	Make sure the location allows the clearances specified in the *Installation Manual* that came with the UPS. Air must be free to circulate around the UPS and the battery cabinets.
4	The cooling fan may have failed.	Check to see if the fan blades are turning. Then, see TIP 771 (500-850VA) or 772 (1.15-1.4KVA) in Section 700 to access the fan wires. Measure AC voltage at the fan wires. If voltage is present but the fan is not turning, replace the fan according to the instructions in TIP771 (500-850VA) or 772 (1.15-1.4KVA).
5	The ambient temperature probe may have failed (shorted).	Check parameter 11. If the heatsink temperature probe is open, the parameter reads -63” C; if the probe is shorted, the parameter reads 191° C. If parameter 11 reads either -63° C or 191” C, replace the temperature probe; see TIP 777 (500-850VA) or 778 (1.15-1.4KVA) in Section 700.
6	The logic board may have failed.	If the alarm stayed the same in step 5, replace the logic board. See TIP 732 in Section 700.

500-9 High Heatsink Temperature (I) (•)

Cause:	**Heatsink** temperature. (parameter 12) ≥ **Heatsink** Temperature Alarm (parameter 82). The **heatsink temperature** probe. on tbe. **power** board or tbe **heatsink** assembly senses **heatsink temperature** and sends a signal to the power board; the ***signal*** then passes to the logic hoard.
Latching?	**No if heatsink temperature** stays below the Heatsink Temperature Shutdown **setpoint** (parameter 82). Yes **if heatsink** temperature rises above the Heatsink Temperature Shutdown **setpoint (parameter** 83).
FERRUPS **Reaction:**	As long as **heatsink temperature** stays above parameter 82 but below parameter 83, **FERRUPS** sounds an alarm but takes no action. If the **heatsink** temperature falls below parameter 82, FERRUPS clears **the alarm.** If the **heatsink** temperature rises above **the Heatsink** Temperature Shutdown **setpoint** (parameter **83),** FERRUPS shuts down its output power and **turns** off the **READY** LED, the UPS can still communicate. At this point, tbe **alarm** latches; **even** if **heatsink** temperature falls below parameter 82, FERRUPS **will** not clear the alarm. To restart the UPS, **turn** it off and on or change the system mode to Auto.

Step #	Possible Cause	How to Correct the Problem
1	The **High Heatsink** Temperature alarm or shutdown **setpoint** (parameters 82 and 83) may be incorrect.	Display parameters 82 and 83. The default settings are below. If the settings are incorrect, reprogram the parameters. 82: **95°** C 83: 105” C
2	The room temperature may be too high.	If room temperature is above the range recommended in the User and Installation Manuals, **lower the temperature.**
3	The cooling fan may have failed.	Check to see if the fan blades are turning. Then, see TIP 771 (SOO-SSOVA) or 772 **(1.15-1.4KVA)** in Section 700 to access the fan wires. Measure AC voltage at the fan wires. If voltage is present but the fan is not **turning,** replace the fan according to the instructions in TIP 771 **(500-850VA)** or 772 **(1.15-1.4KVA).**
4	The **heatsink temperature** probe may have failed.	Check parameter 12. If the **heatsink** temperature probe is open, the parameter reads -63 ° C; if **the probe** is shorted, the parameterreads 191” C. Ifparameter 12 reads either **-63°** C or 191” **C, replace the temperature probe**; see TIP 777 **(500-850VA)** or 778 **(1.15-1.4KVA)** in Section 700.

505-10 User Test (J) (• – – –)

Cause:	The user has started this alarm using one of two methods: - Pressing [CONTROL] [8] [ENTER] [ENTER] at a control panel connected to the FERRUPS' RS232 port. - Sending the **alarmtest** command from a terminal connected to the FERRUPS RS232 port.
Latching?	No.
FERRUPS Reaction:	The FERRUPS sounds an alarm but takes no action. The user can clear the alarm test in one of two (2) ways: - Pressing [CONTROL] [8] [ENTER] [ENTER] at a control panel connected to the RS232 port. - Sending the **alarmtest c** command from a terminal connected to the FERRUPS RS232 port.

505-11 High Transformer Temperature (K) (- • -)

Cause:	**In 1.15-3.1KVA models,** Transformer Temperature (parameter 14) ≥ Transformer Temperature Alarm (parameter 84). The temperature probe mounted near the transformer senses transformer temperature and sends a signal to the logic board; the signal then passes to the logic board. **500-850VA models do not monitor transformer temperature.**
Latching?	**No** if transformer temperature stays below the Transformer Temperature Shutdown setpoint (parameter 85). Yes if transformer temperature rises above the Transformer Temperature Shutdown setpoint (parameter 85).
FERRUPS Reaction:	As long as transformer temperature stays below parameter 85, FERRUPS sounds an alarm but takes no action. If the transformer temperature falls below parameter 84, FERRUPS clears the alarm. If the transformer temperature rises above the Transformer Temperature Shutdown setpoint (parameter 85), FERRUPS shuts down its output power and turns off the READY LED, the UPS can still communicate. At this point, the alarm latches; even if transformer temperature falls below parameter 84, FERRUPS does not clear the alarm. To restart the UPS, turn it off and on or change the system mode to Auto.

Step #	Possible Cause	How to Correct the Problem
1	The room temperature may be too high.	If room temperature is above the range recommended in the User and *Installation Manuals*, lower the room temperature.
2	In 1.15-3.1KVA models, the High Transformer Temperature alarm or shutdown setpoint (parameters 84 and 85) may be incorrect.	Display parameters 84 and 85. The default settings are below. If the settings are incorrect, reprogram the parameters. **In 500-850VA models, these parameters must be set to "0"; 500-850VA models do not monitor transformer temperature; parameters 84 and 85 must be set to 0°C.** 84: 75" Celsius (1.15KVA) or 70" Celsius (1.4KVA) 85: 85" Celsius (1.15KVA) or 80° Celsius (1.4KVA)
3	The cooling fan may have failed.	Check to see if the fan blades are turning. Then, see TIP 771 (500-850VA) or 772 (1.15-1.4KVA) in Section 700 to access the fan wires. Measure AC voltage at the fan wires. If voltage is present but the fan is not turning, replace the fan according to the instructions in TIP 771 (500-850VA) or 772 (1.15-1.4KVA).
4	The logic board may have failed.	At the logic board, the transformer temperature probe is connected to Jl, and the ambient temperature probe is connected to J4. Switch the connections. If the unit still sounds a High Transformer Temperature alarm, replace the logic board; see TIP 732 in Section 700.

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Step #	Possible Cause	How to Correct the Problem
5	The transformer temperature probe may have failed.	Check parameter 14. If the transformer temperature probe is open, the parameter reads -63" C; if the probe is shorted, the parameter reads 191° C. If parameter 84 reads either -63° C or 191° C, replace the temperature probe; see TIP 777 (500-850VA) or 778 (1.15-1.4KVA) in Section 700.
6	The transformer may have failed.	Call Best Power Worldwide Service or your local Best Power office for assistance.

50512 Check Charger (L) (• – • •)

Cause:	Parameter 122 may be set incorrectly.
Latching?	**Yes.**
FERRUPS **Response:**	FERRUPS sounds the alarm, then disables the charger.

Step #	Possible Cause	How to Correct the Problem
1	Parameter 122 is set incorrectly.	Display parameter 122. It should be set to 0. If it is not set to 0, reprogram parameter 122 to 0.
2	The logic board may have failed.	If parameter 122 is set at 0 and the alarm sounds, replace the logic board; see TIP 732 in Section 700.

505-13 Check Battery (M) (- -)

Cause:	FERRUPS failed the battery portion of the automatic system test. See Section 405.
Latching?	Yes.
FERRUPS Reaction:	The FERRUPS sounds an alarm but takes no action.

Step #	Possible Cause	How to Correct the Problem
1	A system test was performed shortly after FERRUPS ran on inverter.	Shut down the loads. Turn the UPS off and then on again, and let the unit charge overnight. Then, run a system test again, see Section 405. Note: The battery needs to be above 12.7VDC.
2	The battery may have failed, and the automatic system test has detected the problem.	Recharge the battery and troubleshoot any alarms. If the battery voltage is less than 6 VDC you must use an external charger. After recharging, run the UPS on inverter with a load applied and measure the voltage. If the battery drops below 11.5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out.
3	Parameter 2 (output voltage), 4 (output current), or 7 (battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameters 2, 4, and 7. **Use a true RMS digital multimeter to prevent false or premature alarms.**
4	Parameter 65 (low battery voltage), 66 (near low battery voltage), 69 (battery AH), or 70 (runtime K) may be incorrect.	Display parameters 65, 66, 69, and 70, and check the settings, The default settings are listed below. If any setting is incorrect, reprogram the parameter. 65: 10.5 VDC 66: 11 VDC 69: 31 (500-850VA), 55 or 75 (1.15KVA), or 75 (1.4KVA). 70: 57 (500VA), 100 (700VA), 100 (850VA), 62 (1.15KVA), or 31 (1.4KVA).
5	The logic board may have failed.	If you did not fmd the problem in steps l-3 and the alarm is still sounding, the logic board has failed. Replace the logic board: see TIP 732 in Section 700.

505-14 Check Inverter (N) (- •)

Cause:	FERRUPS failed the inverter portion of the automatic system test. See Section 405.
Latching?	Yes.
FERRUPS Reaction:	The FERRUPS sounds an alarm but takes no action.

Note: See Section 504 to troubleshoot the inverter section of the UPS. Best Power recommends that you replace the logic board, the power board, and the heatsink assembly (inverter) at the same time for this alarm condition.

Step #	Possible Cause	How to Correct the Problem
1	The battery may have failed or may be at a low voltage	Recharge the battery and troubleshoot any alarms. If the battery voltage is less than 6 VDC you must use an external charger. After recharging, run the UPS on inverter with a load applied and measure the voltage. If the battery drops below 11.5 VDC after the load is applied, replace the battery. A severe discharge has worn the battery out.
2	Parameter 6 (battery current) or parameter 7 (battery voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameters 6 and '7. **Use a true RMS digit multimeter to prevent false or premature alarms.**
3	Parameter 74 (NomILimit) may be incorrect.	Display parameter 74 and check the setting. The default values are: 500-700VA 200 850VA: 240 1.15-1.4KVA: 360 If the setting is incorrect, reprogram the parameter.
4	The FERRUPS' source of AC input mav be soft; a line conditioner or generator may be providing the AC input. The FERRUPS may also have canceled the test because the UPS transferred to inverter.	If the source of AC input is soft, the UPS usually fails the inverter test. Check the test results (parameter 26); the display should show a value for one gate but not the other. Try connecting the unit to a different source of AC input, or cheek for line conditioners. Shut down the loads and turn the UPS off and then on again; then, try a system test again; see Section 404.
5	The inverter gate signals may not be reaching the switching devices; tbis means the power board or logic board may have failed.	At the logic board, measure between the TP2 pad and pm 5 of U10. You should measure 5 VDC. Incorrect voltage: Replace the logic board; see TIP 732 in Section 700. Correct voltage: 500-850VA: Replace the power board; see TIP 730 in Section 700. 1.15-1.4KVA: Replace the power board assembly; see TIP 73 1 in section 700.

505-15 Check Memory (0) (- – -)

Cause:	**FERRUPS failed** the logic **portion** of the automatic system test. (See Section 405.) The **internal memory checksum does** notmatchthevalue stored in parameters 121 and 122 **(software** versions 8.01-8.05) or parameters 138 **and** 139 **(software** versions 8.06 and higher).
Latching?	Yes.
FERRUPS Reaction:	The UPS sounds an **alarm.** Next time you reset the **unit** or start it up, the FERRUPS changes all **parameters** to **their** default **settings**.

Step #	Possible Cause	How to Correct the Problem
1	The logic board has failed.	Replace. the logic board. See TIP 732 in Section 700.

505-16 Emergency Shut Down [Emergency Power Off] (P) (• – – •)

Cause:	The Remote Emergency Shut Down (Emergency Power Off) feature has been activated This means +12 volts is applied to pin 21 at the FERRUPS RS232 port.
Latching?	Yes.
FERRUPS Reaction:	The UPS sounds an alarm and shuts down its output power; however, it can still communicate

Note: Parameters 106,107, and 108 determine how the Remote Emergency Shut Down (Emergency Power Off) feature operates. See TIP 503 for mom information.

106: Determines the type of signal that triggers the RESD (REPO) feature.
107: Determines the length of RESD (REPO) signal required.
108: Determines the delay before Emergency Shut Down (Emergency Power Off).

CAUTION!

Before you reset the alarm and restart the UPS, make sure no one is in contact with the UPS' electrical distribution system.

step #	Possible Cause	How to Correct the Problem
1	The Remote Emergency Shut Down (Emergency Power Off) feature has been activated; 12 volts DC is applied to pin 2 1 at the RS232 port.	Make sure the Emergency Shut Down (Emergency Power Off) feature was not activated because of an emergency; if it was, make sure the emergency no longer exists. Then, remove the 12 volts DC from pin 2 1.
2	If the FERRUPS has a communication cable connected to the RS232 port and the user did not start an ESD (EPO) shutdown, the cable may be too long or in an electrically noisy environment. Too much transient noise on the communication cable can cause a false ESD (EPO) alarm.	Make sure the communication cable is properly shielded, and reprogram parameter 107 to 0.5s.
3	If no cable is connected to the RS232 port, the logic board has failed.	Replace the logic board; see TIP 732 in Section 700.

505-17 High PFM Temperature (Q) (- ▬ • -)

Cause:	PFM resistor temperature (parameter 76) ≥ PFM Temperature Alarm (parameter 86). Tbe temperature probe mounted on a PFM resistor senses PFM temperature and sends a signal to the logic board.
Latching?	No if PFM resistor temperature stays below the PFM Tempcraturc Shutdown setpoint (parameter 87). Yes if PFM temperature rises above the PFM Temperature Shutdown setpoint (parameter 87).
FERRUPS **Reaction:**	As long as PFM resistor temperature remains above parameter 86 but below parameter 87, FERRUPS sounds au alarm but takes no action. If PFM temperature falls below parameter 86, FERRUPS clears the alarm. If PFM resistor temperature rises above the PFM Temperature Shutdown setpoint (parameter 87), FERRUPS shuts down its output power and turns off the READY LED; the UPS can still communicate. The alarm latches; even if PFM resistor temperature falls below parameter 86, FERRUPS does not clear tbe alarm. To restart the UPS, disconnect or bypass the loads and turn the UPS off and on or change the system mode to Auto.

Step #	Possible Cause	How to Correct the Problem
1	The PFM temperature probe may have failed.	Check parameter 76. If the transformer temperature probe is open, the parameter reads -63° C; if the probe is shorted, the parameter reads 191° C. If parameter 86 reads either -63° C or 191° C, replace the temperature probe; see TIP 777 (500-850VA) or 778 (1.15-1.4KVA) in Section 700.
2	**Parameter 86** or 87 may be incorrect.	Display parameters 86 and 87 and check the settings. The default values are listed below. If the parameter settings are incorrect, reprogram the parameters 86: 85” C (500-850VA) or 80” C (1.15-1.4KVA) 87: 95” C (500-850VA) or 95” C (1.15-1.4KVA)
3	The cooling fan may have failed.	Check to see if the fan blades are turning. Then, see TIP 771 (500-850VA) or 772 (1.15-1.4KVA) in Section 700 to access the fan wires. Measure AC voltage at the fan wires. If voltage is present but the fan is not turning, replace the fan according to the instructions in TIP 771 (500-850VA) or 772 (1.15-1.4KVA).
4	The logic board may have failed.	At the logic board, the PFM temperature probe is connected to J11, and the ambient temperature probe is connected to J4. Stitch the two (2) connections. If the alarm stays Higb PFM Temperature, replace the logic board see TIP 732 in Section 700.

Continued on the Next Page...

step #	Possible Cause	How to Correct the Problem
5	A load may be causing the problem.	If the PFM resistor stays cool when there is no load but heats up when the load is applied to the UPS output, one (1) or more loads is feeding oscillations back to the UPS. Disconnect the loads and reconnect them one at a time until the unit starts sounding the alarm again. The last load connected should be the problem load. If you need help, call Best Power Worldwide Service at l-800-356-5737. (Outside of the U.S. and Canada, call your local Best Power office.)
6	The Power Factor Module circuit board may have failed.	If the UPS alarms even when the loads are disconnected, replace the PFM circuit board; see TIP 721 for 500-850VA or TIP 722 for 1.15-1.4KVA models.

505-18 Probe Missing (R) (• – •)

Cause:	One of the four (4) temperature probes — ambient, heatsink, transformer, or PFM — is not connected or is open.
Latching?	No if the ambient temperature probe is not connected or open. Yes if the heatsink, transformer, or PFM temperature probe is not connected or open.
FERRUPS **Reaction:**	If the ambient temperature probe is not connected or open, the FERRUPS sounds an alarm but takes no action. If the heatsink, transformer, or PFM temperature probe is missing or open, the FERRUPS sounds an alarm; two (2) minutes later, it shuts down. If the missing probe is installed or repaired, the FERRUPS clears the alarm.

Note 1: If the alarm setpoint for the temperature condition is set to "0," a missing probe for that temperature condition will not cause the Probe Missing alarm For example, if parameter 86, PFM Temperature Alarm, is set to "0," and the PFM temperature probe is missing or has failed, **the FERRUPS** does **not sound** a Probe Missing alarm. **Do not leave temperature alarm setpoints set to "0." The temperature probes are important for normal FERRUPS operation.**

Note 2: 500-850VA models do not monitor transformer temperature. Parameters 85 and 85 should be set to "0" for these models

Step #	Possible Cause	How to Correct the Problem
1	One (1) of the probes inside the UPS has failed or is disconnected.	See TIP 777 (500-850VA) or TIP 778 (1.15-1.4KVA) in Section 700 to fmd out which probe is causing the alarm. Make sure the probe is connected correctly; if not, reconnect the probe. If the probe is connected properly, check parameters 11, 12, 14, and 76. If any temperature probe is open, the corresponding parameter reads -63" C; if any probe is shorted, the parameter reads 191" C. Ifparameters 11, 12, 14, and 76 reads either -63" C or 191" C, replace the temperature probe; see TIP 777 (500-850VA) or 778 (1.15-1.4KVA) in Section 700.
2	If none of the temperature probes has failed and all are connected correctly, the logic board has failed.	Replace the logic board; see TIP 732 in Section 700.

505-19 **High AC Input(S) (• • ●)**

Cause:	Input voltage (parameter 1) ≥ High Voltage In Alarm (parameter 62). Input voltage comes from the step-down monitor transformer on the power board or heatsink assembly, then goes to the logic board for signal conditioning, where it becomes the AC sensing signal.
Latching?	**No.**
FERRUPS Reaction:	**The FERRUPS alarms but takes no action** If AC input voltage falls below the High Voltage In Alarm setpoint, the FERRUPS clears the alarm.

Step #	Possible Cause	How to Correct the Problem
1	**The** AC voltage to **your unit may be** abnormally high.	A **qualified electrician should check the voltage feeding the UPS system. If the electrical** transformers or wiring feeding your UPS system have failed, this could cause a dangerous high-voltage condition and that could affect other equipment in your facility.
2	Parameter 62 (High Volts In Alarm) may be incorrect.	Display parameter 62. The default setting = 115% of nominal input voltage (parameter 43). If the setting is incorrect, reprogram the parameter.
3	Parameter 1 (input voltage) may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameter 1. **Use a true RMS digital multimeter to prevent false or premature alarms.**
4	You may have a unit with 208 nominal Volts in with a 240VIN source.	Check parameter 43. Ifparameter 43 reads 208 but the source voltage is 240, change the operating voltage of the unit; see TIP 709 (500-850VA) or TIP 716 (1.15 or 1.4KVA) in Section 700.
5	The logic board may have failed.	If the input voltage and parameter settings are correct but the unit is still sounding the alarm, replace the logic boar& see TIP 732 in Section 700.

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505-20 Call Service (T) (-)

Cause:	A diagnostic reading is above the value of parameter 88 (VOutFlt).
Latching?	**Yes.**
FERRUPS Reaction:	The FERRUPS sounds the alarm, shuts down its output power, and turns off the READY LED, the UPS can still communicate.

step #	Possible Cause	How to Correct the Problem
1	The value of parameter 88 (Voltage Out Fault) may be incorrect.	Display parameter 88 and check the setting. The default setting = 20% of the nominal output voltage (parameter 44). If the setting **is incorrect, reprogram the** parameter.
2	Parameter 2 may be calibrated incorrectly.	See Section 403 or 404 to recalibrate parameter 2. **Use a true RMS digital multimeter to prevent false or premature alarms.**
3	The logic board may have failed.	Disconnect the loads. If the unit still alarms, replace the logic board; see TIP 732 in Section 700. If the alarm does not stop, see step 4.
4	The Power Factor Module may have failed.	If the alarm did not stop when you disconnected the loads in step 4, replace the PFM circuit board, see TIP 721 (500-850VA) or TIP 722 (1.150-1.4KVA models) in Section 700.
5	The load may be oscillating output peak to peak voltage too much.	If you still have an alarm after replacing the PFM circuit board, disconnect the loads and reconnect them one at a time until the alarm starts again. The load that caused the alarm is causing too much oscillation for the PFM circuit board to compensate for.

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506 Problems Outside of the UPS

Best Power's statistics show that many FERRUPS problems are actually caused by problems outside the UPS. To make sure the problem is not external, use the table below.

Step #	Possible Problem	How to Correct the Problem
	Other equipment may be connected to the FERRUPS' input circuit.	Check the AC service panel or receptacle that supplies power to the UPS. If a copier, laser printer, or similar equipment is connected to the input circuit, it can cause sags in the input power to the FERRUPS, which can make the FERRUFS run on inverter more often. Even if the AC input circuit was dedicated to the FERRUPS when it was installed, other equipment may have been connected to the same input circuit later.
	The UPS may be overloaded, if so, it sounds alarm G and eventually shuts down.	See Section 505-7. Check **all** UPS-protected receptacles. Loads like coffee pots or small electrical heaters can overload the UPS.
	A load **may** be causing the problem. Internal wiring problems in a load can affect the UPS; they can also keep loads from operating even though FERRUPS is supplying output power.	Disconnect the loads or switch them off one at a time. As you do this, check to see if the UPS runs properly. If the UPS runs properly when one or more loads are off, the load(s) probably caused the problem. **CAUTION!** **Only a qualified service person should disconnect any cables or connections that may contain voltage or current.**
	The UPS may not be installed properly.	See Section 507.

507 Common Installation Errors

Many FERRUF'S problems arc also caused by poor installation practices or an incorrect installation. In the United States, the National Electrical Code (NEC) require that you install the UPS according to the mauufacturer's instructions. (See NEC 1 10-3b.) Even if you are outside of the United States, you must follow the instructions in the *Installation Manual* to correctly install the UPS.

To make sure the installation is correct, review the entire installation and compare it to the correct installation diagram in the *FERRUPS Installation Manual*. Start with the service entrance panel; then, go on to the FERRUF'S connection panel, the bypass switch (if the unit has one), and the receptacles for the UPS loads. The table below lists the most common installation errors, how to correct them, and the U.S. National Electrical Code Article that applies to this error.

Installation Error	How to Correct the Error	U.S. NEC Article
The switch gear, disconnects, and load circuit breakers are not labeled.	Label all disconnects, bypass switches, and load circuit breakers.	110-22
You cannot access the FERRUPS unit well enough to remove the cover and inspect system components.	Make sure you can access the unit for service and maintenance. See the *Installation* Manual for the **required** service clearances!	110-16
The FERRUPS neutral is not grounded, not used or not switched at the external bypass switch.	FERRUF'S is a separately derived power source; the installation must meet the requirements for separately derived power sources. Make sure the neutral is used and grounded, and make sure it is switched at the external bypass switch.	250-5(d) 250-26 250-23
The FERRUPS neutral is fused at the bypass switch.	Use a bypass switch that is not fused.	250-26(c) 250-91(a) 250-92(a) 250-92(b)
The FERRUPS 208 VAC output is fed to the loads with a neutral. As a result, the loads receive 208/120/88 VAC, and loads on the 88 VAC leg are damaged or malfunction.	Never use the 88 VAC leg on the FERRUPS output. Use the 240/120/120 configuration instead. See the *FERRUPS Installation Manual*.	110-3(b)

SECTION 600

SECTION 600

Important: The tables on the following pages include Best Power part numbers. On the parts, these numbers appear in this format: *bbb-nnnna*. "b" stands for the three letters that begin the part number; "n" stands for the four (4) numbers that follow the dash; "a" stands for the part number revision. The first part number revision is "a," the second is "b," and so on.

The TIP column refers to the Technical Information Publication (TIP) procedure that describes the replacement/installation of a certain part. These TIPs are usually sent with any new parts that are shipped, as well as found in Section 700 of the Service *Manual.* If you need a copy of a particular TIP, call Best Power Worldwide Service for a copy.

601 FE, QFESOOVA

Part Description	Part #	Wt	TIP	Notes:
AVR Board (100-120V input/output)	PCP-0207	1	721	(S) Included in Parts Kit.
AVR Board (200-240V output)	PCP-0208	1	721	(0) Included in Parts Kit.
Fuse (charger)	SSFUS-0019	1	N/A	(S) Included in Parts Kit.
Fuses (DC)	PUS-0162	1	773	(S) Included in Parts Kit.
Logic Board	PCL-0172	2	732	(S) Included in Parts Kit; Specify model, input, output voltage.
Power Board (200-240V input-60Hz)	PCP-0078	2	730	(O) Included in Parts Kit.
Power Board (100-120V input)	PCP-0092	2	730	(S) Included in Parts Kit.
Snubber Board(QFE models only)	PCS-0021	1	N/A	(O) Included in Parts Kit.
Backfeed Relay Driver Board	PCF-0004	1	779	(S)
Backfeed Relay (200-240V input)	RLY-0083	1	779	(O)
Backfeed Relay (100-120V input)	RLY-0085	1	779	(S)
Battery	BAT-0058 BAT-0053 BAT-0053 BAT-0122 BAT-0103 BAT-0050 BAT-0103 BAT-0122 BAT-0050 BAT-0050	14 27 27 67 57 73 57 67 73 73	775 (720) (700, 706)	(S) Internal, 1 battery, Std charger; 9m/25m RT (O) Internal, 1 battery, Std charger; 22m/53m RT (O) Internal, 2 batteries, Std charger; 53m/2h9m RT (O) "M" cabinet, 1 battery, Std charger; 1h29m/3h36m RT (O) "M" cabinet, 2 batteries, Std charger; 2h31m/6h5m RT (O) "M" cabinet, 2 batteries, Std charger; 3h37m/8h28m RT (O) "M" cabinet, 3 batteries, 15A charger; 4h15m/10h16m RT (O) "M" cabinet, 3 batteries, 15A charger; 6h/13h56m RT (O) "M" cabinet, 4 batteries, 15A charger; 8h32m/19h57m RT (O) "N" cabinet, 6 batteries, 15A charger; 13h17m/32h58m RT
Battery Bracket Bottom 17AH	BKT-0366	1	N/A	(S)
Battery Bracket Bottom 31/33 AH	BKT-0365	1	N/A	(O)
Battery Bracket Ext Rntm Bottom	BKT-0176	1	N/A	(O)
Battery Bracket Ext Rntm Top	BKT-0177	1	N/A	(O)
Battery Bracket-Top 17/31/33 AH	BKT-0364	1	N/A	(O)
Capacitor	CPR-0260	2	N/A	(S) 12µF; Quantity, 1
Cover	CAB-0741	4	N/A	(S)
Ext Runtime Kit (External)	SSEBK-0002	5	706	(O)
Ext Runtime Kit (Internal)	SSERT-0700	5	720	(O)
Fan Ext Rntm (208/240V output)	FAN-0034	1	N/A	(O)
Fan (208/240V output)	FAN-0033	1	771	(O)
Fan Ext Rntm (100/120V output)	FAN-0015	1	N/A	(O)
Fan (100/120V output)	FAN-0031	1	771	(S)
Lester Charger 12V 15A	BCA-0004	20	700	(O)
Line Cord Std 120V	LCA-0227	3	N/A	(S)
Line Cord Grommet w/LCA-0227	GRO-0001	1	N/A	(S)
Plastic Front	CAB-0055	2	N/A	(S)
Plastic Front Label	LAB-1112	1	N/A	(S)
Ribbon Cable (Logic to power Board)	BAA-0406	1	N/A	(S)

Part Description	Part #	Wt	TIP	Notes:
Ribbon Cable (RS232)	BAA-0059	1	N/A	(S)
Temperature Probe, Ambient	THR-0048	1	777	(S)
Temperature Probe, PFM	THR-0013	1	777	(S)

602FE, QFE700VA

‘art Description	Part #	Wt	TIP	Notes:
‚VR Board (100-120V input/output)	PCP-0207	1	721	(S) Included in Parts Kit.
‚VR Board (200-240V output)	PCP-0208	1	7 2 1	(O) Included in Parts Kit.
use (charger)	SSFUS-0019	1	N/A	(S) Included in Parts Kit.
uses (DC)	FUS-0162	1	773	(S) Included in Parts Kit.
ogic Board	PCL-0172	2	732	(S) Included in Parts Kit; Specify model, input, output voltage.
ower Board (200-240V inout)	IPCP-0078	2	730	(0) Included in Parts Kit.
ower Board (100-120V inout)	IPCP-0092	2	730	(S) Included in Parts Kit.
nubber Board(QFE models only)	PCS-0021	1	N/A	(0) Included in Parts Kit.
ackfeed Relay Driver Board	PCF-0004	1	779	(S)
ackfeed Relav (200-240V input)	RLY-0083	1	779	(O)
ackfeed Relay (100-120V input)	RLY-0085	1	779	(S)
atterv	BAT-0053	27	775	(S) Internal, 1 battery, Std charger; 14m/35m RT
	BAT-0053	27	(720)	(0) Internal, 2 batteries, Std charger; 36/m1h26m RT
	BAT-0122	67	(700.	(O) “M” Cabinet, 1 battery, Std charger; 57m/2h26m RT
	BAT-0103	57	706)	(O) “M” Cabinet, 2 batteries, Std charger; 1h40m/4h2m RT
	BAT-0050	73		(0) “M” Cabinet, 2 batteries, Std chrgr; 2h29m/5h42m RT
	BAT-0103	57		(0) “M” Cabinet, 3 batteries, 15A chrgr; 2h46m/6h57m RT
	BAT-0122	67		(O) “M” Cabinet, 3 batteries, 15A charger; 4h7m/9h24m RT
	BAT-0050	13		(O) “M” cabinet. 4 batteries, 15A chrgr; 5h51m/13h27m RT
	BAT-0050	73		(O j “N” Cabinet, 6 batteries, 15A chrgr; 9h40m/22h12m RT
attery Bracket (Bottom, 17AH)	BKT-0366		N/A	(S)
attery Bracket (Bottom, 31/33 AH)	BKT-0365		N/A	(O)
attery Bracket (Ext Rntm, Bottom)	BKT-0176		N/A	(O)
attery Bracket (Ext Rntm, Top)	BKT-0177		N/A	(O)
attery Bracket (Top, 17/31/33 AH)	BKT-0364	1	N/A	(O)
apacitor	CPR-0433	2	N/A	(S) 15μF; Quantity, 1
over	CAB-0741	-4	N/A	(S)
xt Runtime Kit (External)	SSEBK-000	5	706	(0)
xt Runtime Kit (Internal)	SSERT-070	5	720	(0)
an Ext Rntm (208/240V output)	FAN-0034	1	N/A	(O)
an (208/240V output)	FAN-0033	1	771	(O)
an Ext Rntm (100/120 Voutput)	FAN-0015	1	N/A	(O)
an (100/120 output)	FAN-0031	1	771	(S)
ester Charger 12V 15A	BCA-0004	20	7 0 0	(O)
ine Cord Std 120V	LCA-0227	3	N/A	(S)
ine Cord Grommet w/LCA-0227	GRO-0001	1	N/A	(S)
lastic Front	CAB-0055	2	N/A	(S)
lastic Front Label	LAB-1112	1	N/A	(S)
ibbon Cable (Logic to Power Board)	BAA-0406	1	N/A	(S)
ibbon Cable (RS232)	BAA-0059	1	N/A	(S)

Part Description	Part #	Wt	TIP	Notes:
Temperature Probe, Ambient	THR-0048	1	7 7 7	(S)
Temperature Probe, PFM	THR-0013	1	7 7 7	(S)

Best Power

603 FE, **QFE850VA**

Part Description	Part #	Wt	TIP	(Notes:
1 Board (100-120V input/output)	PCP-0207		721	(S) Included in Parts Kit.
1			721	(O) Included in Parts Kit.
9 1			N/A	(S) Included in Parts Kit.
[illegible] (DC)	[illegible]	[illegible]	773	(S) Included in Parts Kit.
Logic Board	PCL-0172	2	732	(S) *Included in Parts Kit; Specify model, input, output voltage.*
Power Board (200-240V input)	IPCP-0080 I	2	730	(S) Included in Parts Kit.
Power Board (100-120V input)	PCP-0099 I	2	N/A	(S) Included in Parts Kit.
Snubber Board (QFE models only)	PCS-0021	1	N/A	(O) Included in Parts Kit.
Backfeed Relay Driver Board	PCF-0004	1	779	(S)
Backfeed Relay (200-240V input)	RLY-0083	1	779	(O)
Backfeed Relay (100-120V input)	RLY-0085	1	779	(S)
Battery	BAT-0065	27	775	(S) Internal, 1 battery, Std charger; 1 1m/28m RT
	BAT-0053	27	(720)	(0) Internal, 2 batteries, Std charger 29m/1h10m RT
	BAT-0122	67	(700,	(O) "M" Cabinet, 1 battery, Std charger; 45m/2h RT
	BAT-0103	57	706)	(0) "M" Cabinet, 2 batteries, Std charger; 1h19m/3h18m RT
	BAT-0050	73		(0) "M" Cabinet, 2 batteries, Std charger; 2h1m/4h42m RT
	BAT-0103	57		(0) "M" Cabinet, 3 batteries, 15A charger; 2h13m/5h37m RT
	BAT-0122	67		(0) "M" Cabinet, 3 batteries, 1 5A charger; 3h22m/7h46m RT
	BAT-0050	73		(O) "M" Cabinet, 4 batteries, 15A charger; 4h46m/11h5m RT
	BAT-0050	73		(0) "N" Cabinet, 6 batteries, 15A charger, 7h53m/18h18m RT
Battery Bracket (Bottom, 17AH)	BKT-0366	1	N/A	(S)
Battery Bracket (Bottom, 31/33 AH)	BKT-0365	1	N/A	(0)
Battery Bracket (Ext Rntm, Bottom)	BKT-0176	1	N/A	(O)
Battery Bracket (Ext Rntm, Top)	BKT-0177	1	N/A	(O)
Battery Bracket (Top, 17/31/33 AH)	BKT-0364	1	N/A	(0)
Capacitor: 120 VAC	CPR-0446	2	N/A	(S) 18µF; Quantity, 1.
120\208\240 VAC	CPR-0447	2		(0) 20µF; Quantity, 1.
Cover	CAB-0741	4	N/A	(S)
Ext Runtime Kit (External)	SSEBK-0002	5	706	(0)
Ext Runtime Kit (Internal)	SSERT-0700	5	720	(0)
Fan Ext Rntm (208/240V output)	FAN-0034	1	N/A	(0)
Fan (208/240V output)	FAN-0033	1	771	(0)
Fan Ext Rntm (100/120 output)	FAN-0015	1	N/A	(O)
Fan (100/120V output)	FAN-0031	1	771	(S)
Lester Charger 12V 15A	BCA-0004	20	700	(O)
Line Cord Std. 120V	LCA-0227	3	N/A	(S)
Line Cord Grommet w/LCA-0227	GRO-0001	1	N/A	(S)
Plastic Front	CAB-0055	2	N/A	(S)
Plastic Front Label	LAB-1112	1	N/A	(S)
Ribbon Cable (Logic to Pwr Bd)	BAA-0406	1	N/A	(S)

Part Description	Part #	Wt	TIP	Notes:
Ribbon Cable (RS232)	BAA-0059	1	N/A	(S)
Temperature Pmbe, Ambient	THR-0048	1	777	(S)
Temperature Probe, PFM	THR-0013	1	777	(S)

604 FE, **QFE1.15KVA**

Part Description	Part #	Wt	TIP	Notes:
AVR Board (100-120V input/output)	PCP-0207	1	722	(S) Included in Parts Kit.
AVR Board (200-240V output)	PCP-0208	1	722	(O) Included in Parts Kit.
Fuse (charger)	SSFUS-0019	1	N/A	(S) Included in Parts Kit.
Fuses (DC)	FUS-0164	1	773	(S) Included in Parts Kit.
Logic Board	PCL-0172	2	732	(S) Included in Parts Kit; Specify model, input, output voltage.
Power Board (200-240V input)	SSPWA-0019	5	731	(O) Included in Parts Kit.
Power Board (100-120V input)	SSPWA-0013	5	731	(S) Included in Parts Kit.
Power Board *(200-240Vinput QFE models only)*	SSPWA-0018	5	731	(O) Included in Parts Kit.
Power Board (100-120Vinput QFE models only)	SSPWA-0012	5	731	(O) Included in Parts Kit.
Backfeed Relay Driver Board	PCF-0004	1	780	(S)
Backfeed Relay (200-240V)	RLY-0083	1	780	(O)
Backfeed Relay (100-120V)	RLY-0085	1	780	(S)
Battery	BAT-0103 BAT-0122 BAT-0103 BAT-0050 BAT-0103 BAT-0122 BAT-0050 BAT-0050	57 67 57 73 57 67 73 73	776 (706) (701, 706)	(S) Internal, 1 battery, Std charger; 18m/48m RT (O) Internal, 1 battery, Std charger; 30m/1h20m RT (0) "M" Cabinet, 2 batteries, Std charger; 54m/2h18m RT (O) "M" Cabinet, 2 batteries, Std charger; 1h20m/3h19m RT (O) "M" Cabinet, 3 batteries, 15A charger; 1h30m/3h53m RT (0) "M" Cabinet, 3 batteries, 15A charger; 2h24m/5h29m RT (0) "M" Cabinet, 4 batteries, 15A charger; 3h25m/7h49m RT (0) "N" Cabinet, 6 batteries, 15A charger; 5h38m/12h55m RT
Battery Bracket 55/75 AH	BKT-0399	1	N/A	(S)
Capacitor	CPR-0448	2	N/A	(S) 25μF; Quantity, 1.
Cover	CAB-0751	4	N/A	(S)
External Runtime Kit	BTG-0190	6	706	(O)
Fan (100/120V output)	FAN-0050	2	772	(S)
Fan (208/240V output)	FAN-0052	2	772	(O)
Front Panel Label	LAB-1113	1	N/A	(S)
Lester Charger 12V 15A	BCA-0004	20	701	(O)
Line Cord Grommet w\LCA-0042	GRO-0011	1	N/A	(S)
Line Cord Std. 5-15	LCA-0042	2	N/A	(S)
Plastic Front	CAB-0823	2	N/A	(S)
Ribbon Cable (Logic to Power Board)	BAA-0058	1	N/A	(S)
Ribbon Cable (RS232)	BAA-0059	1	N/A	(S)
Temperature Probe, Ambient	THR-0007	1	778	(S)
Temperature Probe, PFM	THR-0013	1	778	(S)
Temperature Probe, Transformer	THR-0015	1	778	(S)

605 FE, **QFE1.4KVA**

Part Description	Part #	Wt	TIP	Notes:
AVR Board (100-120V input/output)	PCP-0207	1	722	(S) Included in Parts Kit.
AVR Board (200-240V output)	PCP-0208	1	722	(O) Included in Parts Kit.
Fuse (charger)	SSFUS-0019	1	N/A	(S) Included in Parts Kit.
Fuses (DC)	FUS-0164	1	773	(S) Included in Parts Kit.
Logic Board	PCL-0172	2	732	(S) Included in Parts Kit; Specify model, input, output voltage.
Power Board (200-240V)	SSPWA-0019	5	731	(O) Included in Parts Kit.
Power Board (100-120V)	SSPWA-0013	5	731	(S) Included in Parts Kit.
Power Board (200-240V input QFE models only)	SSPWA-0018	5	731	(O) Included in Parts Kit.
Power Board (100-120V input QFE models only)	SSPWA-0012	5	731	(O) Included in Parts Kit.
Backfeed Relay Driver Board	PCF-0004	1	780	(S)
Backfeed Relay (200-240V input)	RLY-0083	1	780	(O)
Backfeed Relay (100-120V input)	RLY-0085	1	780	(S)
Battery	BAT-0103 BAT-0122 BAT-0103 BAT-0050 BAT-0103 BAT-0122 BAT-0050 BAT-0050	57 67 57 73 57 67 73 73	776 (706) (701, 706)	(S) Internal, 1 battery, Std charger; 14m/37m RT (O) Internal, 1 battery, Std charger; 21m/56m RT (O) "M" Cabinet, 2 batteries, Std charger; 38m/1h38m RT (O) "M" Cabinet, 2 batteries, Std charger; 55m/2h26m RT (O) "M" Cabinet, 3 batteries, 15A charger; 1h8m/2h49m RT (O) "M" Cabinet, 3 batteries, 15A charger; 1h44m/4h3m RT (O) "M" Cabinet, 4 batteries, 15A charger; 2h31m/5h45m RT (O) "N" Cabinet, 6 batteries, 15A charger; 4h1m/9h42m RT
Battery Bracket 55/75 AH	BKT-0399	1	N/A	(S)
Capacitor: 120 VAC 100\200\220VAC 120\208\240VAC	CPR-0446 CPR-0449 CPR-0449	2 2 2	N/A	(S) 35µF; Quantity, 1. (O) 30µF; Quantity, 1. (O) 30µF; Quantity, 1.
Cover	CAB-0751	4	N/A	(S)
External Runtime Kit	BTG-0190	6	706	(O)
Fan (100/120V output)	FAN-0050	2	772	(S)
Fan (208/240V output)	FAN-0052	2	772	(O)
Front Panel Label	LAB-1113	1	N/A	(S)
Lester Charger 12V 15A	BCA-0004	20	701	(O)
Line Cord Grommet w\LCA-0042	GRO-0011	1	N/A	(S)
Line Cord Std. 5-15	LCA-0042	2	N/A	(S)
Plastic Front	CAB-0823	2	N/A	(S)
Ribbon Cable (Logic to Power Board)	BAA-0058	1	N/A	(S)
Ribbon Cable (RS232)	BAA-0059	1	N/A	(S)
Temperature Probe, Ambient	THR-0007	1	778	(S)
Temperature Probe, PFM	THR-0013	1	778	(S)
Temperature Probe, Transformer	THR-0015	1	778	(S)

SECTION 700

Section 700 Technical Information Publications

This section of your *Service Manual* includes the Technical Information Publications (TIPs) listed below. These TIPs provide more information about the unit and service procedures.

Note: (Q)TIPs are for 50 Hz units only.

TIPs	*Titles*
218	Extended Runtime Table
407	Remote Control Panel Option for FE, FER, FES, QFE, QFER, and QFES Models
503	The FE Series RS232 Communication Port
604	FERRUPS Written Scheduled Maintenance Procedure
605	FERRUPS Scheduled Maintenance and Service. Call Report Form for ME, QME, FD, QFD, and FE Models
700	Adding External Batteries and/or Upgrading the Charger in FERRUPS FWQFE 500-850 VA Models
701	Charger Upgrade and/or Adding External Batteries to FERRUPS FE/QFE 1.15 to 1.4 KVA Models
705	FE Series Calibration through the RS232 Port
706	Extended Runtime Modification for the FERRUPS FE/QFE Series Models
708	Programming the FERRUPS for Use with a Generator
709	Changing the AC Voltages on the FERRUPS FE and QFE 500-850 VA Models
716	Changing the Operating Voltage on FERRUPS FE and QFE 1.15 and 1.4 KVA Models
721	Replacing the Power Factor Module Circuit Board in FE/QFE 500,700, and 850 VA Models
722	Replacing the Power Factor Module Circuit Board in FE/QFE 1.15 and 1.4 KVA Models
730	Replacing the Power Board in FE/QFE 500,700, and 850 VA Models
731	Replacing the Power Board Assembly in FE/QFE 1.15 and 1.4 KVA Models
732	Replacing the Logic Board in FERRUPS FE and QFE 500VA-1.4KVA Models
771	Replacing the Fan in Standard FE and QFE 500,700, and 850 VA Models without Extended Runtime
772	Replacing the Fan in FE and QFE 1.15 and 1.4 KVA Models
773	Replacing the DC Fuse in FE and QFE 500,700, and 850 VA and I. 15 and 1.4 KVA Models
775	Replacing the Batteries in FE and QFE 500,700, and 850 VA Models
776	Replacing the Batteries in FE and QFE 1.15 and 1.4 KVA Models
777	Replacing the Temperature Probes in FE/QFE 500,700, and 850 VA Models
778	Replacing the Temperature Probes in FE/QFE 1. 15 and 1.4 KVA Models
779	Replacing the Backfeed Relay and Backfeed Relay Driver Board in FE and QFE 500,700, and 850 VA Models
780	Replacing the Backfeed Relay and Backfeed Relay Driver Board in FE and QFE I. 15 and 1.4 KVA Models
(Q)709	Changing the AC Voltages on the FERRUPS QFE 500-850 VA Models
(Q)716	Changing the Operating Voltage on FERRUPS QFE 1.15 and 1.4 KVA Models

Best Power
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POWER SYSTEMS

TIP 216
2345
May16.1996

Extended Runtime Table

This table displays by model the most economical battery configurations for extended battery runtimes. If the exact runtime you want is not shown, the next largest runtime is the most economical choice. Example: To obtain a 3-hour runtime for FE500VA order two BAT-0050 batteries in an M cabinet *Extended runtime battery configurations may require larger optional chargers. See the table to select the charger.*

Battery Model #	Weight lbs. (kg)	Dimensions H x W x L in. (cm)	#Amp Hours	Type/Voltage
BAT-0050	74 lbs. (33.5 kg)	6.75 x 7.25 x 12.9 (22.2 x 18.4 ~32.7)	200 AH	AGM/6 V
BAT-0058	15 lbs. (6.6 kg)	6.1 x 3 x 7.1 (15.6 x 7.6 x 18.1)	17 AH	AGM/12 V
BAT-0065	26 lbs. (11.6 kg)	7.1 x 5.25 x 7.75 (18.1 x 13.3 x 19.7)	33 AH	AGM/12 V
BAT-0103	58 lbs. (26.1 kg)	10.2 x 6.6 x 8.7 (26 x 17 x 22)	75 AH	AGM/12 V
BAT-0122	67 lbs. (30.2 kg)	12 x 6.7 x 9.5 (30.5 x 17 x 24.1)	100 AH	AGM/12 V

Model #	Runtime (Full/Half)	Battery (Quantity/ Type)	Cabinet/ Charger
FE/QFE 500VA	■ **9M/25M**	1/BAT-0058	—/Std
	□ *22M/53M*	1/BAT-0065	—/Std
	□ *53M/2H9*	2/BAT-0065	—/Std
	1H29/3H36	1/BAT-0122	M/Std
	2H31/6H5	*2/BAT-0103*	*M/Std*
	★ 3H37/8H28	2/BAT-0050	M/Std
	★4H15/10H16	3/BAT-0103	M/15 A
	★ 6H/13H56	3/BAT-0122	M/15 A
	★8H32/1 9H57	4/BAT-0050	M/15 A
FE/QIFE [illegible]A	■ **14M/35M**	1/BAT-0065	—/Std
	□ *36M/1H26*	2/BAT-0065	—/Std
	57M/2H26	1/BAT-0122	M/Std
	1H40/4H2	*2/BAT-0103*	*M/Std*
	2H29/5H42	2/BAT-0050	M/Std
	★ 4H7/9H24	3/BAT-0122	M/1 5 A
	★5H51/13H27	4/BAT-0050	M/15 A
	★9H40/22H12	6/BAT-0050	N/15 A
FE/QFE 850VA	. **11M/28M**	1/BAT-0065	—/Std
	□ *29,WIHIO*	2/BAT-0065	—/Std
	45M/2H	1/BAT-0122	M/Std
	1H19/3H16	*2/BAT-0103*	*M/Std*
	2H1/4H42	2/BAT-0050	M/Std
	3H22/7H46	3/BAT-0122	M/15 A
	★ 4H46/11H5	4/BAT-0050	M/15 A
	★7H53/18H18	6/BAT-0050	N/15 A
FE/QFE 1.15KVA	● **18M/48M**	1/BAT-0103	—/Std
	□ *30M/1H20*	1/BAT-0122	—/Std
	54M/2H18	*2/BAT-0103*	*M/Std*
	1H20/3H19	2/BAT-0050	M/Std
	2H24/5H29	3/BAT-0122	M/15 A
	3H25/7H49	4/BAT-0050	M/15 A
	★5H38/12H55	6/BAT-0050	N/15 A

Model #	Runtime (Full/Half)	Battery (Quantity/ Type)	Cabinet Charger
FE/QFE 1.4KVA	■ **14M/37M**	1/BAT-0103	—/Std
	□ *21M/56M*	1/BAT-0122	—/Std
	38M/1H38	2/BAT-0103	M/Std
	55M/2H26	2/BAT-0050	M/Std
	1H8/2H49	*3/BAT-0103*	*M/15 A*
	1H44/4H3	3/BAT-0122	M/15 A
	2H31/5H45	4/BAT-0050	M/15 A
	★ 4H1/9H42	6/BAT-0050	N/15 A
FE/QFE 1.8KVA	■ **11M/30M**	4/BAT-0058	—/Std
	□ *1H26/3H26*	4/BAT-0103	—/Std
	2H12/4H53	4/BAT-0122	M/Std
	★ *3H38/8H22*	*8/BAT-0103*	*N/Std*
	★ 5H9/11H30	8/BAT-0050	N/Std
	★ 6H7/14H6	12/BAT-0103	P/15 A
	★8H30/18H53	12/BAT-0122	P/15 A
	★ 12H8/27H6	16/BAT-0050	Q/15 A
FE/QFE 2.1KVA	■ **9M/25M**	4/BAT-0058	—/Std
	□ *1H6/2H43*	4/BAT-0103	—/Std
	1H41/3H54	4/BAT-0122	M/Std
	2H50/6H37	*8/BAT-0103*	*N/Std*
	★ 4H3/9H10	8/BAT-0050	NIStd
	★ 4H46/11H8	12/BAT-0103	P/15 A
	★ 6H42/15H4	12/BAT-0122	P/15 A
	★9H33/21H36	16/BAT-0050	Q/15 A
FE/QFE 3.1KVA	■ **14M/35M**	4/BAT-0065	—/Std
	□ *37M/1H38*	4/BAT-0103	—/Std
	57M/2H27	*4/BAT-0122*	*M/Std*
	1H41/4H3	8/BAT-0103	NIStd
	2H29/5H44	8/BAT-0050	N/Std
	2H52/6H50	12/BAT-0103	P/15 A
	★ 4H7/9H27	12/BAT-0122	P/15 A
	★5H52/13H30	16/BAT-0050	Q/15 A
	★9H41/22H18	24/BAT-0050	Q/15 A
FE/QFE 4.3KVA	■ **10M/24M**	4/BAT-0065	—/Std
	□ *27M/1H6*	4/BAT-0103	—/Std
	40M/1H42	4/BAT-0122	N/Std
	1H11/2H51	8/BAT-0103	N/Std
	1H49/4H5	8/BAT-0050	NIStd
	2H6/4H49	12/BAT-0103	P/10 A
	3H4/6H46	12/BAT-0122	P/10 A
	★ 4H21/9H39	16/BAT-0050	Q/20 A
	★7H12/15H56	24/BAT-0050	Q/20 A

Model #	Runtime (Full/Half)	Battery (Quantity/ Type)	Cabinet/ Charger
FE/QFE 5.3KVA	■ **20M/50M**	4/BAT-0103	—/Std
	27M/1H14	4/BAT-0122	N/Std
	49M/2H10	8/BAT-0103	N/Std
	1H12/3H8	8/BAT-0050	N/Std
	1H27/3H39	*12/BAT-0103*	*P/10 A*
	2H13/5H11	12/BAT-0122	P/10 A
	3H8/7H22	16/BAT-0050	Q/20 A
	★5H10/12H10	24/BAT-0050	Q/20 A
FE/QFE 7KVA	■ **12M/33M**	4/BAT-0103	—/Std
	□ *18M/50M*	4/BAT-0122	—/Std
	34M/1H28	8/BAT-0103	N/Std
	48M/2H13	*8/BAT-0050*	*N/Std*
	1 HRH33	12/BAT-0103	P/10 A
	1H32/3H41	12/BAT-0122	P/10 A
	2H16/5H1	16/BAT-0050	Q/20 A
	★ 3H45/8H3	24/BAT-0050	Q/20 A
FE/QFE I OKVA	● **11M/26M**	10/BAT-0065	N/Std
	27M/1H10	10/BAT-0103	N/Std
	41 M/1H48	10/BAT-0122	P/Std
	1H13/2H5	*20/BAT-0103*	*Q/Std*
	1H51/4H1	20/BAT-0050	Q/Std
	2H9/5H2	30/BAT-0103	Q+N/10 A
	3H7/7H4	30/BAT-0122	Q+P/10 A
	★ 4H26/10H4	40/BAT-0050	Qx2/20 A
	★7H20/16H3	60/BAT-0050	Qx3/20 A
FE/QFE 12.5KVA	● **18M/48M**	10/BAT-0103	N/Std
	27M/1H13	10/BAT-0122	P/Std
	49M/2H7	*20/BAT-0103*	*Q/Std*
	1H12/3H4	20/BAT-0050	Q/Std
	2H12/5H5	30/BAT-0122	Q+P/10 A
	3H8/7H14	40/BAT-0050	Qx2/20 A
	★5H10/11H57	60/BAT-0050	Qx3/20 A
FE/QFE 18KVA	● **10M/26M**	10/BAT-0103	N/Std
	14M/39M	10/BAT-0122	P/Std
	27M/1 HI0	20/BAT-0103	Q/Std
	37M/1 H46	20/BAT-0050	Q/Std
	48M/2H4	30/BAT-0103	Q+N/10 A
	1H13/3H1	30/BAT-0122	Q+P/10 A
	1H49/4H17	40/BAT-0050	Qx2/20 A
	3H4/7H5	60/BAT-0050	Qx3/20A

■ = Standard internal battery.
● = Standard **external** battery.
□ = *Optional internal battery will fit inside unit with standard charger.*
★ = Actual runtimes will vary based on many factors, Including temperature, load. age and condition of batteries, number of battery discharge cycles, etc.

LPT-0218K

N9246 Highway 80 South, PO. Box 280, Necedah, WI 54646 U.S.A. , Web Site: www.bestpower.com
1-608-565-7200 , 1-800-356-5794 [U.S.A. and Canada] , Fax: 1-608-565-2221
Service: 1-800-356-5737 , Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

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TIP 407
March 6, 1997

Remote Control Panel Option for FE, FER, FES, QFE, QFER and QFES Models

This Technical Information Publication explains how to install and use the FERRUPS Remote Control Panel. Each Remote Control Panel (RCP) has three lights: Ready, Battery Power, and Alarm. The Remote also has a 16-character display and 16 keys. Using the Remote Control Panel, you can monitor the UPS by displaying parameters, operating modes, and alarms. You can also use the Remote to control the UPS' operating modes, turn off the alarm beeper or the charger, or start a system test

TIP 407 is for FE FERRUPS models. For older FERRUPS models, you need TIP 405 or TIP 406; call Best Power's Worldwide Service at I-800-356-5737 (U.S.A. and Canada) or l-608-565-2100, or call the nearest Best Power office.

Unpack the Remote Control Panel. You should have received the following:

- the Remote Control Panel,
- a six-foot cable*, and
- A DB25-to-RJ-11 adapter (attached to the cable).

*Best Power offers longer cable; for more information on cable lengths, see Section 103

Start with Section 100 to install the Remote Control Panel; then, go on to Section 200 to learn to use the Remote.

LPT-0407E

N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

100 Installing the Remote Control Panel

101 Connecting the Remote Control Panel

1. Before you install the Remote Control Panel, make sure your FERRUPS is completely installed and started. (Follow the instructions in your FERRUPS User and Installation manuals.)

   Note: If you plan to turn the FERRUPS off, make sure you shut off your protected equipment first (or connect the equipment directly to AC input power).

2. Notice that the Remote has a six-foot cable attached, and this cable is plugged into the DB25-to-RJ-11 adapter (the connector with 2 screws). Figure 1 below shows the Remote Control Panel, the cable, and the adapter. Follow steps a and b to connect the cable to your FERRUPS.

   a. Plug the adapter (Best Power Part Number CNC-03 1 I) into the RS232 port on the back of your FERRUPS. Then, tighten the adapter's screws.

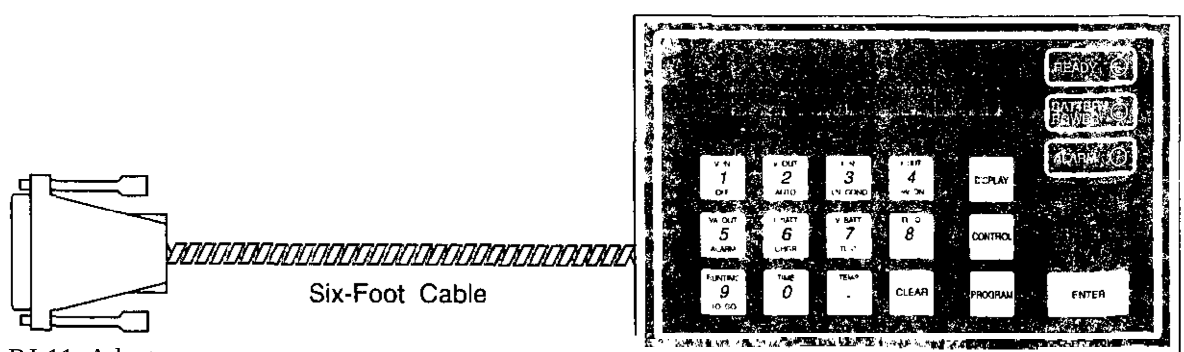
   b. Once the Remote Control Panel is connected, it will display the Best Power logo. Press [ENTER]; the Remote Control Panel will display "**Connecting**" and will automatically start communication with the UPS.[1]

3. If the Control Panel starts scrolling messages from the FERRUPS (starting with "FERRUPS by BEST") it is communicating; go on to Section 102 to set the time and date.

   If the Remote Control Panel shows

   - a blank display,
   - random characters, or
   - "Cannot Connect,"

   the Control Panel's baud rate may be different from the FERRUPS baud rate. This means the Control Panel and the FERRUPS are not set up to communicate at the same rate. To change the Control Panel's baud rate, find the label on the back of the Remote Control Panel. This label tells you how to use the Customer Configuration Menu. Using this menu, change the baud rate to other settings until your Remote Control Panel can communicate with the FERRUPS. If this does not solve the problem, call Best Power's Worldwide Service at I-800-356-5737 (U.S.A. and Canada) or I-608-565-2100, or call the nearest Best Power office.



RJ-11 Adapter

Remote Control Panel

Figure 2

If you have changed "Connect" in the Customer Configuration Menu to "No" (see the Remote Control Panel's back label), must follow the steps in Section 208 to start communication with the UPS.

If you have a control panel on the front of your FERRIS:

You should have set the time and date when you followed the startup instructions in the User Manual. You can skip this section and use the rest of this TIP to learn more about the control panel.

If you do not have a control panel on the front of your FERRUPS:

You should set the time and date using the steps below. FERRUPS needs the correct time and date for its Alarm and Inverter Logs, so you should reset the time and date whenever FERRUPS has been shut down.

1. Before you can set the time and date, you must enter the User password (377). To enter the password, press these keys:

PRESS THESE KEYS:	DISPLAY SHOWS:
[CLEAR]	FERRUPS by BEST
[PROGRAM]	Password:
[3] [7] [7]	Password: 377
[ENTER]	Level: User

Some parameters require the Service password (2639) for changes. (See Section 300 for parameter information.)

2. Next, set the time (parameter 0)

PRESS THESE KEYS:	DISPLAY SHOWS:
[DISPLAY]	Display:
[0]	Display: 0
[ENTER]	00 Time: 11:30:20
[PROGRAM]	00 Pgm:

Enter the correct time using the 24-hour system. To do this, enter times from 1:00 a.m. to 12:59 p.m. just as you would read them from a clock. From 1:00 p.m. to 11:59, however, add 12 hours to the "clock time." So 8:30 a.m. would be entered [8] [3] [0], but 8:30 p.m. would be entered [2] [0] [3] [O]. Midnight is [0] [0] [0] [0], 12:30 a.m. is [0] [0] [3] [0], and so on. For example, if the time is 9:30 a.m.:

PRESS THESE KEYS:	DISPLAY SHOWS:
[9][3][0]	00 Pgm: 930
[ENTER]	00 Time 09:30:00

3. Set the date next (parameter 10). To display the date:

PRESS THESE KEYS:	DISPLAY SHOWS:
[DISPLAY]	Display:
[1][0]	Display: IO
[ENTER]	IO Date: 01/01/93
[PROGRAM]	IO Pgm:

Now, enter the number of the month, then the number of the day, and then the year. For example, to enter June 4, 1993, press the keys shown below:

PRESS THESE KEYS:	DISPLAY SHOWS:
[0] [6] [0] [4] [9] [3]	10 Pgm: 060493
[ENTER]	IO Date 06/04/93

Clear the password by pressing the [CLEAR] key twice (until you see the message "Password Cleared" on the control panel display). **If you plan to use the RS232 port for anything other than a Remote Control Panel now, see Section 209.**

103 Using Longer Cables Between FERRUPS and the Remote Control Panel

The Remote Control Panel comes with a six-foot (1.8-meter) cable. To order more cable, call Best Power. The Remote uses standard six-conductor telephone cable with RJ-11 telephone plugs on each end. The table below shows the maximum length for cables with different wire sizes. (Note that the lengths for some units are different from the lengths for other models.) If your cable is longer than the maximum length for your model and wire size, you may have problems communicating with the UPS.

Cable's Wire Size	Maximum Cable Lengths	
	500 VA - 1.4 kVA Models	Other Models
24 AWG	175 feet (53 meters)	250 feet (76 meters)
22 AWG	275 feet (84 meters)	375 feet (114 meters)
20 AWG	425 feet (130 meters)	625 feet (191 meters)
18 AWG	700 feet (213 meters)	1,000 feet (305 meters)

200 Using the Remote Control Panel

See Section 302 of your FERRUPS User Manual for a basic explanation of how to use your Remote Control Panel. The User Manual explains how you can use the Remote Control Panel to change operating modes, enter passwords, and display and change parameters. It also explains how to lock the control panel and how to use the Configuration Menu.

Sections 201 through 208 give you more information on using the Remote Control Panel. These sections briefly explain how to use the lights and keys, how to disable the alarm beep or the charger, how to start the User Test Alarm, how to start a system test, how to display the Best Power logo, and how to start communication with the control panel if you have turned off its automatic connect feature. Section 20[illegible] explains how to end Remote Control Panel communication; you should [illegible] the RS232 port for another function ([illegible]).

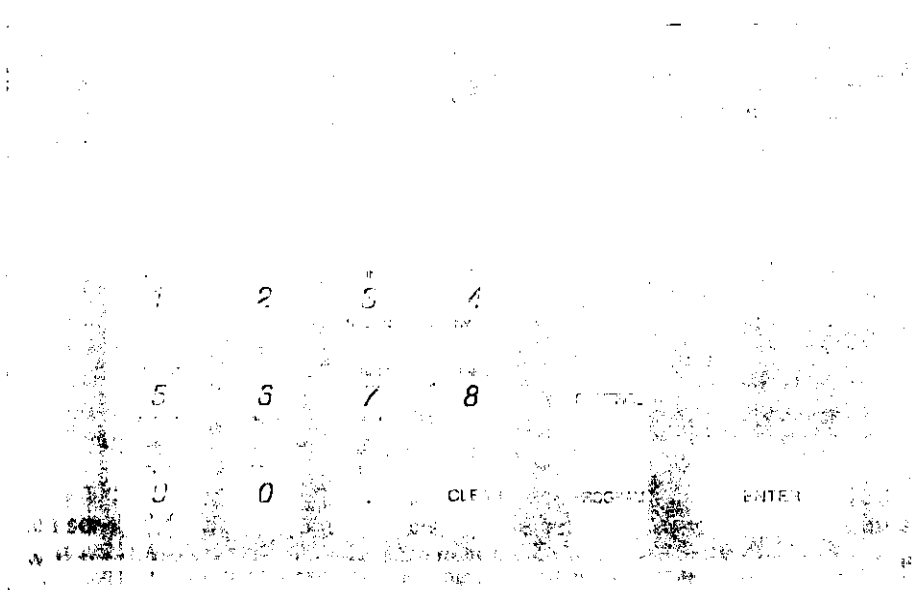


Figure [illegible]

201 Understanding the Eights

The Remote Control Panel includes three status lights. The table below explains what the lights mean

Light	Description
Ready (green)	When this light is on, your FERRUPS is operating normally (using AC input power). The UPS is ready to supply backup power from the battery if there is a power outage.
Battery Power (yellow)	When this light is on, thc FERRUPS has detected input power problems. The UPS is using its battery backup power to provide power for your equipment.
Alarm (red)	When this light is on, the UPS is sounding an alarm. See your User Manual.

202 Using the Keys

The Remote Control Panel keys let you control UPS operation and display and program the FERRUPS parameters. The table below and on the next page describes what you can do using each key

Key	Function(s)	How to Use the Key
DISPLAY]	Shows parameters and their values on the Remote Control Panel's display.	Eleven of the parameters are printed in green on top of the numbered keys so you can display them easily. You can use keys [0] through [9] to display parameters 0 through 9 and [.] to display parameter 1 l. For example, to display Volts In (parameter I), press [DISPLAY], then [I], and then [ENTER]. To display other parameters that are not printed on the keys, press [DISPLAY], then enter the parameter number, and then press [ENTER]. For example, to display parameter 40, Serial Number, press [DISPLAY], [4], [0], and [ENTER]. (Section 300, the Parameter Table. lists the parameters and explains them.)
CONTROL]	•Controls (changes) UPS operating modes,	•The control functions are printed in red on the bottom of keys l-7. These functions include the four UPS operating modes, which are explained in the User Manual. Example: To turn the UPS off, press [CONTROL], [1], [ENTER], and then [ENTER].
	*Disables (silences) alarms,	•You can also use the [CONTROL] key to disable (silence) alarms. See Section 203.
	•Starts the User Test Alarm,	•When you use the [CONTROL] key with the [8] key, you can start a User Test Alarm. See Section 204.
	•Disables the charger,	•Using the [CONTROL] key, you can disable the charger and enable it again. See Section 205.
	*Starts the System Test.	•The [CONTROL] key also lets you start the Automatic System Test manually. See Section 206.

	Function(s)	How to Use the Key
[PROGRAM]	•Enters passwords, or Changes parameter values.	•To enter a password, make sure the Remote is showing its normal scrolling display. Then, press [PROGRAM], enter the password, and press [ENTER]. User password = 377; Service password = 2639. •To change a parameter, enter the correct password and display the parameter first. Then, press [PROGRAM], enter the new value, and press [ENTER]. (See Section 300.)
[ENTER]	•Enters commands, or •Displays the next parameter.	•Use the [ENTER] key to enter a display, finish a parameter change, or confirm a [CONTROL] function. •When you are displaying parameters, use the [ENTER] key to display the next parameter.
[CLEAR]	•Deletes your last keystroke or function, Clears a password, or •Silences an alarm.	•If you press the wrong key at any time, press [CLEAR] to undo the keystroke. [CLEAR] also cancels functions such as special displays or parameter programming. •To clear a password, press [CLEAR] until you see "Password Cleared" on the display. In 8.06 and higher software, [illegible] [CLEAR] key also temporarily silences an alarm.
[.]	Moves the display back one parameter.	When you are displaying parameters, use the [illegible] key to display the previous parameter. You can also use this key when you enter parameter values [illegible] need [illegible] decimal [illegible]nt.
[0]	•Pauses [illegible] scrolling display.	[illegible] pause a scrolling display ([illegible]e the Alarm or Inverter Log), press [illegible] to res[illegible]t the [illegible]lling [illegible] [0] again.
[1] through [0]	•Enters a parameter number, or •Displays the next log entry.	•When you use the [illegible]SPLAY [illegible]y, you can use any of the number key[illegible] to specify the parameter [illegible] want to display. •When you display the Alarm Log or the Inverter Log, use the number keys to go on to the next log entry. (See the User Manual.)

203 Disabling the Alarm Beep

To disable the beeper for all UPS alarms (but not the battery power" beep), press these keys:

PRESS THESE KEYS:	DISPLAY SHOWS:
[CONTROL]	Control:
[5] ALARM	Control: Alarm
[ENTER]	ENTER to Confirm
[ENTER]	Beeper: Disabled

The last message, "Becpcr: Disabled," will continue to scroll on the display until you enable the alarm beep again. UPS alarms will still be displayed on the Remote Control Panel. To enable the alarm beep again, follow the same steps. When you finish, the display will show "Beeper: Enabled." The beeper will also be automatically enabled whenever you change the [illegible]UPS operating mode. (See Section 202 and User Manual for more information on changing operating modes.)

204 User Test Alarm

FERRUPS includes a User Test Alarm that you can switch on and off. This shows you how FERRUPS will inform you of an alarm condition. To start the User Test Alarm, press these keys:

PRESS THESE KEYS:	DISPLAY SHOWS:
[CONTROL]	Control:
[8]	Control: AlmTest
[ENTER]	ENTER to Confirm
[ENTER]	FERRUPS by BEST

The UPS and Remote Control Panel will beep the alarm code for the User Test Alarm (alarm J). The Remote Control Panel will show its normal scrolling display, but it will add "---Alarms---" and "User Test Alarm" to this display. To clear the User Test Alarm, press the same keys: [CONTROL] [8] [ENTER] [ENTER]

205 Disabling and Enabling the Charger

Only a trained service **person should disable** the **FERRUPS'** battery charger. To disable the charger, press the keys shown below:

PRESS THESE KEYS:	DISPLAY SHOWS:
[CONTROL]	Control:
[6] CHGR	Control: Charger
[ENTER]	ENTER to Confirm
[ENTER]	Charger: Disabled

The last display, "Charger: Disabled," will continue to scroll on the display until you enable the charger again. For normal **operation,** the charger **must** be enabied. To enable the charger, follow the same steps. When you finish, the display will show "Charger: Auto."

206 Starting the System Test

Using the [CONTROL] and [7] keys, you can start the Automatic System Test that the User Manual describes. (See Section 303 in the User Manual.) FERRUPS does this test automatically, usually every 7 days, but there may be times when you want to start the test yourself. To do this, press the keys shown below:

PRESS THESE KEYS:	DISPLAY SHOWS;
[CONTROL]	Control:
[7] TEST	Control: SysTest
[ENTER]	ENTER to Confirm
[ENTER]	Sys Test Started

The Remote Control Panel will display parameter 26 (Test Results) as the FERRUPS does the System Test. This parameter shows the results of the test. (If the display does not show this parameter, press [DISPLAY] [ENTER].) The FERRUPS should find no problems; if this happens, parameter 26 will show that FERRUPS has "PASSED" each part of the test. If there is a problem, FERRUPS will sound an alarm. (See Section 303 of the User Manual.)

207 Displaying the Best Power Logo

You can display the moving sine-wave with the words "Best Power" by pressing the [DISPLAY] and [CLEAR] keys at the same time. To return to the previous display, press any key.

208 Establishing Communication

When you first receive the Remote Control Panel, it is set up to establish communication with the UPS automatically whenever you connect it to a FERRUPS RS232 port. However, the Remote Control Panel's Configuration menu lets you turn that feature off. (See the "Connect" menu item in Figure 3.) If you have turned the feature off, you must follow the procedure on the next page whenever you reconnect the Remote Control Panel to the FERRUPS RS232 port.

Remote Control Panel **(RCP)**

Access Instructions for Configuration Menu

Simultaneously press ***[CONTROL] and [PROGRAM]*** *to enter* ***RCP*** Configuration *menu*

At any time: Press [ENTER] to display/edit next menu item
Press [PROGRAM] to exit menu and save changes
Press [CLEAR] to exit menu without saving changes

Menu Item	Range	Notes
Baud Rate	0 - 5	0=300, 1=1200, 2=2400, 3=4800, 4=9600, 5=19200
Brightness	0 - 7	Display brightness: 0=Min, 7=Max
Beeper	0 - 1	Beeper enabled? 0=No, 1=Yes
Keyclick	0 - 1	Keyclick enabled? 0=No, 1=Yes
Repeat	0 - 1	Autorepeat of depressed key? 0=No, 1=Yes
Connect	0 - 1	Send '123DCP' at startup? 0=No, 1=Yes

Figure 3 - Label on the back of the Remote Control Panel (RCP).

This **procedure is only necessary if**

1) **you have changed the last item of** the **Customer Configuration Menu (Connect) to "0" (No) (see Figure 3),**

AND

2) **the Remote Control Panel is connected to the UPS' RS232 port (not the front of a 4.3-18 kVA UPS).**

If both of these are true, follow the procedure below whenever you reconnect the Remote Control Panel to the UPS. This procedure allows the Remote Control Panel to communicate with the UPS.

PRESS THESE KEYS:	DISPLAY SHOWS:
	Best Power logo
[ENTER] [CLEAR] [CLEAR]	
[ENTER]	=>
[1] [2] [3]	=>123
[DISPLAY]	=>123D
[CONTROL]	=>123DC
[PROGRAM]	=>123DCP
[ENTER]	FERRUPS Remote FERRUPS by BEST SysMode: Auto Status: Ready

If the Remote Control Panel does not respond and shows a blank display or random characters while you send the "123DCP" message, the Remote Control Panel's baud rate may not match the UPS baud rate. To solve this problem you can use the Customer Configuration Menu to change the baud rate. (See Figure 3 or the label on the back of your Remote Control Panel.)

Note: If you need to use the RS232 port for other functions (such as terminal communication, CheckUPS, or other power monitoring software), see Section 209 to terminate communication with the FERRUPS. If you do not terminate communication, the FERRUPS will only be able to communicate with the Control Panel.

209 Ending Remote Control Panel Communication

Once you have connected a Remote Control Panel to the RS232 port and used it to communicate with the FERRUPS, the RS232 port is ***in*** the Control Panel mode. When the port is in this mode, you cannot use it for other functions (like terminal communication, CheckUPS software, or other power monitoring software) until you end (terminate) Remote Control Panel communication.

This is not necessary if you only plan to use the RS232 port for Remote Control Panel communication.

To end communication, clear any passwords you have entered by pressing the [CLEAR] key until you see "Password Cleared" on the display. Then, press the keys shown below.

PRESS THESE KEYS:	DISPLAY SHOWS
[CLEAR] and [ ] at the same time	
[ENTER]	=>

The "=>" on the display shows you that you have ended Remote Control Panel communication. If you do not disconnect the Remote Control Panel from the port, you must follow the steps in Section 208 to restart communication. If you do disconnect the Remote Control Panel, it will automatically establish communication when you reconnect it (unless you have changed the "Connect" item in the Configuration Menu; if you have, see Section 208).

300 Parameter Table

The Parameter Table below lists the parameters you can display and change with the Remote Control Panel. The table shows parameters, their ranges, and the passwords you need to change them. Parameters let you display an operating condition, calibrate an alarm setpoint or metering function, display alarm and inverter logs, and perform other functions.

The table sometimes shows different parameters for different revisions of FERRUPS software. If you are not sure which software version is in your FERRUPS, display parameter 120. If parameter 120 is SW Ver, it will show your software version; if not, display parameter 137 to see the software version.

Call Best Power's Worldwide Service at 1-800-356-5737 or 1-608-565-2100 before you try to change any parameters except 0 **(Time), 10 (Date), and 15 (Unit ID). Other parameters should only he changed by qualified service personnel who are using the proper metering equipment. Setting parame-**ters **incorrectly may make the FERRUPS malfunction. (If you are outside of the United States or Canada, please call the nearest Best Power office before you change any parameters except 0, 10 and 15.)**

Number	Sample Display	Password	Range	Explanation
0	00Time 07:04:00	User	00:00:00-23:59:59	System Time. FERRUPS uses this time to record alarms and inverter runs. Reset time when you restart the unit after DC power has been off.
1	01 v In 120.7	Service	0.0-500.0 (In 8.01 software, 00-300.0)	The input voltage FERRUPS is receiving. When this value drops below the brownout voltage, FERRUPS switches to inverter.
2	02 V Out 120.7	Service	0.0-500.0 (I" 8.01 software, 0.0-300.0)	The voltage FERRUPS is providing to your equipment.
3	03 --Reserved--			--
4	04 I Out 5.3	Service	0.0-220.0	The current your equipment is drawing from FERRUPS.
5	05 VA Out 637	Change No Allowed	O-27000	Volt-Amps Out. The total "apparent power" your equipment is drawing from FERRUPS. This value is based on parameters 2 and 4, and should be less than or equal to VALimit, parameter 19.
6	06 I Batt 0.5	Service	0.0-200.0	When the UPS runs on battery power, this is the amount of cu rent (in amps) the batteries are supplying to the UPS. When th UPS runs on AC line, this is the charging current.
7	07 V Batt 13.48	Service	0.0-175.00	Battery voltage. The FERRUPS will alarm if this value is too low.
8	08 Freq 60.43 Hz	Change No! Allowed	47.00-63.00	During normal operation, this is the frequency of the AC input power the FERRUPS is receiving. If this value falls outside preset limits, the FERRUPS switches to battery power. When the UPS is running on battery power. this is the frequency it is supplying to your equipment.
9	39 RunTime 12m	Change Not Allowed	0-9999	The estimated amount of time the FERRUPS will continue support your equipment when the FERRUPS is running on tery power. he UPS will alarm when this value falls below a "reset limit.
10	I 0 Date 06/01/93	User	01/01/1988-12/31/2166	Date. The FERRUPS uses this date to record alarms and invert er runs. Reset the date when you restart the unit after DC power has been turned off.
. or 11[2]	11 Amb Temp 24c	Change Not Allowed	-63 to 193	The temperature (in Celsius) inside the unit. The FERRUPS will alarm and shut down if this value is too high.
12	12 SinkTemp 24c	Change Not Allowed	-63-193	The temperature of the heatsink. The UPS will alarm if this value is too high.
13	I3 --Reserved--	(Service to display.)		--
14	14 XfmrTemp 28c	Change Not Allowed	-63 to 193	The temperature of the transformer. The UPS will alarm and shut down if this value is too high. (This parameter is only active for models that monitor transformer temperature; for other models, the display will always show -63c.)
15	15 Unit ID Network #1 UPS	Service	up to 20 characters.	Unit ID. You can enter any string of 20 characters or less into this parameter. This string can help you identify individual FERRUPS units in network environments that use more than one UPS.

' On a FERRUPS Control panel, you can display the Ambient Temperature by pressing [DISPLAY] [ ] [ENTER] or [DISPLA' [I] [I] [ENTER].

Number	Sample Display	Password	Range	Explanation
16	16 FullLoad% 075	Change Not Allowed	0-150	Percent of Full Load. The percentage of the UPS' total capacity that your equipment is actually using.
17	17 Watts 465	Change Not Allowed	0-15000	The total "real power" your equipment is drawing from the FERRUPS.
18	18 PF 0.73 Lead	Change Not Allowed	0.00-1.00	The power factor of your equipment; the difference in the way it draws voltage and current. Power factor = Watts Out (parameter 17) divided by VA Out (parameter 5). This parameter also tells whether the power factor is leading (Lead), lagging (Lag), or distortion (Dist).
19	19 VALimit 850	Change Not Allowed	350-18000	The maximum volt-amps the FERRUPS can supply to your equipment at the present power factor. The UPS will alarm when VA Out (parameter 5) is higher than this value.
20	20 #PwrOut 1	Change Not Allowed	0-65535	The number of times there has been a loss of input power since you started the FERRUPS.
21	21 #OvrLds 0	Change Not Allowed	0-65535	The number of times the FERRUPS has sensed an overload; that is, the number of times VA Out has been greater than VA Limit.
22	22 Sys Hrs 00000	Change Not Allowed	0-65535	The total number of hours FERRUPS has been operating, regardless of mode. This number does not increase while the On/Off switch is turned off.
23	23 InvMin 0000.0	Change Not Allowed	0000.0-6553.5	The total number of minutes the inverter has run since startup.
24	24 Inverter Log A 0319 2127 1215	Change Not Allowed	Not Applicable	A record of the date, time, duration and reason for the last 20 inverter (battery power) runs. (See the User Manual.)
25	25 Alarm Log A 0319 2127 1215	Change Not Allowed	Not Applicable	A record of the date, time duration and reason for the last 20 alarms. (See the User Manual.)
26	26 Test Results (See the Explanation column.)	Change Not Allowed	Not Applicable.	This parameter records the results of the last system test. The parameter display includes the time and date of the test and the results of each part of the system test. (See the User Manual)
27	27 Crest 1.41	Change Not Allowed	0.00-5.00	Crust factor (peak AC amps out divided by RMS AC amps out).
28	28 BrnLvl 79.8	Change Not Allowed	0.0-500.0 (In 8.01 software, 74.4-192.0)	The AC input voltage at which FERRUPS will switch to inverter (battery power). If extended brownout (parameter 63) is set to "Yes," this varies from [illegible] nominal AC volts in at no load to 80% at full load. If parameter 63 is set to "No," this is fixed at 80% of nominal AC volts in. See parameter 64.
29	29 BeepFreq 1320	Service	0-9999	This parameter sets the pitch of the beeper. Smaller numbers set the pitch higher; larger numbers set it lower.
30	30 MinDCV 11.36	Service	0.00-200.0	The minimum battery voltage measured since you started the UPS or since the last time you used the extendedhistory command.
31	31 Max DCV 13.59	Service	0.00-200.00	The maximum battery voltage measured since you started the UPS or since the last time you used the extendedhistory command.
32	32 Min ACVI 0.2	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC input voltage measured since you started the UPS or since the last time you used the extendedhistory command.

Number	Sample Display	Password	Range	Explanation
33	33 MaxACVI 125.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC input voltage measured since you started the UPS or since the last time you used the extendedhistory command.
34	34 MinACVO 119.1	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC output voltage measured since you started the UPS or since the last time you used the extendedhistory command
35	35 MaxACVO 122.5	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC output voltage measured since you started the UPS or since the last time you used the extendedhistory command.
36	36 Min VA 0	Service	0-20000	The minimum volt-ampere output measured since you started the UPS or since the last time you used the extendedhistory command.
37	37 Max VA 700	Service	0-30000	The maximum volt-ampere output measured since you started the UPS or since the last time you used the extendedhistory command.
38	38 # Bad PW 0	Service	O-65535	The number of times an invalid password was entered.
39	39 Ctrl PW 0)No	User	0)No-1)Yes	If this is set to 1)Yes, you need a User password (or a higher password) to use the red Control key functions on your Remote Control Panel and to use some commands during terminal communication. If this is set to 0)No, you do not need a password to use these functions or commands.
40	40 Serial Number FE850VA12345	Change Not Allowed	Not Applicable	The FERRUPS' factory serial number. This is used to identify your FERRUPS.
41	41 ModelIndex 3 03: FE850VA	Change Not Allowed	1:FE500VA-14:FE18KVA	Your FERRUPS' size and model number.
42	42 NomFrq 1)60Hz	Change Not Allowed	0)50Hz-1)60Hz	The nominal frequency of the AC input and output voltages
43	43 NomVIn 120.0	Change Not Allowed	60.0-500.0 (In 8.01 software, 100.0-300.0)	The nominal AC input voltage to the FERRUPS.
44	44 NomVOut 120.0	Change Not Allowed	60.0-500.0 (In 8.01 software, 75.0-500.0)	The nominal AC output voltage from the FERRUPS to the protected equipment.
45	45 RatedVA 850	Change Not Allowed	100-30000	The maximum rated volt-amperes that the FERRUPS may deliver to your protected equipment without sounding an Overload alarm.
46	46 RatedW 600	Change Not Allowed	100-30000	The maximum rated watts that the FERRUPS may provide to your protected equipment without sounding an Overload alarm.
47	47 ILimitLvl 123	Change Not Allowed	10-253	The level at which the FERRUPS' inverter limits current drawn from the batteries.
48	48 ILimitAmp 229	Change Not Allowed	O-600	The approximate level of DC current (in amps) at which the FERRUPS' inverter will limit the current drawn from the batteries.
49	49 Rackmnt 0)No	Change Not Allowed	0)No-1)Yes	The parameter shows whether your FERRUPS is a rackmount model or a standard model.

Number	Sample Display	Password	Range	Explanation
50	50 Startup 1)On	Service	0)Off-1)On	This parameter determines whether the FERRUPS will be in the Auto mode when you turn the On/Off switch on. If this is set to 0)Off, the FERRUPS will stay in the Off mode when you turn the switch on until you put it into Auto mode. If this parameter is set to 1)On, the UPS goes into Auto mode when you switch on the On/Off switch.
51	51 LowFreq 57.00	Service	45.00-65.00	The low AC input frequency at which the FERRUPS switches to inverter (battery power). The UPS will continue to use battery power until the frequency rises above this point.
52	52 HiFreq 63.00	Service	45.00-65.00	The high AC input frequency at which the FERRUPS switches to inverter (battery power). The UPS will continue to use battery power until the frequency drops below this point.
53	53 SlewRate 100	Service	5-500	The rate at which the FERRUPS' inverter tracks a varying AC input source.
54	54 PhaseLk 500	Service	50-5000	The point at which the FERRUPS has locked onto the AC input phase before transferring from inverter (battery power) to AC input power.
55	55 FreqGlCnt 3	Service	1-60	The number of cycles that AC input frequency must be outside of the range set by parameters 51 and 52 before the FERRUPS switches to inverter (battery power).
56	56 LineGlCnt 3	Service	1-20	The number of AC input glitches in a row that must happen before the FERRUPS switches to inverter (battery power).
57	57 LineDelta 80	Service	1-512	This parameter helps the FERRUPS determine what qualifies as an AC input glitch. Higher values make the FERRUPS less sensitive to input line transients.
58	58 XferDly 1.0s	Service	0.0-999.9	The minimum number of seconds the FERRUPS will run on inverter (battery power) before it switches back to AC input power.
59	59 LVOAlrm 108.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which the FERRUPS sounds a Low AC Output alarm. See the User Manual.
60	60 LVOShdn 102.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The point at which the FERRUPS shuts down because of low output voltage.
61	61 HVOAlrm 129.6	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which the FERRUPS sounds a High AC Output alarm. See the User Manual.
62	62 HVIAlrm 138.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The input voltage at which the FERRUPS sounds a High AC Input alarm. See the User Manual.
63	63 ExBrOut 1)Yes	User	0)No-1)Yes	This parameter enables or disables extended brownout. If this is set to "Yes," then the Brownout setpoint (28) varies from 62% of nominal AC Volts In at no load to 80% of nominal AC Volts In at full load. If this is set to "No" the Brownout setpoint (parameter 28) stays at 80%. (See parameter 64.)

mber	Sample Display	Password	Range	Explanation
64	64 BrnOutV 96.0	Service	50.0-500.0	When parameter 63 is set to 0)No, this parameter determines when there is a brownout condition. When AC input voltage falls below this setpoint, the FERRUPS switches to battery power.
65	65 LoBatV 10.50	Service	6.00-175.00	The DC voltage at which the FERRUPS shuts down because of a low battery condition. The UPS will remain off until you switch it off and on again.
66	66 NLBatV 11.00	Service	6.00-175.00	The battery voltage at which the FERRUPS sounds a Near Low Battery alarm. See the User Manual.
67	67 HiBatV 14.90	Service	6.00-200.00	The battery voltage at which the FERRUPS sounds a High Battery alarm. See the User Manual.
68	68 LowRunTm 6m	User	0-999	When runtime (parameter 9) drops to this point, the FERRUPS sound a Low Runtime alarm. See the User Manual.
69	69 Batt AH 31	Service	5-20000	The ampere-hour capacity of the FERRUPS' batteries.
70	70 RuntimeK 20	Service	1-200	A constant that the FERRUPs uses to calculate runtime.
71	71 Test Level 3	User	0-3	This determines which parts of the Automatic System Test the UPS will do. See the User Manual for more information. 0 = None; 1 = Logic Test; 2 = Logic and Inverter Tests; 3 = Logic, Inverter, and Battery Tests.
72	72 TestInt 7dy	User	0 (Off)-366	The number of days between Automatic System Tests. See the User Manual for more information on the test.
73	73 Test@ 1:00:00	User	00:00:00-23:59:59	The time of day (in 24-hour time) when the FERRUPS will do the Automatic System Test.
74	74 NomILimit 360	Service	10-999	The maximum current the FERRUPS can draw from its batteries when it runs on battery power.
75	75 BT Time 60s	Service	0-9999 (In 8.01-8.05 software, 0-999)	The number of seconds the FERRUPS must run on battery power during the battery test before it compares calculated run-time to the Low Runtime alarm setpoint.
76	76 PFM Temp 25c	Change Not Allowed	-63 to 193	The temperature of the Power Factor Module in Celsius.
77	77 AutoRst 60s	Service	0-9999	When you have shut down the UPS using an off or shutdown command (see the User Manual), or when some alarms have shut down the UPS, this is the minimum number of seconds the UPS will remain off before it can restart automatically. To disable the automatic restart, set this parameter to 0.
78	78 AlmEnbl 1)Yes	Service	0)No-1)Yes	This parameter enables or disables the FERRUPS' ability to sense an alarm.
79	79 Console Mode	User	1-4	This parameter helps make the UPS compatible with CheckUPS. The setting affects parameter 97. 1 = UPS sends inverter/alarm messages 2 = UPS suppresses inverter/alarm messages 3 = UPS does not echo back commands 4 = UPS sends the "F" string every 15 seconds. (See TIP 503.)

Number	Sample Display	Password	Range	Explanation
80	**80** AT Alarm 60c	Service	**0-200**	**The** point **at which** the FERRUPS sounds a High Ambient Temperature **alarm**. See the Use: Manual.
81	81 AT Shdn 70c	Service	**0-200**	The point at which the FERRUPS shuts down because of a High Ambient Temperature.
82	**82** HT Alarm 95c	Service	**0-200**	The point at which the FERRUPS sounds a High Heatsink Temperature alarm. See the User Manual.
83	83 HT Shdn 105c	Service	0-200	**The point at which** the FERRUPS shuts down because of a High Heatsink Temperature.
84	**84** XT Alarm 0c	Service	**0-200**	The **point at which** the FERRUPS sounds a High Transformer Temperature alarm. **See the** User Manual. **In models that do not monitor transformer temperature, this is set to "0."**
85	**85** XT Shdn 0c	Service	**0-200**	The point at **which** the FERRUPS shuts down because of a High Transformer Temperature. **In models that do not monitor transformer temperature, this is set to "0."**
86	**86** PF Alarm 85c	Service	**0-200**	The point at which the FERRUPS sounds a High Power Factor Module Temperature alarm. See the User Manual.
87	**87** PF Shdn 95c	Service	**0-200**	The point at which the FERRUPS shuts down because of a High Power Factor Module Temperature alarm.
88	**X8** VOutFlt 24.0	Service	0.0-500.11 (In **8.31** software, 0.0-300.0)	The point at which the FERRUPS shuts down because of output power problems.
89	89 [illegible] (Reserved in 8.01 software)	Service	0-9 [illegible]	When the FERRUPS [illegible] running on inverter (battery power), the [illegible] the FERRUPS will delay before it [illegible] the inverter relay.
	90 Rem Baud [illegible] [07]: 1200 baud	Service	[0]:50 [illegible] 9600	[illegible] RJ-11 (phone jack) connector [illegible] is connector [illegible] and control panel on the front [illegible] 3 kVA-18 kVA models [illegible] changing the baud rate could cause [illegible] munication problems. Settings: [0]:50, [1]:75, [2]:1[illegible], [illegible], [7]:1200, [8]:1800, [illegible] [13]:9600, [14]:19200, [15]:3840[illegible]
91	91 RemWordF[illegible] 0 [00]: [illegible] 8N1	Service	0-7	[illegible] J-11 (phone jack) connector (on the [illegible] models). Call Best Power for more information.
92	92 Rem HndSh[illegible] SRx|STx|CTS|RTS	Service	0-15	This parameter enables or disables hardware and software handshaking of the control panel's RJ-11 (phone jack) connector (on the front of 4.3 kVA-18 kVA models). Call Best Power for more information.
93	93 Rem RCP 1)Yes	Service	0)No-1)Yes	When this is set to 1)Yes, the control panel's RJ-11 (phone jack) connector on the front of 4.3 kVA-18 kVA models is set up to communicate with the control panel. When this is set to 0)No, the RJ-11 connector acts as an RS232 communication port.
94	94 Rem Ctrl 15 Eco|Err|Msg P	Service	**0-3**1	This parameter enables or disabler messaging and echo back on the control panel's RJ-11 connector. Call Best Power for more information.

Number	Sample Display	Password	Range	Explanation
95	95 Con Baud 7 [07]: 1200 baud	Service	[0]:50-[15]:38400 (See Explanation column.)	This parameter sets the baud rate of the FERRUPS' RS232 communication port. See TIP 503. [0]:50, [1]:75, [2]:110, [3]:135, [4]:150, [5]:300, [6]:600, [7]:1200, [8]:1800, [9]:2400, [10]:3600, [11]:4800, [12]:7200, [13]:9600, [14]:19200, [15]:38400.
96	96 ConWordFmt 0 [00]: 8N1	Service	0-7	This parameter sets the data word format for the RS232 communication port. Settings are 8N1, 8N2, 7N1, 7N2, 7E1, 7E2, 701, and 702. Changing the setting could cause communication problems.
97	97 ConHndShk 12 Srx|STx| |	Service	0-15	This parameter enables and disables hardware and software handshaking at the RS232 communication port.
98	98 Con RCP 0)No	Service	0)No-1)Yes	When this set to 1)Yes, the FERRUPS' communication port is set up to communicate with a control panel. When this is set to 0)No, the communication port acts as an RS232 port.
99	99 Con Ctrl 15 Eco|Err|Msg|P=>	Service	0-31	This parameter enables and disables UPS messaging and echo back of the FERRUPS' RS232 communication port.
100	100 Search #1 Network UPS I	Service	Up to 20 characters.	To enable the UPS to automatically log onto the host system that it is connected to, you can use this parameter to enter the string the host system uses to search for a UPS. When the UPS receives this search string, it will respond with the string you enter in parameter 102. See parameters 101-103.
101	101 Search #2 Network UPS 1	Service	Up to 20 characters.	When the UPS receives the search string entered in this parameter, it will execute the command you enter in parameter 103.
102	102 Response #1 UPS #1 active	Service	Up to 40 characters.	See parameter 100. When the UPS receives the search string you enter in parameter 100, it will respond to your host system with the string you enter for this parameter (102).
103	103 Response #2 Identify	Service	Up to 40 characters.	See parameter 101. When the UPS receives the search string you enter in parameter 101, it will execute the command you enter for this parameter (103).
104	104 RMask1 65535 PONMLKJIHGFED CBA	Service	0-65535	This parameter determines which of alarms A-P will activate the alarm relay contact at the FERRUPS' RS232 port. See TIP 503 to program this parameter.
105	105 RMask2 65535 543210ZYXWVUT-SRQ	Service	0-65535	This parameter determines which of parameters Q-T will activate the alarm relay contact at the FERRUPS' RS232 port. See TIP 503.
106	106 EPO Mode 0 | | |	Service	0-16	This parameter selects the remote shutdown mode. See TIP 503 for more information.
107	107 EPODbc 0.3s	Service	0.0-999.9	The length of remote shutdown signal that the FERRUPS requires. See TIP 503 for more information.
108	108 EPODly 0.1s	Service	0.0-999.9	The amount of time the FERRUPS delays a remote shutdown after it receives the signal. See TIP 503 for more information.
109	109 PABase 3560	Change Not Allowed	0-20000	This parameter affects FERRUPS transfers.
110	110 CFACVIN 1202	Change Not Allowed	0-32767 (In 8.01 software, O-3000)	The calibration factor numerator for AC input voltage.

Number	Sample Display	Password	Range	Explanation
111	111 CFACVID 526	Change Not Allowed	1-1023	The calibration factor denominator for AC input voltage.
112	112 CFACVON 1197	Change Not Allowed	0-32767 (In 8.01 software, 0-3000)	The calibration factor numerator for AC output voltage.
113	113 CFACVOD 613	Change Not Allowed	1-1023	The calibration factor denominator for AC output voltage.
114	114 CFACAON 45	Change Not Allowed	0-32767 (In 8.01 software, 0-2200)	The calibration factor numerator for AC output current.
115	115 CFACAOD 251	Change Not Allowed	1-1323	The calibration factor denominator for AC output current
116	116 CFDCVN 1326	Change Not Allowed	0-32767 (In 8.01 software. 0-17500)	The calibration factor numerator for DC voltage.
117	117 CFDCVD 784	Change Not Allowed	1-1023	The calibration factor denominator for DC voltage.
118	118 CFDCAN 602	Change Not Allowed	0-32767 (In 8.01 software, 0-2000)	The calibration factor numerator for DC current.
119	119 CFDCAD 132	Change Not Allowed	1-1023	The calibration factor denominator for DC current.
120 (8.01-8.05 software)	120 SW Ver 8.02	Change Not Allowed	00.00-99.99	The FERRUPS software version for units with versions 8.01-8.05. See parameter 137 for later software versions.
(8.06 [illegible]are)	120 CFCHGN 1000	Change Not Allowed	0-32767	The calibration factor numerator for charger current.
121 (8.01-8.05 software)	121 Chksum [illegible]	Change Not Allowed	0000[illegible]Fh	[illegible] RAM Checksum [illegible] with 8.01-8.05 software [illegible] See parameter [illegible] software versions.
(8.06 software)	121 C[illegible]	[illegible] Allowed	[illegible]	[illegible] current.
122 (8.01-8.05 software)	122 RO[illegible]	[illegible]	[illegible]	[illegible] 5 software versions. [illegible]
(8.06 software)	122 Chg Typ[illegible]	[illegible]	[illegible]	[illegible] charger [illegible]: 0 = Hardware float charger. 1 = Software-controlled float charger. 2 = Software-controlled hysteresis charger. 3 = Disabled; independent external charger
123 (8.06 software only)	123 MaxChgA [illegible]	Change Not Allowed	1.0-99.9	If parameter 122 is set to "1" or "2," parameter 123 is the continuous rated charger current. The average charger current cannot exceed this value. If parameter 122 is set to "0," parameter 123 is not effective.
124 (8.06 software only)	124 LoCV 1 3 . 0 0	Service	0.0-200.0	When parameter 122 is set to "2," this parameter is the low charging voltage setpoint. The charger is started when DC volt! falls below this value.

lumber	Sample Display	Password	Range	Explanation
125 (8.06 ;oftware only)	125 FltCV 13.60	Service	0.0-200.0	When parameter 122 is set to "1," this parameter is the float charger voltage level. The FERRUPS maintains the battery voltage at this level if possible.
126 (8.06 ;oftware only)	126 HiCV 14.40	Service	0.0-200.0	When parameter 122 is set to "2," this parameter is the high charging voltage setpoint. The charger is turned off when DC volts rise above this value.
127 (8.06 software only)	127 EqlCV 12.60	Service	0.0-200.0	When parameter 122 is set to "2" or "3," this parameter is the equalize charging voltage setpoint. When battery voltage is below this point, the charger equalizes the batteries.
128 (8.06 software only)	128 ChOnDly 240s	Change Not Allowed	0.0-200.0	When parameter 122 is set to "2" or "3," this parameter is the equalize charging voltage setpoint. When battery voltage is below this point, the charger equalizes the batteries.
129 (8.06 software only)	129 LoACDly 5s	Change Not Allowed	l-255	Once the FERRUPS senses a low AC output, this parameter determines the number of seconds the unit waits before causing a Low AC Output alarm shutdown.
130 (8.06 software only)	130 --Reserved--	—	—	
131 (8.06 software only)	131 --Reserved--	—	—	
132 (8.06 software only)	132 --Resewed	—	—	
133 (8.06 software only)	133 --Reserved	—	—	—
134 (8.06 software only)	134 --Reserved--	—	—	
135 (8.06 software only)	135 --Reserved--	—	—	
136 (8.06 software only)	136 --Reserved--	—	—	
137 (8.06 software only)	137 SW Ver 8.06	Change Not Allowed	0.00-99.99	The FERRUPS software version for units with 8.06 and higher versions. See parameter 120 for earlier software versions.
138 (8.06 software only)	138 Chksum 1CF8h	Change Not Allowed	0000h-FFFFh	Nonvolatile RAM Checksum for units with 8.06 and higher software versions. See parameter 121 for earlier software versions.
139 (8.06 software only)	139 ROMChk 41B7h	Change Not Allowed	0000h-FFFFh	EPROM Checksum for units with 8.06 and higher software versions. See parameter 122 for earlier software versions.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

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The FE Series RS232 Communication Port

This Technical Information Publication explains how to use the FERRUPS communication port; it expands on information in the FERRUPS User Manual. This TIP applies to all FE, FES, FER, QFE, QFES, and QFER models with 8.01-8.07 software versions.

The communication port lets you set up full duplex RS232 communication with FERRUPS so you can send commands and receive messages from the UPS. You can also display the information that your FERRUPS gathers and stores about power conditions and its own operation. The communication port also includes relay contacts, a +12 VDC level, a Remote Emergency Power Off connection, and pins for special options.

Section 100 describes the many ways you can use the RS232 port. Sections 200 and 300 describe RS232 communication. Section 400 describes the Remote Emergency Power Off feature and how you can adjust FERRUPS settings to work with your EPO system. Section 500 describes how to control the operation of the alarm contacts. Section 600 describes how to connect an external relay to monitor the FERRUPS' contacts.

Contents

LPT-0503C

N9246 Highway 80 South, PO. Box 280, Necedah, WI 54646 U.S.A. , Web site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) , Fax: 1-608-565-2221
service: 1-800-356-5737 , Fax: 1-608-565-2509 , Fax-On-Demand: 1-800-487-6813

100 How You Can Use the Communication Port

This section describes the ways that you can use the FERRUPS DB25S communication port. You can use more than one feature at a time as long as you connect each device to the correct pins on the FERRUPS communication port. To use a combination of features, you must have a cable that is made specifically for your applications, Figure 1 below shows the many ways you can use the port Figure 2 explains the functions of each pin.

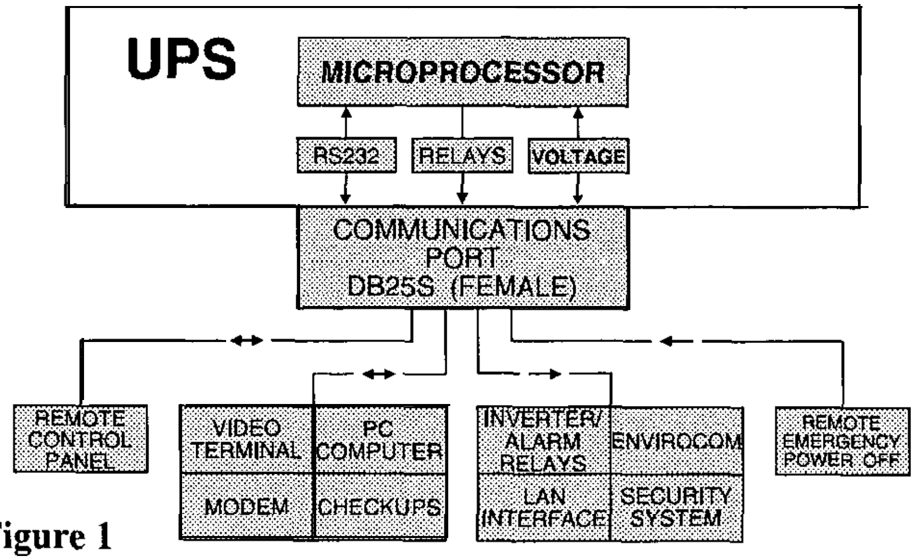
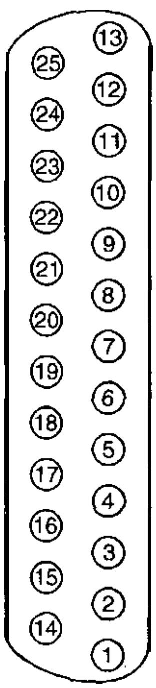


Figure 1



Pin	Description	
2	Transmit Data.	
3	Receive Data.	
4	Request to Send.	To enable hardware handshaking on these pins, see page 5.
5	Clear to Send.	
6	+12V Level (0.01 amp) when UPS is operating.	
7	Signal Ground.	
11	Contact opens when on inverter.	These relay contacts are rated at 25V AC/DC and 250 mA. See the User Manual and Section 600 of this TIP.
12	Contact closes when on inverter.	
13	Common Inverter Signal Contact.	
14	+12V, 0.3 amp (500VA to 3. IKVA) or 0.5 amp (4.3 to18KVA). See Section 600 to use this pin with an external relay.	
18	+12V Level (0.01 amp) when UPS is operating.	
20	AS/400 Option.	
21	Remote Emergency Power Off, See Section 400.	
23	contact closes on alarm	These relay contacts are rated at 25 V AC/ DC, 250 mA. Pins 23 and 25 change status when UPS is turned off. See the User Manual and Sections 500 and 600 of this TIP.
24	Common Alarm Signal Contact.	
25	Contact opens on alarm.	

Figure 2

RS232 Communication: Pins 2, 3, 4, 5, and 7

You can connect your FERRUPS to a terminal, computer, or modem for full duplex communication. This lets you send FERRUPS commands, change the FERRUPS operating mode, view and change parameters, receive messages from the FERRUPS, and read the alarm and inverter logs. To communicate with the FERRUPS. see the User Manual and Sections 200 and 300 of this TIP.

Relay Contacts: Pins 11-13 and 23-25

You can use FERRUPS' alarm and inverter contacts for remote. monitoring or for your own alarm system or indicator. With the right interface cable, you can also use the relay contacts to control the shutdown of computer networks. (See the description of CheckUPS software under "Options.") For more information on the relay contacts, see the FERRUPS User Manual. To control the operation of the alarm contacts; see Section 500 of this TIP. To connect an external relay to monitor the contacts, see Section 600 of this TIP.

Remote Emergency Power Off: Pin 21 (with 6 or 18)

The Remote Emergency Power Off feature lets you connect your computer room's emergency shutdown switch to the FERRUPS. By doing this, you can make sure your emergency shutdown system will shut off the power that goes from FERRUPS to your protected equipment. You can determine what type of shutdown signal the FERRUPS responds to and how long it waits before shutting down. See Section 400 for more information.

+12 Level: Pins 6, 14, and 18

You can use the +12 VDC Level on pins 6 and 18 for setting an external logic level I. You can use this to set a fixed input logic level in an external device. The voltage is present any time the FERRUPS is operating.

Pin 14 has +12 Volta DC at 0.5 amperes (or 0.3 amperes for FE500VA to FE3.1KVA models). You can use this pin to connect an external relay to monitor the contacts at the port; see Section 600.

Options

Remote Control Panels: You can connect an optional control panel to the RS232 port to communicate with FERRUPS. Optional control panels work like the control panel that is standard on 4.3 KVA-18 KVA models; if you have one of these models, you can use a standard and optional control panel to communicate with the FERRUPS at the same time. The control panel provides quick, easy communication with the FERRUF'S. See the User Manual or TIP 407 for more information.

CheckUPS®
Software: BEST's CheckUPS runs on your computer. During a long power outage, this optional software automatically shuts down the computer and the FERRUPS before the FERRUPS batteries run down. It also lets you communicate with FERRUPS. CheckUPS is available for most kinds of computers and operating systems. Call BEST for more information.

Interface Kits: If your computer or Local Area Network has its own UPS monitoring or shutdown software, you can use a BEST interface kit. These kits include cables, cards, adapters and instructions for interfacing between the FERRUPS and your computer system. Call BEST for details.

EnviroCom: BEST's EnviroCom I and II monitor the FERRUPS' alarm and inverter contacts. These devices use a telephone line to let you know when there is an alarm or when FERRUPS is running on inverter (battery power). EnviroCom II includes a modem so you can communicate with FERRUPS from a remote location. See TIP 577 for more information.

200 Setting Up RS232 Communication

201 Connecting a Terminal or Computer

The Communication section in your FERRUPS User Manual provides basic instructions for connecting a terminal or computer to the FERRUPS RS232 port. This section provides a few additional guidelines.

1. Important: When you connect your computer or terminal to the FERRUPS' RS232 port, signal ground and chassis ground must not be connected within the terminal or computer. These two signals may or may not be common in your computer or terminal. If they are common, you **must** remove any jumper connection between signal ground and chassis ground.

   When you connect the computer or terminal to FERRUPS, signal ground from your computer or terminal is connected to pin 7 (signal ground) on the FERRUPS. See the User Manual. This signal ground is a reference ground for the other RS232 signals.

2. Before you connect a computer or terminal to the UPS, make sure it receives its power from the UPS.

3. The battery bank **must not be positive ground.**

WARNING

Do not make connections to the RS232 communications port if the UPS is connected to a positive ground battery system. The RS232 ground must be isolated or equipment damage will result. For help, call BEST's Technical Support Center at l-800-356-5737 or call your nearest BEST office.

202 Terminal Emulation

The computer or terminal that you connect to FERRUPS must be able to I) send commands that you type on a keyboard to FERRUPS and 2) send responses to the computer's or terminal's screen. A standard terminal does this; however, if you are using a computer, you must run a terminal emulation program.

Computers, serial interface cards, and modems often include terminal emulation programs. If you do not have an emulation program, you can use the BASIC program on the next page. Before you use an emulation program, you must often set the baud rate and data format. On some computers, you can do this with switches, and on others, you can make the changes with software. (For example, MS-DOS users would use MODE COM1:1200 N, 8, 1.)

The BASIC program below lets a computer emulate a dumb terminal. It should work on any IBM PC or compatible. To use the program, simply connect the proper cable from your computer's COM 1: serial port to the FERRUPS communication port. (See the User Manual.) After you have made the connection, run the program. There are four comments after the program. You can find more help in the IBM BASIC manual's communication appendix.

Emulation Program

```
10 REM program to communicate with the FERRUPS
20 REM
30 SCREEN 0,0: WIDTH 80: CLS
40 KEY OFF:LOCATE 25,1
50 PRINT "FERRUPS COMMUNICATIONS PROGRAM-hit ESC to exit"
60 LOCATE 1,1,1 : PRINT "Enter the command HELP for a menu"
70 OPEN "COM1:1200,N,8,1,CS,DS" AS #1
80 PRINT #1,""
100 A$=INKEY$: IF A$="" THEN 120
110 IF A$=CHR$(27) THEN 990 ELSE PRINT #1,A$
120 IF EOF(1) THEN 100
130 A$=INPUT$(LOC(1),#1)
140 B$=CHR$(10):C$=" ":GOSUB 200: REM Replace line feeds by spaces
150 B$=CHR$(8):C$=CHR$(29):GOSUB 200: REM Replace backspaces by cursor lefts
160 PRINT A$;
180 GOT0 100
200 P%=0
210 P%=INSTR(P%+1,A$,B$)
220 IF P%>0 THEN MID$(A$,P%,1)=C$:GOTO 210
230RETURN
990 CLOSE: KEY ON
```

Comments:

1. If you are using hardware handshake, omit the "CS" option in the OPEN statement of line 70

2. If you are using MS-DOS@ QBASIC (which comes with DOS 6.0) or MICROSOFT@ QUICKBASIC™, change the OPEN statement in line 70 to this:

   OPEN "COM1:1200,N,8,1,DS,RB1024,TB64" AS #1

3. Note the use of the "DS" option in the OPEN statement of line 70. This inhibits testing of the DSR line from FERRUPS. This is necessary because FERRUPS does not use this line.

4. Because of the way the BASIC PRINT statement works, the program must strip out or make substitutions for the line-feeds and backspaces sent from FERRUPS to preserve the screen display. Hence lines 140 and 150. and the subroutine at line 200.

203 Enabling Hardware Handshaking

To enable hardware handshaking with your computer or terminal, change the setting for parameter 97 (console handshake) to 15. You can do this either through a control panel or through a computer or terminal that you have connected to the communication port

Control Panel:	Display parameter 97; then press [PROGRAM], [1], [5], and [ENTER].
Computer or Terminal:	Enter **the command program 97,** and enter 15 as the new value.

204 Using a Modem

To use a modem with the FERRUPS, you must configure both the modem and the FERRUPS properly.

To configure the UPS, set parameter 97 (consolehandshake) to "15"; see Section 203 if you need instructions for changing parameter values.

Set up the modem to ignore the DTR signal and to support the RTS and CTS signals. You should also disable the modem's ability to send result codes. In most modem modems, you can make these changes using modem "AT" commands. In these modems, you can use a computer or terminal to send the following string to your modem; this string will set your modem to work optimally with the FERRUPS.

AT &F&DO &K3 QO &W <CR>

AT is a required command prefix.
&F reset the modem to factory defaults.
&DO sets the modem to ignore the state of DTR.
&K3 enables RTS/CTS handshaking.
QO puts the modem in the quiet mode, suppressing result codes.
&W makes the changes permanent.
<CR> is a required terminating carriage return.

Since modem commands vary for different brands of modems, the above string may not work as shown. In many older modems, you must set dipswitches to make the required changes in your modem. See the documentation that came with your modem to configure its response to RS232 control signals.

The FERRUPS communication port is wired as a DCE (Data Communications Equipment) device. Since most modems are also wired DCE, you must use a "null modem" cable to connect the modem to the FERRUPS. See the drawing in the User Manual to build a cable to connect the FERRUPS to a modem. If you want to use handshaking, see Figure 3.

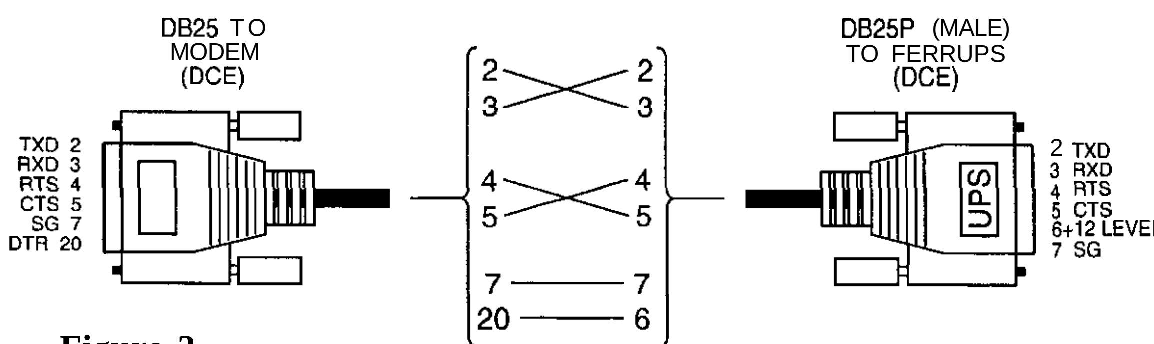


Figure 3

300 Communicating with FERRUPS

The FERRUPS User Manual includes a command table and basic information about entering commands. The sections below provide more detailed information about some commands.

301 Entering Commands

See the User Manual for a complete table of FERRUPS commands. The FERRUPS microprocessor can recognize commands in a variety of formats. Commands can be in uppercase, lowercase, or a combination of uppercase and lowercase.

Example:
alarmlog would be a valid command, but so would ALARMLOG, **Alarmlog** or **alarmLog.** The terminal or computer would display the alarm log.

You can enter the complete command or the short form shown in the User Manual. You can also enter an abbreviation of the command. The command you enter must 1) include the letters in the short form, 2) have the letters in the correct order, and 3) use the same spacing as the original command.

Example 1:
alarmlog, al, or **alog** are all valid commands. The terminal or computer displays the alarm log. If you put a space between any of the letters in the command, the FERRUPS does not recognize it.

Example 2:
systemmode auto, sm a and sysmode a arc all valid commands; the FERRUPS switches to auto mode. However, if you do not include the space before "a" or "auto," the UPS will not recognize the command.

If you make an error when you enter the command, your terminal will display "Error" with a pointer that shows what part of the command may be incorrect.

Example:
If you misspell a command, the Error arrow will point to the command and give you **an error message:**

=>displey time
displey time
^ Error
Command not recognized.

If you are using commands to display and change FERRUPS parameters, see Section 305

302 Passwords

Some FERRUPS commands require a password; in other words, the FERRUPS won't recognize certain commands unless you have entered the corrcct password first. You must also enter a password before you change most FERRUPS parameters.

Note: If you change parameter 39 to "Ycs," some parameters and commands that do not normally require a password will require a User password. [CONTROL] functions at a control panel will also require a User password.

To enter a password, use the password command shown in the FERRUPS User Manual. For example, to enter the User Password, you would type the command below and press <ENTER> on your keyboard.

password 377

You don't need to use the complete password command; instead, you could just enter this:

pw 377

You can use one of two passwords: the User password (377), or the Service password (2639). The password level determines whether a user or a trained service person should make the changes. To find out which commands require a password, see the command table in your FERRUPS User Manual. That table also shows which password you need for each command. To find out which password you need to display and change each parameter, see the Parameter Table in Section 306 of this TIP.

You can use some commands to help you learn more about how FERRUPS communication works. These commands are **help** (or **?**), **alarmshelp**, and **commands**.

Help Command

When you enter the **help** or ? command, your terminal will display each FERRUPS command and a brief explanation.

Example: For example, the display begins with the AlarmTest command:

AlarmTest [Cancel]
-- Set [or Cancel] user test alarm (J).

Notice that some letters in the command are capitalized; these letters make up the short form of the command. You could enter **alarmtest**, **at**, or any abbreviation that includes the short form letters in the correct order. "[Cancel]" means **alarmtest cancel** (or **at c**) cancels the User Test Alarm.

AlarmsHelp Command

The **alarmshelp** command displays a list of alarms with their letters and codes, the current status of the alarm (active or off), and the relay setting. See the sample list below:

Active	Alarm Name	Ltr	Code	Relay
No	Low Battery	A	• –	Yes
No	Near Low Battery	B	– • • •	Yes
No	High Battery	C	– • – •	Yes
No	Low Runtime Left	D	– • •	Yes
No	Low AC Output	E	•	Yes
No	High AC Output	F	• • – •	Yes
No	Output Overload	G	– – •	Yes
No	Hi Ambient Temp	H	• • • •	Yes
No	Hi Heatsink Temp	I	• •	Yes
No	User Test Alarm	J	• – – –	Yes
No	Hi Transfmr Temp	K	– • –	Yes
No	Check Charger	L	• – • •	Yes
No	Check Battery	M	– –	Yes
No	Check Inverter	N	– •	Yes
No	Check Memory	O	– – –	Yes
No	Emergency PwrOff	P	• – – •	Yes
No	Hi PFM Res Temp	Q	– – • –	Yes
No	Probe Missing	R	• – •	Yes
No	High AC Input	S	• • •	Yes
No	Call Service	T		Yes

Commands

When you enter **commands**, the terminal will display all valid FERRUPS commands. The capitalized letters in each command are the short form for that command.

304 Status Commands

The status and contstatus commands display several FERRUPS parameter values, active alarms, and other status information. This is one example of a **status** display:

Status report for FE500VA [Unit ID Number from parameter 15] [Serial Number]
Tuesday, November 16, 1993 - 14:51:31

Parameters				System	
V In	120.4	Freq	60.20	Mode:	Auto
		Watts	347	Ready:	Yes
V out	118.8	VA Out	345	Inverter:	Off
I out	2.9	PF 1.00	—	Charger:	On
		Load	99%	Beeper:	Enabled
V Batt	12.45	Runtime	6m	Level:	(None)
I Batt	0.9	AmbTemp	20C		
		BrnLvl	95.8		

Active Alarms

No active alarms

The contstatus command shows the same display, but it continuously updates the information until you press a key.

305 Parameter Commands

This section describes the commands you can use to display and program parameters

When you use the commands described below, you must often specify a parameter. To do this, you can enter the parameter number or its name. The Parameter Table in Section 306 shows the name you can use for each parameter; you can also use the short form shown in the table, or you can enter an abbreviation of the name as long as you include the letters in the short form. (You can also abbreviate commands; see Section 301.)

The **display, contdisplay, parameters and paramkeywords** commands let you display parameters. The **program command** changes parameter values.

Display

The display (or d) command lets you display specific parameters on your computer or terminal. For example, if you enter **display 0, display time** or **d t,** your computer or terminal will display parameter 0 (below). Notice that you must leave a space between the command and the parameter number or name.

00 Time 14:42:21

If you enter more than one parameter name or number after this command, your computer or terminal will display **those parameters. For example,** if you enter **d time** 45 IO, the display will show parameters 0, 45 and 10:

00 Time 14:42:21
45 RatedVA 500
10 Date 06/01/93

Notice that you can mix names and numbers, and you can list the parameters in any order.

If you have already displayed a parameter, you can display the next parameter by entering **display** alone.

Contdisplay

The contdisplay (or cd) command works like the **display** command, but it constantly updates the parameter values displayed until you press a **key**.

Parameters

Like **the display command, the parameters** (or **p**) command will display a parameter if you enter a parameter number **or** name after the command. For example, If **you** enter **parameter 0, parameter time,** or **p t,** your terminal or computer will display something like this:

00 Time 14:42:21

However, **the parameters** command works differently when you enter it alone or when you enter more **than one** parameter after **the command. When you enter parameters (or p) alone, your** computer or terminal displays all of the user-level and service-level parameters shown in Section **306.**

To display a range of parameters, enter the starting and ending parameters after the command. Instead of showing just the parameters **you** list (as **the display** command does), the **parameters** command will display all of the parameters in between. For example, if **you** enter **parameter 0 5, parameter time vaout,** or **p t va,** your computer or terminal will display parameters 0 through 5:

00 Time 14:42:21
01 V In 118.2
02 v out 118.2
03 --Reserved--
04 I out 2.9
05 VA Out 345

Paramkeywords

The paramkeywords (or **pk)** command works like **the parameters** command, but it also displays the keyword or name of each parameter you display. (The keyword is the name shown in Section **306.)** For example, if **you enter paramkeywords time vaout** (or **pk t va**), your computer or terminal display will be similar to this:

00 Time	14:43:59	Time
01 V In	118.2	acVoltsIn
02VOut	118.8	acVOltsout
03	--Reserved--	*
04 I out	2.9	acampsiOut
05 VA Out	345	VAout

Notice that some letters are capitalized in the keywords on the right. These letters are the short form of the parameter name (or keyword). Reserved parameters (like 03 above) do not have keywords.

To display all of the user and service parameters and their keywords, enter **paramkeywords** (or **pk)** alone.

Program

Before you can program or change some parameters, you must enter the User or Service password. (See Section 302.) Some parameters cannot be changed.

The program (or pr) command lets you program parameters. If you have already displayed a parameter, you can enter program alone to program the parameter. The computer or terminal displays the parameter's old value and ask you to enter a new value.

Example 1: If you have displayed parameter 0, "00 Time 14:59:43," and you want to change the time, you can enter **program** to change the parameter. You may need to enter a User password before you can make this change; see Section 306.

```
User =>display 0
00 Time 14:59:43
user =>program
Old value: 00 Time 14:59:50
>>> New value for parameter 00 ->
```

You can enter the new value in response to the new prompt; the display will then show the new parameter value. For example, if you enter 09:30:00, you will see this display:

```
>>> New value for parameter 00-> 09:30:00
New value: 00 Time 09:30:00
User =>
```

If you have not displayed the parameter already, you can specify which parameter you want to change by entering its number or name after the program (or **pr**) command.

Example 2: If you enter program time, the computer or terminal will display the old value and ask you for the new value:

```
User =>program time
Old value: 00 Time 14:59:50
>>> New value for parameter 00 ->
```

You can enter the new value at the prompt. (See Example 1.)

If you want to enter a new parameter value without seeing the old value first, you can enter program, the parameter number or name, and the new value at the same time.

Example 3: If you enter program time **09:30:00**, the time will be changed, and the computer or terminal will show a display similar to the one below:

```
User =>program time 09:30:00
Old value: 00 Time 14:59:50
New value: 00 Time 09:30:00
User=>
```

306 Parameter Table

The. table on the next few pages shows the parameters that you can view or reset from a terminal or computer. Some of these parameters keep track of information (like Time, Date, or the Alarm and Inverter Logs) or display operating and power conditions (like voltage, current, or temperature). Other parameters (like User ID) let you program FERRUPS for special situations.

When you use the FERRUPS commands to display and program parameters, you can identify the parameter with either its number or name. If you use the name, you can enter the whole parameter name or just the letters in the short form. (See the Name column in the Parameter Table.)

Passwords restrict **access** to some parameters. See Section 302.

The table sometimes shows differed parameters for different revisions of FERRUPS software. If you are not sore which software version is in your FERRUPS, display parameter 120. If parameter 120 is SW Ver, it will show your software version; if not, display parameter 137 to see the software version

All changeable parameters except 0 (Time), 10 (Date) and 15 (Unit ID) are set at the factory. Only qualified technicians using the proper metering equipment should change other parameters. Incorrect settings may make FERRUPS malfunction. Call BEST's Technical Support Center at l-800-356-5737 before you trv to change any parameters except 0.10, and 15. (Outside of the U.S.A. and Canada, call your nearest BEST office.)

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
0	time (t)	00 Time 07:04:00	None (User if parameter 39 has been changed to "Yes.")	00:00:00-23:59:59	Time. The FERRUPS uses the time to record alarms and inverter runs. Reset the time when you restart the FERRUPS after DC power has been off.
1	acvoltsin (vi)	01 V In 120.7	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The input voltage the FERRUPS is receiving. When this value drops below the brownout voltage, the FERRUPS switches to inverter.
2	acvoltsout (vo)	02 V Out 120.7	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The voltage the UPS is providing to your equipment.
3	Reserved	03 --Reserved--	—	—	—
4	acampsiout (o)	04 I Out 5.3	Service	0.0-220.0	The current your equipment is drawing from tbe FERRUF'S.
5	vaout (va)	OS VA Out 637	Change Not Allowed	o-27000	The total "apparent power" (volt-amperes) your equipment is drawing from the UPS. This value is based on parameters 2 and 4, and should be less than or equal to VALimit, parameter 19.
6	ibatt (ib)	06 I Batt 0.5	Service	0.0-200.0	In 8.06 and higher software, when the UPS runs on AC line, this is the charging current. In all software versions, when the UPS runs on battery power, this is the amount of current (in amps) the batteries are supplying to the UPS.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
7	vbatt (vb)	07 V Batt 13.48	Service	0.00-175.00	Battery voltage. The FERRUPS will alarm if this value is too low.
8	frequency (f)	38 Freq 60.43 Hz	Change Not Allowed	47.00-63.00	During normal operation, this is the frequency of the AC input power the FERRUPS is receiving. If this value falls outside the limits set by parameters 5 I and 52, the UPS switches to battery power, When the UPS is using battery power, this is the frequency it is supplying to your equipment.
9	runtime (rt)	09 RunTime 12m	Change Not Allowed	a-9999	The estimated amount of lime the FERRUPS will continue to support your equipment when the FERRUPS is running on battery power. The FERRUPS will alarm when this value falls below parameter 68.
10	date (d)	10 Date 06/01/93	None (User if parameter 39 has been changed to "Yes.")	01/01/1988-12/31/2166	Date The FERRUPS uses the date to record alarms and inverter runs. Reset tbe date when you restart the unit after DC power has been turned off.
. or 11[1]	ambtemp (at)	1 I Amb Temp 23c	Change Not Allowed	-63 to 193	The temperature (in Celsius) inside the unit. The UPS will alarm if this value is too high.
12	heatsinktemp (st)	12 SinkTemp 26c	Change Not Allowed	63 to 193	The temperature of the heatsink. The FERRUPS will alarm if this value is too high.
13	Reserved	13 --Reserved--	—		—
	xfmrtemp (xt)	14 XfmrTemp 28c	Change Not Allowed	-63 to 193	Transformer temperature. The FERRUPS will alarm if this value is too high. This parameter ii only for models that monitor transformer temperature; for other models, this parameter will always show -63 ° C.
15	unitident (id)	15 Unit ID Network #1 UPS	Service	Up to 20 characters.	Unit ID. You can enter any string of 20 characters or less into this parameter. This string can help you identify individual FERRUPS units in network environments that use more than one UPS.
16	fullload (l)	16 FullLoad% 075	Change Not Allowed	o-150	Percent of Full Load. The percentage of the FERRUPS' total capacity that your equipment is actually using.
17	watts (w)	17 Watts 465	Change Not Allowed	0-1 5000	The total "real power" your equipment is drawing from the FERRUPS.
18	powerfact (pf)	18 PF 0.73 Lead	Change Not Allowed	0.00-1 .oo	The power factor of your equipment; the difference in the way it draws voltage and current. Power factor = watts out (parameter 17) divided by VA Out (parameter 5). This parameter also tells whether the power factor is leading (Lead), lagging (Lag), or distortion (Dist).

[1] To display parameter 11 at a control panel, press [DISPLAY] [ ] [ENTER] or [DISPLAY] [1] [1] [ENTER].

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
19	valimit (val)	19 VALimit 850	Change Not Allowed	350-18000	The maximum volt-amps the FERRUPS can supply to your equipment at the present power factor. The FERRUPS will alarm when VA Out (parameter 5) is higher than this value.
20	powerout (po) (In 8.06 and higher software. the short form is pwro).	20 #PwrOut 1	Change Not Allowed	0-65535	The number of times there has been a loss of input power since you started the FERRUPS.
21	overloads (ol)	21 #OvrLds 0	Change Not Allowed	0-65535	The number of times the FERRUPS has been overloaded; that is, the number of times VA Out has been greater than VA Limit.
22	syshours (sh)	22 Sys Hrs 00000	Change Not Allowed	0-65535	The total number of hours the FERRUPS has been operating, regardless of mode. This number does not increase while the Off/On switch is turned Off.
23	invmin (im)	23 InvMin 0000.0	Change Not Allowed	0000.0-6553.5	The total number of minutes the inverter has run since startup.
24	inverterlog (il)	24 Inverter Log L 0319 2127 1215	Change Not Allowed	Not Applicable	A record of the date, time, duration, and reason for the last 20 inverter (battery power) runs. (See the User Manual.)
25	alarmlog (al)	25 Alarm Log A 0319 2127 1215	Change Not Allowed	Not Applicable	A record of the date, time, duration, and reason for the last 20 alarms. (See the User Manual.)
26	testresults (tr)	26 Test Results (See the Explanation column.)	Change Not Allowed	Not Applicable	This parameter records the results of the last system test. The parameter displays the time and date of the test and the results of each part of the system test. (See the User Manual.)
27	crestfact (cf)	27 Crest 1.41	Change Not Allowed	0.00-5.00	Crest factor (peak AC amps out divided by RMS AC amps out).
28	brownlevel (bl)	28 BrnLvl 79.8	Change Not Allowed	74.4-192.0	The AC input voltage at which the FERRUPS will switch to inverter (battery power). If extended brownout (parameter 63) is set to "Yes," this varies from 62% of nominal AC Volts In at no load to 80% at full load. If parameter 63 is set to "No," this is fixed at 80% of nominal AC volts in. See parameter 64.
29	beepfreq (bf)	29 BeepFreq 1320	Service	0-9999	This parameter sets the pitch of the beeper. Smaller numbers set the pitch higher; larger numbers set the pitch lower.
30	mindcv (mind)	30 MinDCV 11.36	Service	0.00-200.00	The minimum battery voltage measured since you started the FERRUPS or since the last time you used the extendedhistory command.
31	maxdcv (maxd)	31 MaxDCV 13.59	Service	0.00-200.00	The maximum battery voltage measured since you stated the FERRUPS or since the last time you used the extendedhistory command.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
32	minacvi (minvi)	32 MinACVI 0.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC input voltage measured since you started the FERRUPS or since the last time you used the **extendedhistory** command.
33	maxacvi (maxvi)	33 MaxACVI 124.2	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC input voltage measured since you started the FERRUPS or since the last time you used the **extendedhistory** command.
34	minacvo (minvo)	34 MinACVO 119.1	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The minimum AC output voltage measured since you started the FERRUPS or since the last time you used the **extendedhistory** command.
35	maxacvo (maxvo)	35 MaxACVO 122.5	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The maximum AC output voltage measured since you started the FERRUPS or since the last time you used the **extendedhistory** command.
36	minva (minva)	36 Min VA 115	Service	0-20000	The minimum volt-ampere output measured since you started the UPS or since the last time you used the **extendedhistory** command.
37	maxva (maxva)	37 Max VA 705	Service	0-30000	The maximum volt-ampere output measured since you started the UPS or since the last time you used the **extendedhistory** command.
38	badpassword (bp)	38 #Bad PW 0	Service	0-65535	The number of times an invalid password was entered.
39	ctrlpw (cp)	39 Ctrl PW 0)No	None (User if the setting has been changed to "Yes.")	0)No-1)Yes	If this is set to 1)Yes, you need a User password (or higher) to change some parameters and to use the red Control key functions on a control panel. If this is set to 0)No, you do not need a password to use these functions.
40	serialnumber (sn)	40 Serial Number FE850VA12345	Change Not Allowed	Not Applicable	This is the FERRUPS factory serial number; it is used to identify your FERRUPS.
41	modelindex (mi)	41 ModelIndex 3 03: FE850VA	Change Not Allowed	1:FE500VA-14:FE18KVA	Your FERRUPS' size and model number.
42	nomfreq (nf)	42 NomFrq 1)60Hz	Change Not Allowed	0)50Hz-1)60Hz	The nominal frequency of the AC input and output voltages.
43	nomvin (nvi)	43 NomVIn 120.0	Change Not Allowed	60.0-500.0 (In 8.01 software, 100.0-300.0)	The nominal AC input voltage to the FERRUPS.
44	nomvout (nvo)	44 NomVOut 120.0	Change Not Allowed	60.0-500.0 (In 8.01 software, 75.0-500.0)	The nominal AC output voltage from the FERRUPS.
45	ratedva (rva)	45 RatedVA 850	Change Not Allowed	100-30000	The maximum rated volt-amperes that the UPS can deliver to your protected equipment without sounding an Overload alarm

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
46	ratedwatts (rw)	46 RatedW 600	Change Not Allowed	100-30000	The maximum rated watts that the FERRUPS can provide to your protected equipment without sounding an Overload alarm.
47	ilimitlevel (ill)	47 ILimitLvl 123	Change Not Allowed	10-253	The level at which the FERRUPS' inverter limits current drawn from the batteries.
48	ilimitamps (ila)	48 ILimitAmp 229	Change Not Allowed	0-600	The approximate level of DC current (in amps) at which the FERRUPS' inverter will limit current drawn from the batteries.
49	rackmount (rm)	49 Rackmnt 0)No	Change Not Allowed	0)No-1)Yes	This parameter shows whether your FERRUPS is a rackmount model or a standard model.
50	startup (sta)	50 Startup 1)On	Service	0)Off-1)On	This parameter determines whether the UPS will be in the Auto mode when you turn the On/Off switch on. If this is set to 0)Off, the UPS will stay in the Off mode when you turn the witch on until you put it into Auto mode. If this is set to 1)On, the UPS goes into the Auto mode when you switch on the On/Off switch.
51	lowfreq (lf)	51 LowFreq 57.00	Service	45.00-65.00	The low AC input frequency at which the FERRUPS switches to inverter (battery power). The UPS will continue to use battery power until the frequency rises above this point again.
52	highfreq (hf)	52 HiFreq 63.00	Service	45.00-65.00	The high AC input frequency at which the UPS switches to inverter battery power. The UPS will continue to use battery power until the frequency drops below this point again.
53	slewrate (sr)	53 SlewRate 100	Service	5-500	The rate at which the FERRUPS' inverter tracks a varying AC input.
54	phaselock (pl)	54 PhaseLk 500	Service	50-5000	The point at which the FERRUPS has locked onto the AC input phase before it transfers from inverter (battery power) to AC input power.
55	freqglitchcnt (fgc)	55 FreqGlCnt 3	Service	1-60	The number of cycles that AC input frequency must be outside of the range set by parameters 51 and 52 before the FERRUPS switches to inverter (battery power).
56	lineglitchcnt (lgc)	56 LineGlCnt 3	Service	1-20	The number of AC input glitches in a row that must happen before the FERRUPS switches to inverter (battery power).
57	linedelta (lid)	57 LineDelta 80	Service	1-512	This parameter helps the FERRUPS determine what qualifies as an AC input glitch. Higher values make the FERRUPS less sensitive to input line transients.
58	xferdelay (xd)	58 XferDly 1.0s	Service	0.0-999.9	The minimum number of seconds the FERRUPS will run on inverter (battery power) before it switches back to AC input power.
59	lowvoutalarm (lvoa)	59 LVOAlrm 108.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which the FERRUPS sounds a Low AC Output alarm. See the User Manual.

Number	**Name (Short Form)**	Sample Display	Password to Change	**Range**	Explanation
60	lowvoutshutdn (lvos)	60 LVOShdn 102.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The point at which the FERRUPS shuts dow because of low output voltage.
61	hivoutalarm (hvoa)	61 HVOAlrm 129.6	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The output voltage at which the FERRUP: sounds a High AC Output alarm (See the Use Manual.)
62	hivinalarm (hvia)	62 HVIAlrm 138.0	Service	0.0-500.0 (In 8.01 software, 0.0-300.0)	The input voltage at which the FERRUP! sounds a High AC Input alarm. (See the Use Manual.)
63	extbrnout (ebo)	63 ExBrOut 1)Yes	None (User if parameter 39 has been changed to "Yes.")	0)No-1)Yes	This parameter enables or disables extende brownout. If this is set to "Yes," then th Brownout setpoint (parameter 28) varies fron 62% of nominal AC Volts In at no load to 80% of nominal AC Volts In at full load. If this is se to "No," the Brownout setpoint (parameter 28 stays at 80%. (See parameter 64.)
64	brownoutv (bv)	64 BrnOutV 96.0	Service	50.0-500.0	When parameter 63 is set to 0)No, thi: parameter determines when there is a brownou condition. When AC input voltage falls belov this setpoint, the FERRUPS switches to batter power
65	lowbattv (lb)	65 LoBatV 10.50	Service	6.00-175.00	The DC voltage at which the UPS shuts dowr because of a low battery The UPS will remair off until you switch it off and on again.
66	nearlowbattv (nlb)	66 NLBatV 11 .00	Service	6.00-175.00	The battery voltage at which the UPS sounds a Near Low Battery alarm. (See the User Manual.)
67	highbattv (hb)	67 HiBatV 15.00	Service	6.00-200.00	The battery voltage at which the UPS sounds a High Battery alarm (See the User Manual.)
68	lowruntime (lr)	68 LowRunTm 6m	None (User if parameter 39 has been changed to "Yes.")	o-999	When runtime (parameter 9) drops to this point, the FERRUPS sounds a Low Runtime alarm (See the User Manual.)
69	battamphours (bah)	69 Batt AH 31	Service	5-20000	The amp-hour capacity of the FERRUPS' batteries.
70	runtimek (k)	70 RuntimeK 20	Service	I-200	A constant that the FERRUPS uses to calculate runtime.
71	testlevel (tl)	71 Test Level 3	None (user if parameter 39 has been changed to "Yes.")	o-3	This determines which parts of the Automatic System Test the FERRUPS will do. See the User Manual for more information. 0=None; 1=Logic Test; 2=Logic and Inverter Tests; 3=Logic, Inverter, and Battery Tests.

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
72	testint (tei)	72 TestInt 7dy	None (User if parameter 39 has been changed to "Yes.")	0 (Off)-366	The number of days between Automatic System Tests. See the User Manual for more information on the test.
73	testtime (tt)	73 Test@ 1:00:00	None (User if parameter 39 has been changed to "Yes.")	00:00:00-23:59:59	The time of day (in 24-hour time) when the FERRUPS will do the Automatic System Test.
74	nomilimit (nil)	74 NomILimit 360	Service	10-999	The maximum current the FERRUPS can draw from its batteries when it runs on battery power.
75	batttesttime (btt)	75 BT Time 60s	Service	0-9999 (In 8.01-8.05 software, 0-999)	The number of seconds the FERRUPS must run on battery power during the battery test before it compares calculated runtime to the Low Runtime alarm setpoint.
76	pfmtemp (pt)	76 PFM Temp 28c	Change Not Allowed	- 63 to 193	The temperature of the Power Factor Module.
77	autorestart (ar)	77 AutoRst 60s	Service	o-9999	When you have shut down the FERRUPS using **an off or shutdown** command (see the User Manual), or when an alarm shuts down the FERRUPS, this is the minimum number of seconds the FERRUPS will remain off before it can restart automatically. To disable the automatic restart, set this to "0."
78	alarmsenable (ae)	78 AlmEnbl 1)Yes	Service	0)No-1)Yes	This parameter enables or disables the FERRUPS' ability to sense an alarm.
79	consolemode (cm)	79 Console Mode	None (User if parameter 39 has been changed to "Yes.")	1-4	This parameter helps make the UPS compatible with CheckUPS. Setting affects parameter 97. 1 = UPS sends inverter/alarm messages. 2 = UPS suppresses inverter/alarm messages. 3 = UPS does not echo back commands. 4 = UPS sends the "F" string every 15 seconds (See Section 307.)
80	ambtempalarm (ata)	80 AT Alarm 60c	Service	0-200	The point at which the FERRUPS sounds a High Ambient Temperature alarm. See the User Manual.
81	ambtempshutdn (ats)	81 AT Shdn 70c	Service	0-200	The point at which the FERRUPS shuts down because of a High Ambient Temperature.
82	hstempalarm (hta)	82 HT Alarm 105c	Service	0-200	The point at which the FERRUPS sounds a High Heatsink Temperature alarm. See the User Manual.
83	hstempshutdn (hts)	83 HT Shdn 110c	Service	o-200	The point at which the FERRUPS shuts down because of a High Heatsink Temperature.
84	xtempalarm (xta)	84 XT Alarm 75c	Service	0-200	The point at which the UPS sounds a High Transformer Temperature alarm. See the User Manual. **In models that do not monitor transformer temperature, this is set**

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
85	xtempshutdn (xts)	85 XT Shdn 85c	Service	0-200	The point at which the FERRUPS shuts down because of a High Transformer Temperature. **In models that do not monitor transformer temperature, this is set to "0."**
86	pfmtempalarm (pta)	86 PF Alarm 85c	Service	0-200	The point at which the FERRUPS sounds a High Power Factor Module Temperature alarm. See the User Manual.
87	pfmtempshtdn (pts)	87 PF Shdn 95c	Service	0-200	The point at which the FERRUPS shuts down because of a high Power Factor Module temperature.
88	acvofault (vof)	88 VOutFlt 24.0	Service	**0.0-500.0** (In 8.01 software, 0.0-300.0)	The point at which the FERRUPS shuts down because of output power problems.
89	invrelaydelay (ird)	89 IRlyDly 0s (Reserved in 8.01 software)	Service	0-9999	When the UPS starts running on inverter (battery), this is the number of seconds the UPS will delay before it activates the inverter relay.
90	remotebaudrate (rb)	90 Rem Baud 7 [07]: 1200 baud	Service	[0]: 50- [15]: 38400	The baud rate of the control panel's RJ-45 (phone jack) connector. If you have a device connected to the port, changing the baud rate could cause communication problems. Settings: [0]:50, [1]:75, [2]:110, [3]:135, [4]:150, [5]:300, [6]:600, [7]:1200, [8]:1800, [9]:2400, [10]:3600, [11]:4800, [12]:7200, [13]:9600, [14]:19200, [15]:38400.
91	remotewordfmt (rwf)	91 RemWordFmt 0 [00]: 8N1	Service	0-7	This parameter sets the data word format of the control panel's RJ-45 (phone jack) connector on 4.3-18KVA models. Call BEST for more information.
92	remotehandshake (rh)	92 Rem HndShk 15 SRx|STx|CTS|RTS	Service	0-15	This parameter enables or disables hardware and software handshaking of the control panel's RJ-45 (phone jack) connector on 4.3-18KVA models. Call BEST for more information.
93	remotercp (rrcp)	93 Rem RCP 1)Yes	Service	0)No-1)Yes	When this is 1)Yes, the control panel's RJ-45 (phone jack) connector (4.3-18KVA models) is set up to communicate with the control panel. When it is set to 0)No, the connector acts as an RS232 communication port.
94	remotectrl (rc)	94 Rem Ctrl 15 Eco|Err|Msg|P=>	Service	0-31	This parameter enables or disables messaging and echoback on the control panel's RJ-45 connector. Call BEST for more information.
95	consolebaudrate (cb)	95 Con Baud 7 [07]: 1200 baud	**Service**	[0]: 50- [15]: 38400 **(See Explanation column.)**	The baud rate of the UPS' communication port. If you have a device connected to the RS232 port, changing the baud rate could cause communication problems. Settings: [0]:50, [1]:75, [2]:110, [3]:135, [4]:150, [5]:300, [6]:600, [7]:1200, [8]:1800, [9]:2400, [10]:3600, [11]:4800, [12]:7200, [13]:9600, [14]:19200, [15]:38400.

lumber	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
96	consolewrdfmt (cw)	96 ConWordFmt 0 [00]: 8N1	Service	0-7	The data word format of the RS232 communication port. Settings: 8N1, 8N2, 7N1, 7N2, 7E1, 7E2, 7O1, and 7O2. Changing this setting could cause communication problems.
97	cons&handshake (ch)	97 Con HndShk 12 SRx|STx| |	Service	0-15	This parameter enables and disables hardware and software handshaking at the RS232 communication port.
98	consolercp (crcp)	98 Con RCP 0)No	Service	0)No-1)Yes	When this is set to 1)Yes, the FERRUPS' communication port is set up to communicate with a control panel. When this is set to 0)No, the communication port acts as an RS232 port.
99	consolectrl (cc)	99 Con Ctrl 15 Eco|Err|Msg|P=>	Service	0-31	This parameter enables and disables UPS messaging and echoback of the UPS' RS232 communication port (on the back panel).
100	search1 (s1)	100 Search #1 Network UPS 1	Service	up to 20 characters.	To enable the UPS to automatically log onto the host system that it is connected to, you can use this parameter to enter the string the host system uses to search for a UPS. When the UPS receives this search string, it will respond with the string you enter in parameter 102. See parameters 101-103.
101	search2 (s2)	101 Search #2 Network UPS 1	Service	up to 20 characters.	When the UPS receives this search string, it will execute the command you enter in parameter 103.
102	response1 (r1)	102 Response # 1 UPS #1 active	Service	Up to 40 characters.	See parameter 100. When the UPS receives the search string you enter in parameter 100, it will respond to your host system with the string you enter for this parameter (102).
103	response2 (r2)	103 Response #2	Service	up to 40 characters.	See parameter 101. When the UPS receives the search string you enter in parameter 10 1, it will execute the command you enter in this parameter (103).
104	relaymask1 (rm1)	104 RMask1 65535 PONMLKJIIIGFEDC BA	Service	O-65535	This parameter determines which of the alarms A-P will activate the alarm relay contact at the FERRUPS' RS232 port (on the back panel). (See Section 500 to program this parameter.)
105	relaymask2 (rm2)	105 RMask2 65535 543210ZYXWWTS RQ	Service	O-65535	'This parameter determines which of alarms Q-T will activate the alarm relay contact at the FERRUPS' RS232 port (on the back panel). (See Section 500 to program this parameter.)
106	epomode (em)	106 EPO Mode 0 I I	Service	0-16	This parameter selects the Remote Emergency Power Off Mode. (See Section 400.)
107	epodebounce (edb)	107 EPODbc 0.3s	Service	0.0-999.9	The length of Emergency Power Off signal that the FERRUPS requires. (See Section 400.)
108	epodelay (edl)	108 EPODly 0.1s	Service	0.0-999.9	The amount of time the FERRUPS delays a Remote Emergency Power Off shutdown after it receives the signal. (See Section 400.)

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
109	pabase (pab)	109 PABase 3560	Change Not Allowed	0-20000	This parameter affects FERRUPS transfers.
110	cfacvin (cfvin)	110 CFACVIN 1180	Change Not Allowed	0-32767 (In 8.01 software, O-3000)	The calibration factor numerator for AC input voltage.
111	cfacvid (cvid)	111 CFACVID 554	Change Not Allowed	I-1023	The calibration factor denominator for AC input voltage.
112	cfacvon (won)	112 CFACVON 1180	Change Not Allowed	0-32767 (In 8.01 software, O-3000)	The calibration factor numerator for AC output voltage.
113	cfacvod (cvod)	113 CFACVOD 554	Change Not Allowed	l-1023	The calibration factor denominator for AC output voltage.
114	cfacaon (caon)	114 CFACAON 68	Change Not Allowed	O-32761 (In 8.01 software, O-2200)	'The calibration factor numerator for AC output current
115	cfacaod (caod)	115 CFACAOD 44	Change Not Allowed	I-1023	The calibration factor denominator for AC output current.
116	cfdcvn (cdvn)	116 CFDCVN 1100	Change Not Allowed	o-32767 (In 8.01 software, O-17500)	The calibration factor numerator for DC voltage.
117	cfdcvd (cdvd)	1 17 CFDCVD 629	Change Not Allowed	l-1023	The calibration factor denominator for DC voltage.
118	cfdcan (cdan)	118 CFDCAN 2732	Change Not Allowed	O-32767 (In 8.01 software, O-2000)	The calibration factor numerator for DC current.
119	cfdcad (cdad)	119 CFDCAD 512	Change Not Allowed	I-1023	The calibration factor denominator for DC current.
120 (8.01-8.05 software)	softwver (sv)	120 SW Ver 8.02	Change Not Allowed	00.00-99.99	The FERRUPS software version for units with 8.01-8.05 software versions. See parameter 138 for higher software versions.
(8.06 and higher software)	cfchgn (cm)	120 CFCHGN 1000	Change Not Allowed	O-32767	The calibration factor numerator for charger current.
121 (8.01-8.05 software)	nvchecksum (c)	121 Chksum 1CF8h	Change Not Allowed	0000h-FFFFh	Nonvolatile RAM Checksum for units with 8.01-8.05 software versions. See parameter 138 for higher software versions.)
(8.06 and higher software)	cfchgd (ccd)	121 CFCHGD 1023	Change Not Allowed	I-1023	The calibration factor denominator for DC amps (charging current).

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
122 (8.01-X 05 software)	romchecksum (KS)	122 ROMChk 41B7h	Change Not Allowed	0000h-FFFFh	EPROM Checksum for ""its with 8.01-8.05 software versions. See parameter 139 for higher software versions.
(8.06 and higher software)	chargertype (ct)	122 Chgr Type 0	Service	0-3	The type of charger installed: 0 = Hardware float charger. 1 = Software-controlled float charger. 2 = Software-controlled hysteresis charger. 3 = Disabled; independent external charger.
123 (8.06 and higher software)	maxchargeamp (mc)	123 MaxChgA 20.0	Change Note Allowed	1.0-99.9	If parameter 122 is set to "I" or "2," parameter 123 is the continuous rated charger current. The average charger current cannot exceed this value. If parameter 122 is set to "0," parameter 123 is not effective.
124 (8.06 and higher software)	lowchargerv (lcv)	124 LoCV 1300	Service	0.0-200.0	When parameter 122 is set to "2," this parameter is the low charging voltage setpoint. The charger is started when DC volts fall below this value.
125 (8.06 and higher software)	floatchargerv (fcv)	125 FltCV 13.60	Service	0.0-200.0	When parameter 122 is set to "1," this parameter is the float charger voltage level. The FERRUPS maintains the battery voltage at this level if possible.
126 (8.06 and higher software)	highchargerv (hcv)	126 HiCV 14.40	Service	0.0-200.0	When parameter 122 is set to "2," this parameter is the high charging voltage setpoint. The charger is turned off when DC volts rise above this value,
127 (8.06 and higher software)	equalizechargerv (ecv)	127 EqlCV 12.60	Service	0.0-200.0	When parameter 122 is set to "2" or "3," this parameter is the equalize charging voltage setpoint. When battery voltage is below this point, the charger equalizes the batteries.
128 (8.06 and higher software)	chargerondelay (cod)	128 ChOnDly 240s	Change Not Allowed	2-9999	The amount of time (in seconds) that the FERRUPS will delay before stating the charger after startup or after an inverter run.
129 (8.06 and higher software)	lowacdelay (lacd)	129 LoACDly 5 s	Change Not Allowed	1-255	Once the FERRUPS senses a low AC output, this parameter determines the number of seconds the unit waits before causing a Low AC Output alarm shutdown.
130 (8.06 and higher software)	Reserved	130 --Reserved--	—	—	—
131 (8.06 and higher software)	Reserved	131 --Reserved--	—	—	—
132 (8.06 and higher software)	Reserved	132 --Reserved--	—	—	

Number	Name (Short Form)	Sample Display	Password to Change	Range	Explanation
133 (…nd …er software)	Reserved	133 --Reserved--	—	—	—
134 (8.06 and higher software)	Reserved	134 --Reserved--	—	—	—
135 (8.06 and higher software)	Reserved	135 --Reserved--	—	—	—
136 (8.06 and higher software)	Reserved	136 --Reserved--	—	—	—
137 (8.06 and higher software)	softwver (sv)	137 SW Ver 8.06	Change Not Allowed	00.00-99.99	The FERRUPS software version for units with 8.06 and higher versions. See parameter 120 for earlier software versions.
138 (8.06 and higher software)	nvchecksum (c)	138 Chksum 1 CF8h	Change Not Allowed	OOOOh-FFFFh	Nonvolatile RAM Checksum for units with 8.06 and higher software versions. See parameter 121 for earlier software versions.
139 (8.…nd … so…e)	romchecksum (rcs)	139 ROMChk 41B7h	Change Not Allowed	0000h-FFFFh	EPROM Checksum for units with 8.06 and higher software versions. See parameter 122 for earlier software versions.

307 The Format Command

The format command tells the FERRUPS to send system status and metering information in a fixed format. This information can be incorporated into your host system software without any text or punctuation. The data string is made up of

1. For 8.01-8.04 software, <cr><lf><cr>, or a carriage return, a line feed, and another carriage return. For 8.05 and higher software, <cr><cr><lf>, or two carriage returns and a line feed.
2. 80 ASCII characters that represent 40 hexadecimal bytes of information.
3. <cr><cr><lf>, or two carriage returns and a line feed.

The data is in the format shown in the table below and on the next two pages.

Characters	# Bytes	Description
header	Not Applicable	For 8.01-8.04 software, a <cr><lf><cr> or <ODH><OAH><ODH> sequence. For 8.05 and higher software, a <cr><cr><lf> or <ODH><ODH><OAH> sequence.
0-1	1	Month (BCD) Range: 01-12
2-3	1	Day (BCD) Range: 01-3 1
[illegible]	1	Hours (BCD) Range: 00-23
6-7	1	Minutes (BCD) Range: 00-59

Characters	# Bytes	Description
8-9	1	Seconds (BCD) Range: 00-59
10-11	1	System Mode (BCD) Range: 00-03 — 00 = Off; 01 = Auto; 02 = Line Conditioning; 03 = Inverter (Battery Power)
12-13	1	Reserved.
14-15	1	Alarm Status (BCD) Range: 00-01 — 00 = Alarms disabled, 01 = Alarms enabled.
16-17	1	Inverter Status (BCD) Range: 00-01 — 00 = Inverter is off; 01 = Inverter is on.
18-19	1	Charger Status (BCD) Range 00-01 — 00 = Charger is off; 01 = Charger is on.
20-21	1	Alarm Status Register #1, alarms A-H (bit-mapped, 1=true). See the information below.

Bit Position

	7	6	5	4	3	2	1	0
Alarm	High Ambient Temp	Output Overload	High AC out	LOW AC out	LOW Runtime Left	High Battery	Near LOW Battery	LOW Battery

Characters	# Bytes	Description
22-23	1	Alarm Status Register #2, alarms I-P (bit-mapped, 1=true). See the information below.

Bit Position

	7	6	5	4	3	2	1	0
Alarm	Emergency Power Off	Check Memory	Check Inverter	Check Battery	Check Charger	High Trans-former Temp	User Test Alarm	High Heatsink Temp

Characters	# Bytes	Description
24-27	2	AC Volts In (BCD) Range: 0000-9999
28-31	2	AC Volts Out (BCD) Range: 0000-9999
32-35	2	Reserved.
36-39	2	AC Current Out in Amps (BCD) Range: 0000-9999. A decimal point is implied after the third digit (xxx.x)
40-45	3	Volt-Amperes (VA) Out (BCD) Range: 000000-999999
46-49	2	DC Current in Amps (BCD) Range: 0000-9999. A decimal point is implied after the third digit (xxx.x).
50-53	2	DC Volts (BCD) Range: 0000-9999. A decimal point is implied after the third digit (xxx.x).
54-57	2	Frequency in Hz (BCD) Range: 0000-9999. A decimal point is implied after the second digit (xx.xx).
58-61	2	Runtime Minutes Remaining (BCD) Range: 0000-9999
62-65	2	Ambient Temperature in Degrees Celsius (BCD) Range: 0000-9999
66-67	2	Alarm Status Register #3, alarms Q-X (bit-mapped, 1=true). See the information below.

Bit Position

	7	6	5	4	3	2	1	0
Alarm	Reserved	Reserved	Reserved	Reserved	Call Service	High AC Input	Probe Missing	Check PFM Temp

<table>
<tr><th>Characters</th><th># Bytes</th><th colspan="9">Description</th></tr>
<tr><td rowspan="4">68-69</td><td rowspan="4">2</td><td colspan="9">Alarm Status Register #4, alarms Y-Z and O-S (bit-mapped, 1=true). See the information below</td></tr>
<tr><td></td><td colspan="8">Bit Position</td></tr>
<tr><td></td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Alarm</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>70-71</td><td>1</td><td colspan="9">Console Error Codes:
00 = No error
01 = Unrecognized command
02 = Not implemented
03 = Number expected
04 = Bad/missing keyword
05 = String expected
06 = Keyword or number expected
07 = Additional parameters expected
08 = Too many parameters
09 = Value out of range
0A= Bad password
0B = Password required
0C = Parameter not programmable
0D = Cannot change system mode
0E = Unrecognized error code</td></tr>
<tr><td>72-73</td><td>1</td><td colspan="9">ADR5. Range: 00-FF. A/D conversion value of aux board input.</td></tr>
<tr><td>74-77</td><td>2</td><td colspan="9">Software Version number.</td></tr>
<tr><td>78-79</td><td>1</td><td colspan="9">Checksum Byte (Hexadecimal, 00-FF is valid). Equal to the 2's complement hex sum, without carry, of the preceding 39 two-digit hexadecimal numbers.</td></tr>
<tr><td>trailer</td><td>Not Applicable</td><td colspan="9"><cr><cr><lf> or <0DH><0DH><0AH> sequence</td></tr>
</table>

400 Remote Emergency Power Off

The **Remote Emergency Power Off** feature on pin 21 lets you shut down the FERRUPS' output power through your computer room's emergency shutdown switch. Usually, the computer room's emergency shutdown switch shuts down AC input power to all of the equipment that is connected to the switch. This kind of switch can shut down the FERRUPS' input power if FERRUPS receives its input power through the emergency shutdown switch. However, this setup will not shut down the output power that the FERRUPS provides to the protected equipment; instead, the FERRUPS will continue to provide output power until its batteries run down. To set up the emergency shutdown switch to shut off the FERRUPS' **output power, you** need to use the Remote Emergency Power Off feature.

To shut down the **FERRUPS'** output power, your computer room's emergency shutdown switch must have a set of contacts that apply the +12 VDC level on pin 6 (or on pin 18) to pin 21. Use a shielded, single twisted pair cable to connect your switch to these pins. **Do not use pin 14.**

A brief connection between pins 6 and 21 (or pins 18 and 21) will shut down the FERRUPS' output and start the Emergency Power Off alarm As long as pin 6 or pin 18 is connected to pin 21, you cannot restart the FERRUPS to provide output power. To restart the UPS, break the connection between pins 6 and 21 (or between pins 18 and 21). Then, tom the FERRUPS On/Off switch off and on again. (You can put the UPS in the Auto Mode instead of turning the On/Off switch off and on again.)

Note: The +12 VDC level on pin 6 or pin 18 **is only** available when the FERRUPS is operating,

You can change the way the Remote Emergency Power Off feature operates by using parameters 106, 107, and 108. Seethe instructions in Sections 401-403.

401 Changing the Remote Emergency Power Off Mode (Parameter 106)

Parameter 106, EPO Mode, lets you decide which of four available features you want to use. The tables below describe these features. All four are off when the FERRUPS is shipped to you. To choose one or more of the features, simply add the values of the features you want to use and use the total as the new parameter setting. If you don't want to use any of these features, leave the setting at 0. You can completely disable the EPO feature by setting parameter 106 to 16. (See Section 305 for information on programming parameters.)

Name	Value	What the FERRUPS Does When You Select This Option	What the FERRUPS Does When You Leave this Off
Rst (Restart)	8	The FERRUPS automatically restarts when the emergency power off signal from your emergency shutdown switch stops.	The FERRUPS does not restart until you break the connection between pins 6 and 2 1 (or 18 and 2 I) and turn the UPS on manually.
Inv (Inverter)	4	The FERRUPS will only shut down if it receives the emergency power off signal when it is running on battery power.	The UPS will shut down when it receives the emergency power off signal regardless of whether it is running on AC input or battery power.
Lvl (Level)	2	Level-sensitive. The UPS responds to a level emergency power off signal (not a rising or falling signal). (See the table below.)	Edge-Sensitive. The UPS responds to an emergency power off signal made up of rising or falling voltage. (See the table below.)
Neg (Negate)	1	FERRUPS responds to 0 volts on pin 21 as an emergency power off signal.	FERRUPS responds to 12 volts on pin 21 as a" emergency power off signal.

Examples: If you chose the Restart and Level features, you would add the values (8 and 2) to get your new parameter setting (10).

Using the Level and Negative Features		
Level	**Negative**	**What FERRUPS Does**
On	Off	Pin 6 or IX is usually not applied to pin 2 1, so the UPS usually receives no signal (0 volts). When pin 6 or 18 is applied to pi" 21 and the UPS receives a **steady** or **level** 12-volt signal, the UPS will shut down its output power and start the Emergency Power Off alarm.
On	On	Pin 6 or pi" 18 is usually applied to pin 2 1, so the UPS usually receives a 12-volt signal. After pin 6 or IX is **removed** from pin 2 I and the UPS is not receiving a signal (0 volts), the UPS will shut down its output power and start the Emergency Power Off alarm.
Off	Off	Pin 6 or 18 is usually **not** applied to pin 21, so the UPS usually receives no signal (0 volts). When pi" 6 or 18 is applied to pin 2 1 and the voltage **is rising** to 12 volts, the UPS will shut down its output power and start the Emergency Power Off alarm
Off	On	Pin 6 or 1X usually is applied to pi" 21, so the UPS usually receives a 12-volt signal. When pin 6 or 1X is **removed** from pin 21 and the voltage **is falling** to 0 volts, the UPS will shut down its output power and start the Emergency Power Off alarm.

402 Changing the Length of Emergency Power Off Signal FERRUPS Requires (Parameter 107)

Using parameter 107, you can also tell the FERRUPS how long an emergency power off signal should be.

Note: This delay only works if "level" is set (on) in parameter 106. (See Section 40 1.)

In some environments with a lot of electrical noise, the noise could act like an emergency power off signal. To make sure that the FERRUPS **recognizes** a true emergency power off signal, you can change the value of parameter 107.

As shipped, the FERRUPS' parameter 107 is set to 0.3s (.3 seconds). This means that the FERRUPS will wait for an emergency power off signal on pin 21 that is at least .3 seconds long. If you want the FERRUPS to wait for a longer signal, you can change the setting of parameter 107. (See the Parameter Table in Section 306 for more information.)

403 Changing FERRUPS' Delay Before Shutdown (Parameter 108)

As shipped, the UPS waits 0.1 seconds after it recognizes an emergency shutdown signal before it shuts down You can adjust this delay by changing the value of parameter 108. (See the Parameter Table in Section 306.)

500 Using the RelayMask Parameters to Control the Alarm Contacts

The RelayMask parameters (104 **and** 105) let you choose which alarms will operate the alarm signal contacts at the UPS communication port For more information on the alarm contacts, see the FERRUPS User Manual (Section 403).

As shipped, the alarm signal contacts change status whenever the UPS alarms. By programming the RelayMask parameters, you can set up the alarm contacts so they will only change status during certain alarms. RelayMask1 (parameter 104) is for alarms A-P, and RelayMask (parameter 105) is for alarms Q-T. No matter **how you program these parameters, when the On/Off switch is off, the alarm contacts will act as if an alarm is present.**

To program parameters 104 and 105, follow these steps:

1. Enter the Service password (2639). If you are using a FERRUPS control panel, use the [PROGRAM] key to enter the password. If you are using a terminal or computer, use the **password (or pw)** command.

2. Display parameter 104 (RelayMask1). If you have a control panel, press [DISPLAY] [1] [0] [4] [ENTER]. If not, enter **display 104** on your computer or terminal.

3. Parameter 104 determines whether alarms A-P will activate the contacts At the factory, it is set to 65535; this setting means all of the alarms (A-P) will activate the alarm relay contacts.

   If you do not want any of the alarms to activate the contacts, write 0 for the "Total" on the next page. If you want some of the alarms to activate the contacts, find the Alarm Value for each of those alarms and write it in the third column on the next page. Write 0 for each alarm that you do not want to activate the contacts. Then, add the numbers in the third column.

   For example, to enable alarms A (Low Battery), B (Near Low Battery), and C (High Battery), write 1 for alarm A, 2 for alarm B, 4 for alarm C, and 0 for the rest of the alarms. The total is 7.

   Note: For the AS/400, you should only enable the alarm signal contacts for the Low Battery and Near Low Battery alarms. In the blanks on the next page, A=1, B=2, C through P=0, and Total=3.

Alarm	Alarm Value	Enter 0 to disable contacts or the Alarm Value to enable them
Low Battery (A)	1	______
Near Low Battery (B)	2	______
High Battery (C)	4	______
Low Runtime (D)	8	______
Low AC Output (E)	16	______
High AC Output (F)	32	______
Output Overload (G)	64	______
High Ambient Temperature (H)	128	______
High Heatsink Temperature (I)	256	______
User Test Alarm (J)	512	______
High Transformer Temperature (K)	1024	______
Check Charger(L)	2048	______
Check Battery (M)	4096	______
Check Inverter (N)	8192	______
Memory Check (0)	16384	______
Emergency Power Off(P)	32168	______
	Total:	______

4. Now, change the parameter 104 setting to the total you found in step 3. If you have a control panel, use the [PROGRAM] key to change the setting; if not, use the **program** (or pr) command at your terminal or computer.

5. Next, display parameter 105 (RelayMask2); this parameter is for alarms Q-T. If you have never changed the setting, it should be 65535 now, which means alarms Q-T will all activate the alarm signal contacts.

6. If you do not want any of these alarms (Q-T) to operate the alarm contacts, write 0 for the "Total" below.

   Note: For AS/400, the contacts should be disabled for all of these alarms. Write 0 for the "Total."

   If you want some of the alarms to operate the contacts, write the Alarm Value for each of those alarms in the blanks below; write "0" for any alarm that you do not want to operate the contacts. (Notice that several alarms are "Reserved"; this means no alarm has been assigned to these letters, and the alarms will not appear on your UPS.) Now, **add the numbers in the third column.**

Alarm	Alarm Value	Enter 0 to disable contacts or the Alarm Value to enable them
High PFM Temperature (Q)	1	______
Probe Missing (R)	2	______
High AC Input(S)	4	______
Call Service (T)	8	______
Reserved (U)	16	______
Reserved (V)	32	______
Reserved (W)	64	______
Reserved (X)	128	______
Reserved (Y)	256	______
Reserved (Z)	512	______
Reserved (0)	1024	______
Reserved (1)	2048	______
Reserved (2)	4096	______
Reserved (3)	8192	______
Reserved (4)	16384	______
Reserved (5)	32768	______
	Total:	______

7. Change the parameter 105 setting to the total you found in step 6. (Use the [PROGRAM] key on the control panel or the program or **pr** command on a terminal or computer.)

8. Display parameter 104 and 105 to verify the settings.

600: Connecting an External Relay to Monitor the Dry Contacts

The FERRUPS provides a 12 VDC, 0.5-amp source on pin 14 that you can use to power an external relay. See Figure 5. When you connect the relay, you *must place* a 1N41 48 or equivalent diode in parallel with the relay coil to clamp spikes. Spikes are induced when the relay coil is de-energized.

The FERRUPS' dry contacts are rated at 25 volts AC or DC and 250 mA.

CAUTION: If you do not connect the diode in parallel with the relay coil, the spikes could damage the logic board or make it reset. If the logic board resets, it loses any parameter changes you have made and some programming important to your model .

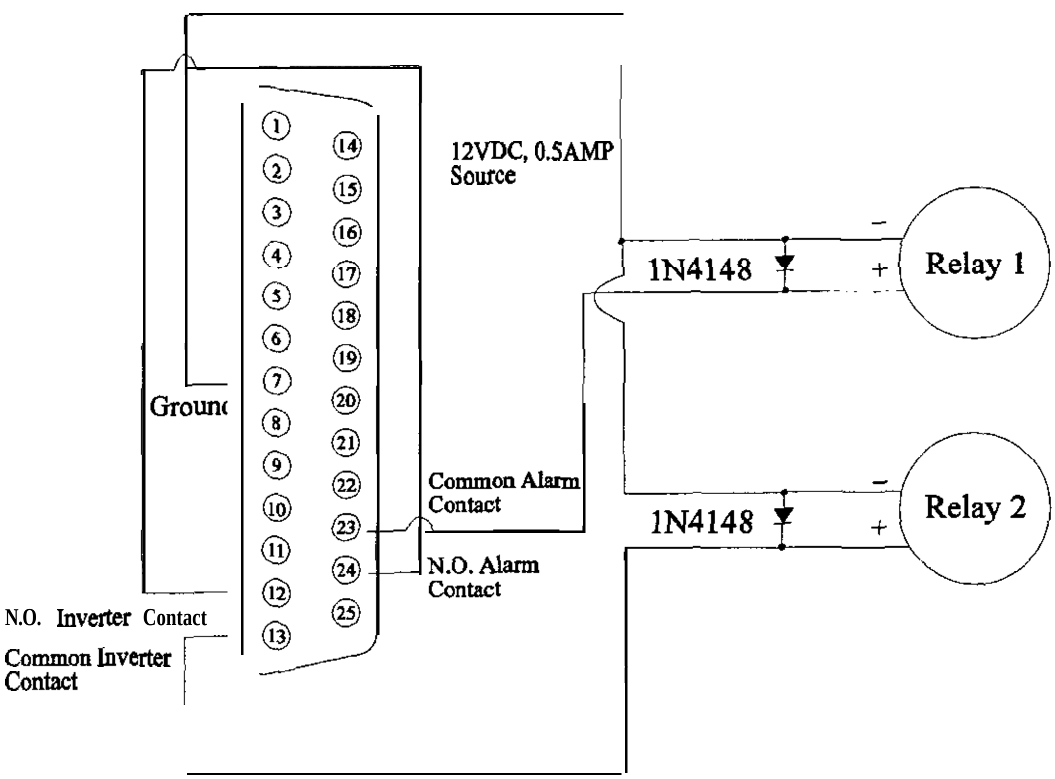


Figure 5

Index

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

TIP 604
2345
June 1, 1994

FERRUPS® Written Scheduled Maintenance Procedure

Use TIP 605 with this TIP to record the responses to the steps below.

1. ***Name and signature of the contact person who authorized the maintenance and UPS test.*** Does the customer understand that during this procedure the load equipment must be powered down if the bypass is "break before make" or if the UPS is a line cord model?

2. ***Comments orproblems regarding the UPS.*** Record any comments or problems the UPS has had since its last scheduled maintenance.

3. ***Is the UPS environment clean andfreefrom dust and dirt?*** If the UPS is not in a safe, clean, dry area, stop and call BEST's Technical Support at 800-356-5737.

YOU MUST EITHER BYPASS THE UPS OR SHUT DOWN THE LOAD EQUIPMENT FOR STEPS 4, 5, AND 6.

Note: If you have a BEST "make before break" bypass, switch it to Line. If you have a BEST "break before make" bypass, a non-BEST bypass or a line cord UPS unit, protect your load equipment by shutting it down.

4. ***FloorSaver models only.*** Follow this step only if your FERRUPS is a FloorSaver FD or FE model. See if the battery extension cable [BAA-0024) is installed on the back of the FloorSaver unit. If not, you must bypass or turn off the load equipment and then turn off the FERRUPS unit. Turn off the DC switch and install the battery extension cable.

WARNING!

These procedures must be performed by a qualified technician ONLY!
UPS units are designed to provide power under a variety of operating conditions.
Dangerous voltages may be present even if AC line or DC voltage is removed.
TEST BEFORE TOUCHING!
Turn off the UPS' power switch (500 VA - 3.1 KVA models) or key switch (4.3 - 18 KVA models) and then remove AC line and DC input power before continuing.
UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.
Always wear protective clothing and eye protection and use insulated tools when working near batteries.

N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 , 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

TURN OFF THE UPS AND REMOVE AC LINE AND DC INPUT POWER TO THE UPS BEFORE REMOVING THE COVER AND CONTINUING WITH STEPS 5 AND 6. TEST BEFORE TOUCHING!

Cover Removal:

For ME or FE 500 VA - 3.1 KVA models- Remove the #1 Phillips screw on the top of the unit and loosen the #2 Phillips screw on the front of the unit behind the sticker. Then, slide the cover forward until it is completely off the UPS.
For FD or FE 4.3 KVA - 18 KVA models- Loosen the screws on the top center strip and then loosen and/or remove the side screws to remove the side covers.

5. ***Perform a visual inspection of the UPS.*** With the covers off, look for any damage on the boards or any marks inside the unit. Check all terminal connections, including battery AC Input, and AC Output, to make sure each is in good working order and free of corrosion. Tighten the connection if a wire is loose. Check each battery connection to ensure each one is tight. We recommend each connection be torqued to 55 inch/lbs (7.2 newton-meters). If any damage is evident, stop and call BEST's Technical Support. If not, continue.

6. ***FD and FE 4.3 KVA - 18 KVA models*** only. Check the 587 Spike Suppression Board for any damage. This board is located in the back of the unit by the DIN rail. If any damage is evident or fuses are open, stop and call BEST's Technical Support. If not, continue.

THE UPS MUST BE OPERATING AND AT LEAST 50% OF FULL LOAD SHOULD BE APPLIED FOR THE FOLLOWING TESTS.

Note: To start the UPS you must take the unit off of bypass. The load applied should be as close to 50% of full load as possible.

7. ***List the five most recent inverter and alarm*** log ***events.*** In this order, turn on DC power, AC power, and the UPS power switch or key switch. Apply the load to the UPS. The load applied should be at least 50% of full load. Then, to view the inverter log activity, display parameter 24 (Inverter Log) on the control panel by pressing [DISPLAY] [24] [ENTER]. To view the alarm log activity, display parameter 25 (Alarm Log) on the control panel by pressing [DISPLAY] [25] [ENTER].

Note: On FE models, pressing [0] immediately after [ENTER] will halt the scrolling of the logs. Pressing [1] will display the next recorded event in the logs.

On ME or FD models, pressing [ENTER] will display the next recorded event in the logs.

The first entry listed after the parameter wording display is always the most recent. Refer to TIP 406 (ME or FD) or TIP 407 (FE) if you need more information on using the hand-held remote control panel.

8. ***Is there anything in the logs that implies the UPS will not sustain the equipment during an outage?*** Look at step 7 and determine if any battery alarms have occurred since the last scheduled maintenance was performed, such as Alarm A (LOW BATTERY), Alarm B (NEAR LOW BATTERY), or Alarm C (HIGH BATTERY). If so, stop and call BEST's Technical Support. If not, continue.

9. ***Is customer using UPS contacts for a communications link?*** If the customer is using a communications link with UPS monitoring software (for example, AS/400) or BEST CheckUPS software, you must disable the software prior to doing the battery and alarm tests.

   For ME or FD models: Perform a battery test by pressing [CONTROL] [77] [ENTER] [ENTER].

   Note: Although the unit will actually run on battery power for only one minute, the full test cycle may take up to 30 minutes.

   For FE models: Perform a system test by pressing [CONTROL] [7] [ENTER] [ENTER].

   Note: If the unit fails, repair accordingly.

10. ***Perform*** an ***alarm test.*** Press [CONTROL] [8] [ENTER] [ENTER] to test the alarm. While the unit is sending an alarm, check to make sure that the alarm LED is on. Press [CONTROL] [8] [ENTER] [ENTER] to cancel the alarm test. If the alarm did not work, stop and call BEST's Technical Support. If the alarm did work, continue.

    Note: The ME and FD alarm LED on the front of the unit will not light if the unit is set up to operate with an AS/400 or if the User Test Alarm is disabled (masked).

11. Check the LED *status indicators* to *make* sure they work when they ***should.*** The LED status indicators are located on the front panel. You may want to press [CONTROL] [4] [ENTER] [ENTER] to have the inverter come on and make sure the battery power LED is lit. Next, press [CONTROL] [2] [ENTER] (ENTER] to verify that the AC LINE and READY LEDs are lit. If so, continue. If not, stop and call BEST's Technical Support. (The CHARGING LED may or may not be lit.)

    Note: On ME and FD units, Alarm J must be enabled.

12. ***Battery*** *load test.* Remove AC line from the UPS. With a load applied, run the UPS on inverter for 10 minutes per battery string or until each battery is 11.5 volts DC. Record these figures in the "Inverter On With Load" row and record the date code in the "Date Code" row.

Note: On BEST batteries, the date code is the three digit number printed neai the positive (+) battery post. Example: 311 would represent November of 1993 as the date of manufacture.

On Panasonic batteries, the date code is a six digit number printed on the side of the battery. Example: 931120 would represent November 20, 1993 as the date of manufacture.

On Gates batteries, the date code is the last 4 numbers of a 12 digit number printed on the top of the battery. Example: 0765-0001-3295W would represent the 295th day of 1993 as the date of manufacture.

Ifadditional space for battery information is needed, use another TIP 605 and attach it to the back of the form on which you're working.

On 12VDC batteries, watch for any battery that deviates by more than 0.5 VDC from the average of all batteries. On 6VDC batteries, watch for any battery that deviates by more than 0.25 VDC from the average of all batteries. If a battery that deviates from these averages is found, reapply AC line so that the customer's protected loads will not be dropped. If you find one or more bad batteries, circle the date code(s). If you replace one or more bad batteries, note this in step 15. If all of the batteries are in tolerance, continue. If not, stop and call BEST's Technical Support (after applying AC line to protect the load equipment).

13. *Fill in the parameters in the list that apply to the model being tested.* This is a two step process:

    a. While the UPS is running on inverter (from the battery load test in step 12), display the parameters listed and record these values in the "On Inverter" column. After the inverter test has been completed, fill in the information for "Length of load test" (record how many minutes the test ran) and "Battery Type" (write down the BATA number located on the top of the batteries).

    b. Reapply AC line to the UPS. After the UPS has transferred back to AC line, display the parameters listed and record the values in the "On Line" column. Reset the time and date.

14. *Record any repairs or changes that you made.* Did you change anything? If yes, you must completely describe what you found and what you did to correct the problem.

15. *List all parts, including batteries, used to repair the system.*

16. *For BEST IFSCs:* Fill out the information on the bottom of page two (travel time, time on site, was the unit operational, is a return trip required, and whether BEST must contact the customer). If a billable battery replacement is necessary, fill out the P.O. section and have an authorized site contact sign the form under "Authorized by". If proper authorization cannot be obtained for a PO#, do **not** replace any battery. Have the form signed by the required individuals and return it to BEST.

IEST POWER, a division of General Signal Power Systems, Inc (hereinafter called BEST POWER) and Customer agree that Start-Up, Repair, Exchange, Preventive Maintenance, Training and other services or epair parts sales ("Service") provided by BEST POWER to Customer shall be performed exclusively ursuant to the charges, terms and conditions stated below in the absence of an applicable Service greement between BEST POWER and Customer. Charges are based on BEST POWER'S then ppli charges for Service, including labor, parts, travel (portal to portal) and other expenses.

. R . The charge for any repairs not covered by a Service Agreement (a "Non-covered Repair") nd any repairs made in the absence of a Service Agreement will be invoiced to the Customer at BEST OWER's standard rates. A Non-Covered Repair includes, but is not limited to, repairs or replacements including all parts and labor) due to damage, unreasonable use or other cause and include, without imitation, all damage from road hazards, accident, fire or other casualty, misuse or misapplication, egligence, premises wiring, load equipment, high temperature, dirty or dusty environments, and any use r installation not in conformity with instructions furnished, as well as any repairs or replacements needed ue to unauthorized modifications to the equipment or related software or the use of parts not authorized r supplied by BEST POWER, or multiple trips including trips due to denied access to the equipment.

. **REPAIR COMPONENTS.** Under a Service Agreement or Standard Limited Warranty, parts required repair a unit will be provided by BEST POWER and replaced on an exchange basis. In the absence of overage under a Service Agreement or Warranty, parts are provided at the current non-warranty exchange rices, if returned parts are repairable and remarketable. If the parts returned are not repairable or marketable then the customer will be invoiced for the full list price of the parts. All parts removed or nused become the property of BEST POWER and must be returned to the factory within 30 days of eceipt of replacement. Any unused parts returned to BEST POWER may be subject to the current stocking fee. In the absence of an applicable Service Agreement or Standard Limited Warranty, Batteries ill be provided at BEST POWER's then applicable charges.

. **PAYMENT TERMS.** All invoices are payable to BEST POWER within thirty (30) days of the date f the invoice. Customer shall make such arrangements for payment as BEST POWER may require, and EST POWER may suspend service until such arrangements are made. Past due amounts shall be subject an interest charge of one percent (1%) per month or the highest rate permitted by law plus all costs of ollection, including attorneys fees. All sales, property, excise and other federal, state and other local xes (other than those based upon BEST POWER's net income) shall be paid by Customer.

SUPERSEDING EFFECT. Any terms and provisions of Customer's order or other document which e inconsistent with any of the terms and conditions hereof are rejected, will not be binding on BEST OWER nor considered applicable to the Services ordered. Acceptance of these terms and conditions all be conclusively indicated by issuance by Customer of any written or oral order or request for Service Service Order"). Except as set forth in an applicable Service Agreement, these terms and conditions onstitute the entire Agreement between the parties and replace any prior understandings, proposals or her communication with respect to this subject matter.

LIMITED WARRANTY. This Limited Warranty applies to all Services rendered by BEST POWER its authorized representatives. (The standard Limited Warranty applicable to a Product shall apply to y sale of new Products.) BEST POWER warrants that the Services that the Customer has received or ill rec BEST POWER or its authorized representative pursuant to the terms of a Service Order all be ed properly and/or any parts supplied by BEST POWER under this Service Order shall free f cts in materials and workmanship under normal use for a period of thirty (30) days. This arranty, however, extends only to the Customer. It cannot be transferred to anyone who subsequently urchases the product from the Customer.

XCEPT AS EXPRESSLY SET FORTH IN THIS WARRANTY BEST POWER MAKES NO OTHER ARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED ARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BEST OWER EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED IN THIS LIMITED ARRANTY. WITH RESPECT TO INTERMITTENT PROBLEMS, COMPLEX PROBLEMS THAT IVOLVE SITE SPECIFIC ISSUES OR ANY NON-COVERED REPAIR, BEST POWER MAKES NO ARRANTY, EXPRESS OR IMPLIED, THAT THE SERVICES SHALL FULLY RESOLVE ALL ROBLEMS OR ISSUES.

EST POWER IS NOT LIABLE FOR ANY DAMAGES CAUSED BY (I) THE PRODUCT OR PARTS SED BY IT OR THE SERVICES RENDERED BY IT OR (II) THE FAILURE OF THE PRODUCT OR ARTS TO PERFORM OR (III) THE FAILURE OF ANY SERVICES RENDERED TO HAVE BEEN ROPERLY RENDERED, INCLUDING, BUT NOT LIMITED TO, ANY LOST PROFITS, LOST AVINGS, INCIDENTAL DAMAGES, OR CONSEQUENTIAL DAMAGES. THIS LIMITATION OF ABILITY WILL BE EFFECTIVE EVEN IF THE CUSTOMER HAS ADVISED BEST POWER, OR AN UTHORIZED REPRESENTATIVE OF BEST POWER, OF THE POSSIBILITY OF SUCH DAMAGES. IE LIMITATIONS CONTAINED HEREIN MAY NOT BE WAIVED OR ALTERED BY ANY PERSON.

JRTHERMORE, THE CUSTOMER'S ONLY REMEDY IS TO HAVE BEST POWER REPLACE ANY ARTS OR REDO THE SERVICES RENDERED. IF BEST POWER IS UNABLE TO REPAIR OR EPLACE THE PRODUCT OR PARTS OR CORRECT THE SERVICES TO CONFORM TO THIS ARRANTY AFTER A REASONABLE NUMBER OF ATTEMPTS, THEN BEST POWER WILL EFUND THE CHARGE FOR THE DEFICIENT SERVICE. REMEDIES UNDER THIS WARRANTY RE EXPRESSLY LIMITED TO THOSE SPECIFIED ABOVE.

me states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation incidental or consequential damages for consumer products. In such states, if the Service should be emed a consumer product, the exclusions or limitations of this Limited Warranty may not apply to the istomer. This Limited Warranty gives the Customer specific legal rights. However, the Customer may o have other rights that may vary from state to state. The Customer is advised to consult applicable ite laws to ascertain the full extent of his rights.

6 **GOVERNING LAW.** The terms of this Agreement shall be governed by the laws of the State of Wisconsin exclusive of conflict of laws rules.

7 **LIABILITY AND CLAIMS.** Liability of BEST POWER on any claim of any kind, including claims for negligence or other torts, or for any loss or damage, arising out of, or connection with, or resulting from, any Service, or from the manufacture, sale, delivery, resale, repair or use of any products covered by, or furnished under, such an order, shall in no case exceed the price allocable to the product, service or part thereof which gives rise to the claim. In no event shall BEST POWER be liable for any special, incidental, consequential or exemplary damages. Any claims against BEST POWER for shortages by it in making shipments shall be made in writing to BEST POWER within fifteen (15) days after receipt of shipment.

The fulfillment of any Service Order is subject to strikes, labor disputes, lockouts, accidents, fires, delays in manufacture or in transportation or delivery of material, floods, severe weather or other acts of God, embargoes, governmental actions, or any other cause beyond the reasonable control of BEST POWER, whether similar to, or different from, the causes above enumerated, whether affecting BEST POWER or BEST POWER's supplier or subcontractor, and any such causes shall absolve BEST POWER from any liability to Customer.

8. **CHANGES.** BEST POWER may, at any time, without notice, make changes (whether in design, materials, the addition of improvements, or otherwise) in any product, and may discontinue the manufacture of any product, all in its sole discretion, without incurring any obligations of any kind as a result thereof, whether for failure to fill an order accepted by BEST POWER or otherwise. In performing Services, BEST POWER may use factory reconditioned parts or product. BEST POWER may subcontract with others to perform Services without Customer's prior consent, but BEST POWER shall remain responsible for performing the Service.

9. **EXCLUSIONS.** In no event shall BEST POWER have any obligation to identify, correct, abate, cleanup, control or remove any defective premises electrical equipment or wiring or any code violation or any toxic or hazardous material in Customer's premises.

10. **LIMITATION OF ACTIONS.** No action, regardless of form or basis, arising out of transactions related to a Service Order or the Services performed or to be performed may be brought by either party more than two (2) years after the cause of action has accrued.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

TIP 605
2345
June 24, 1996

FERRUPS' Scheduled Maintenance and Service Call Report Form For ME, QME, FD, QFD, FE and QFE Models

Please check one: ☐ Maintenance ☐ Service Service Order Number ____________________
Technician ____________________ Technician ID Number- ____________
LOCATION OF SYSTEM: Model Number ____________ Serial Number ____________
Company Name, Address and Phone Number ____________________

____

Work Instructions ____________________
Bypass Type: ☐ BBM ☐ IMBB Date and Time of service ____________________

1. Name and signature of contact person who authorized the maintenance and UPS test. ____________________
____
2. Comments or problems regarding the UPS ____________________
____
3. Is the UPS environment clean and free from dust and dirt? Yes☐ No ☐ **If not, correct the problem at this time.**

YOU MUST EITHER BYPASS THE UPS OR SHUT DOWN THE LOAD EQUIPMENT FOR STEPS 4, 5, AND 6.

4. **FloorSaver models** only: Is your battery extension cable (BAA-0024) installed at this time? Yes☐ No☐ ______ If not, you must install it **now.** To do this **you must turn off the** FERRUPS. **Before installing the cable, make sure the DC switch is in the "Off" position.**

CAUTION! **Turn off the UPS and then remove AC line and DC input power before removing the cover and continuing with steps 5 and 6. TEST BEFORE TOUCHING!**

5. Perform a visual inspection of the UPS. Check all terminal connections (battery, AC Input, and AC Output). Are connections tight, free of corrosion and in good condition? Yes☐ No☐ **If not, correct the problem at this time.**

6. **FD and FE 4.3 KVA - 18 KVA models only -** Are there open fuses or physical damage on the Spike Suppression Board?
Yes☐ No ☐ **If yes, correct the problem at this time.**

7. List the five most recent inverter and alarm log events:

	1	-	-	-	-		1	-	-	- - - -
Inverter	2	______				**Alarm**	2	____	____	____ ____
Log	3	____	____	____	____	**Log**	3	____	____	____ ____
	4	____	____	____	____		4	____	____	____ ____
	5	____	____	____	____		5	____	____	____ ____

8. Is there anything in the logs that implies the UPS will not sustain the equipment during an outage? Notify the site that you are going to perform a battery load test and that in the unlikely event of a problem, all equipment should be prepared for a power outage.

FOR BEST RESULTS APPLY AT LEAST 50% OF FULL LOAD FOR THE FOLLOWING TESTS

9. Is customer using UPS contacts for a communications link? Take the necessary precautions so that this contact closure will not cause a premature shutdown. **For ME** or **FD models:** Perform a battery test by pressing [CONTROL] [77] [ENTER] [ENTER]. **For FE models:** Perform a system test by pressing [CONTROL] [7] [ENTER] ENTER].

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10. Perform an alarm test. Check the LED status indicators to make sure they work when they should.

11. Battery load test. Remove AC line from the UPS. With a load applied, run inverter for 10 minutes per battery string or until each battery measures 11.5 volts. Record voltages below in the "Inverter On With Load" column. Circle the date code for any bad batteries.

Battery Number	1	2	3	4	5	6	7	8	9	10
Inverter On With Load										
Date Code										

12. Fill in the parameters in the following list that apply to the model being tested.

Parameter Number	On Inverter	On Line
0 Time	x x x	________
1 Volts In	________	
2 Volts Out	________	
3 Reserved (I In FD/QFD only)	________	
4 I Out	________	
5 VA Out	________	
6 I Batt	________	
7 V Batt	________	
8 Freq	________	
9 Rn Tm	________	
10 Date	x x x	________
11 Amb Temp	________	
12 HS Temp	________	
13 Reserved (% Hum FD/QFD only)	XXX	________
14 Xfmr Temp (certain FE models)	________	
14 Unit ID (ME or FD only)	x x x	________
15 Unit ID (FE only)	XXX	________

Parameter Number	On Inverter	On Line
16 Full Ld %	________	
17 Watts	________	
1% PF	________	
19 VALimit	________	
20 #Pwr out	________	
21 #OvrLds	________	
22 Sys Hrs	________	
23 Inv Min	________	
26 Test Results (FE only)		
Time/Date	XXX	________
Logic RA/RD	x x x	________
Invgate L/R	XXX	________
Batt RT/DC	XXX	________
67 Hi Batt	XXX	________
73 Pkl (FD only)	________	________
74 Pk2 (FD only)	________	________

Length of load test ____________________ minutes. Battery Type ____________________

13. Record any repairs or changes that you made. Document any wiring problems and any corrective action that was taken.

____

____

____

____

____

14. List all parts, including batteries, used to repair the system

____

____

____

15. Travel time ____________ Time on Site ____________ Unit Operational? Yes/No ________ Return Trip required? Yes/No ________

Battery type ____________________ Quoted price ______________ (Quoted price does not include shipping or tax, if applicable.)

P.O. # Authorized by ____________________ Verified by (BEST employee) ____________________

Site Representative's signature ____

I have read and understood the terms and conditions listed on the reverse side of this form.

Service Representative's signature ____

SERVICE ORDER TERMS & CONDITIONS

BEST POWER, a division of General Signal Power Systems, Inc (hereinafter called BEST POWER) and Customer agree that Start-Up, Repair, Exchange, Preventive Maintenance, Training and other services or repair parts sales ("Service") provided by BEST POWER to Customer shall be performed exclusively pursuant to the charges, terms and conditions stated below in the absence of an applicable Service Agreement between BEST POWER and Customer. Charges are based on BEST POWER'S then applicable charges for Service, including labor, parts, travel (portal to portal) and other expenses.

1. REP e charge for any repairs not covered by a Service Agreement (a "Non-covered Repair") and any re made in the absence of a Service Agreement will be invoiced to the Customer at BEST POWER's standard rates. A Non-Covered Repair includes, but is not limited to, repairs or replacements (including all parts and labor) due to damage, unreasonable use or other cause and include, without limitation, all damage from road hazards, accident, fire or other casualty, misuse or misapplication, negligence, premises wiring, load equipment, high temperature, dirty or dusty environments, and any use or installation not in conformity with instructions furnished, as well as any repairs or replacements needed due to unauthorized modifications to the equipment or related software or the use of parts not authorized or supplied by BEST POWER, or multiple trips including trips due to denied access to the equipment.

2. **REPAIR COMPONENTS.** Under a Service Agreement or Standard Limited Warranty, parts required to repair a unit will be provided by BEST POWER and replaced on an exchange basis. In the absence of coverage under a Service Agreement or Warranty, parts are provided at the current non-warranty exchange prices, if returned parts are repairable and remarketable. If the parts returned are not repairable or remarketable then the customer will be invoiced for the full list price of the parts. All parts removed or unused become the property of BEST POWER and must be returned to the factory within 30 days of receipt of replacement. Any unused parts returned to BEST POWER may be subject to the current restocking fee. In the absence of an applicable Service Agreement or Standard Limited Warranty, Batteries will be provided at BEST POWER's then applicable charges.

3. **PAYMENT TERMS.** All invoices are payable to BEST POWER within thirty (30) days of the date of the invoice. Customer shall make such arrangements for payment as BEST POWER may require, and BEST POWER may suspend service until such arrangements are made. Past due amounts shall be subject to an interest charge of one percent (1%) per month or the highest rate permitted by law plus all costs of collection, including attorneys fees. All sales, property, excise and other federal, state and other local taxes (other than those based upon BEST POWER's net income) shall be paid by Customer.

4. **SUPERSEDING EFFECT.** Any terms and provisions of Customer's order or other document which are inconsistent with any of the terms and conditions hereof are rejected, will not be binding on BEST POWER nor considered applicable to the Services ordered. Acceptance of these terms and conditions shall be conclusively indicated by issuance by Customer of any written or oral order or request for Service ("Service Order"). Except as set forth in an applicable Service Agreement, these terms and conditions constitute the entire Agreement between the parties and replace any prior understandings, proposals or other communication with respect to this subject matter.

5. **LIMITED WARRANTY.** This Limited Warranty applies to all Services rendered by BEST POWER or its authorized representatives. (The standard Limited Warranty applicable to a Product shall apply to any sale of new Products.) BEST POWER warrants that the Services that the Customer has received or will recei EST POWER or its authorized representative pursuant to the terms of a Service Order shall be l properly and/or any parts supplied by BEST POWER under this Service Order shall be free fr s in materials and workmanship under normal use for a period of thirty (30) days. This warranty, however, extends only to the Customer. It cannot be transferred to anyone who subsequently purchases the product from the Customer.

EXCEPT AS EXPRESSLY SET FORTH IN THIS WARRANTY BEST POWER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BEST POWER EXPRESSLY DISCLAIMS ALL WARRANTIES NOT STATED IN THIS LIMITED WARRANTY. WITH RESPECT TO INTERMITTENT PROBLEMS, COMPLEX PROBLEMS THAT INVOLVE SITE SPECIFIC ISSUES OR ANY NON-COVERED REPAIR, BEST POWER MAKES NO WARRANTY, EXPRESS OR IMPLIED, THAT THE SERVICES SHALL FULLY RESOLVE ALL PROBLEMS OR ISSUES.

BEST POWER IS NOT LIABLE FOR ANY DAMAGES CAUSED BY (I) THE PRODUCT OR PARTS USED BY IT OR THE SERVICES RENDERED BY IT OR (II) THE FAILURE OF THE PRODUCT OR PARTS TO PERFORM OR (III) THE FAILURE OF ANY SERVICES RENDERED TO HAVE BEEN PROPERLY RENDERED, INCLUDING, BUT NOT LIMITED TO, ANY LOST PROFITS, LOST SAVINGS, INCIDENTAL DAMAGES, OR CONSEQUENTIAL DAMAGES. THIS LIMITATION OF LIABILITY WILL BE EFFECTIVE EVEN IF THE CUSTOMER HAS ADVISED BEST POWER, OR AN AUTHORIZED REPRESENTATIVE OF BEST POWER, OF THE POSSIBILITY OF SUCH DAMAGES. THE LIMITATIONS CONTAINED HEREIN MAY NOT BE WAIVED OR ALTERED BY ANY PERSON.

FURTHERMORE, THE CUSTOMER'S ONLY REMEDY IS TO HAVE BEST POWER REPLACE ANY PARTS OR REDO THE SERVICES RENDERED. IF BEST POWER IS UNABLE TO REPAIR OR REPLACE THE PRODUCT OR PARTS OR CORRECT THE SERVICES TO CONFORM TO THIS WARRANTY AFTER A REASONABLE NUMBER OF ATTEMPTS, THEN BEST POWER WILL REFUND THE CHARGE FOR THE DEFICIENT SERVICE. REMEDIES UNDER THIS WARRANTY ARE EXPRESSLY LIMITED TO THOSE SPECIFIED ABOVE.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages for consumer products. In such states, if the Service should be deemed a consumer product, the exclusions or limitations of this Limited Warranty may not apply to the Customer. This Limited Warranty gives the Customer specific legal rights. However, the Customer may also have other rights that may vary from state to state. The Customer is advised to consult applicable state laws to ascertain the full extent of his rights.

6. **GOVERNING LAW.** The terms of this Agreement shall be governed by the laws of the State of Wisconsin exclusive of conflict of laws rules.

7. **LIABILITY AND CLAIMS.** Liability of BEST POWER on any claim of any kind, including claims for negligence or other torts, or for any loss or damage, arising out of, or connection with, or resulting from, any Service, or from the manufacture, sale, delivery, resale, repair or use of any products covered by, or furnished under, such an order, shall in no case exceed the price allocable to the product, service or part thereof which gives rise to the claim. In no event shall BEST POWER be liable for any special, incidental, consequential or exemplary damages. Any claims against BEST POWER for shortages by it in making shipments shall be made in writing to BEST POWER within fifteen (15) days after receipt of shipment.

The fulfillment of any Service Order is subject to strikes, labor disputes, lockouts, accidents, fires, delays in manufacture or in transportation or delivery of material, floods, severe weather or other acts of God, embargoes, governmental actions, or any other cause beyond the reasonable control of BEST POWER, whether similar to, or different from, the causes above enumerated, whether affecting BEST POWER or BEST POWER's supplier or subcontractor, and any such causes shall absolve BEST POWER from any liability to Customer.

8. **CHANGES.** BEST POWER may, at any time, without notice, make changes (whether in design, materials, the addition of improvements, or otherwise) in any product, and may discontinue the manufacture of any product, all in its sole discretion, without incurring any obligations of any kind as a result thereof, whether for failure to fill an order accepted by BEST POWER or otherwise. In performing Services, BEST POWER may use factory reconditioned parts or product. BEST POWER may subcontract with others to perform Services without Customer's prior consent, but BEST POWER shall remain responsible for performing the Service.

9. **EXCLUSIONS.** In no event shall BEST POWER have any obligation to identify, correct, abate, cleanup, control or remove any defective premises electrical equipment or wiring or any code violation or any toxic or hazardous material in Customer's premises.

10. **LIMITATION OF ACTIONS.** No action, regardless of form or basis, arising out of transactions related to a Service Order or the Services performed or to be performed may be brought by either party more than two (2) years after the cause of action has accrued.

Best Power
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OWERSYSTEMS

TIP 700
24
February 11, 1997

Adding External Batteries and/or Upgrading the Charger in FERRUPS FE/QFE 500-850 VA Models

This Technical Information Publication (TIP) describes adding, or changing to, external batteries and upgrading to a 15-amp charger in the FE and QFE 500-850VA. Tbis TIP is intended for a qualified service person familiar with the FERRUPS® unit. **This procedure cannot be performed on** units **ordered** with **duplex 5-15, L5-15, 5-20 or 4 gang IEC-320 receptacles and internal battery!** The **back** panel is one piece and cannot be retrofitted with the external battery and battery connector. If you have any problems or questions during this procedure, call call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only), l-608-565-2100. or call your local Best Power office.

Tools Needed – Use Insulated Tools:

Safety Equipment Required by Local Codes
Torque Wrench Calibrated for In./Lbs or N/m
Terminal or Remote Control Panel
7/16-inch Nutdriver
7/16-inch Wrench
Side Cutter
Phillips Screwdriver
Needle Nose Pliers

Parts Needed:

SSEBK-0002	Extended Runtime Kit (External Batteries)
BCA-0004	Lester Battery Charger; 12-volt, 15-amp
LAB-0905	New Product ID Label

CAUTION!

This procedure must be performed by qualified service personnel ONLY! FERRUPS units arc designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed **TEST BEFORE TOUCHING!**

Turn off the FERRUPS according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the *FERRUPS User Manual* (Section 308). Make sure that the FERRUPS batteries and the AC input arc off or disconnected before you upgrade the charger or add external batteries.

This unit contains electrostatic-sensitive devices. If you **do not follow** proper ESD procedures, you may cause **severe damage to the electrical circuitry.**

FERRUPS batteries are high current sources. Shorting battery terminals can cause severe arcing. equipment damage and injury A short circuit can cause a battery to explode.

Best Power recomments the following for qualified service personnel servicing the FERRUPS unit:

A) Remove rings, watches, and other jewelry before servicing the FERRUPS unit.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries
C) Whenever servicing an energized unit with the doors open, electric shock is possible; follow all local safety codes.

Make certain the UPS complies with all applicable electrical codes when you have finished changing the charger and/or adding external batteries.

T-0700A

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1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

10 1. Before you start make sure the AC line is removed and the On/Off (l/O) switch on the rear of the FERRUPS is in the Off (O) position.

102. Locate the grounding (Phillips-head) screw on the top of the FERRUPS and remove it. (See Figure 1.)

103. Locate the small round blue sticker in lower right comer of the BEST emblem on the front of the unit and remove it. Underneath is a large Phillips head screw. Loosen the screw eight (8) to nine (9) turns. Slide the cover toward the front of the unit and remove it.

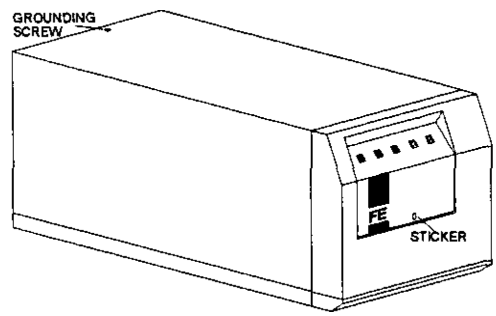

Figure 1

Section 200: Converting to External Batteries

201: Removing the Internal Battery

201-I Use a **7/16-inch** nut driver to disconnect the positive (+) and negative (-) battery cables and wrap the exposed metal on the cable in electrical tape.

201-2 Use a **7/16-inch** nut driver to remove the upper and lower battery brackets. (See Figure 2.)

CAUTION! **Be careful** when you **remove the upper battery bracket so it does not short across the battery terminals.**

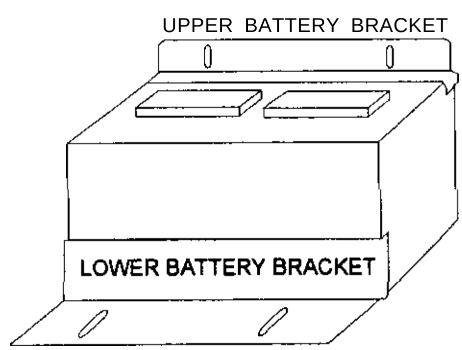

Figure 2

201-3 Tip the **battery** *toward the rear* of the unit **and lift** it out through the **side.**

202: Installing the External Battery Option Receptacle Panel

202-1. Remove the four (4) screws holding the receptacles in the panel. (See Figure 3.)

Note: Receptacles used on 50 Hz units snap in. On Shukos receptacles, the screw in the center may be removed and the front of the receptacle may be snapped out: on all other 50 Hz receptacles you must disconnect the wires.

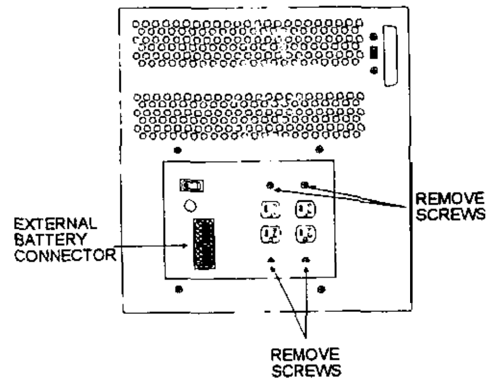

Figure 3

202-2. Disconnect the linecord from the relay inside the unit.

202-3. Disconnect the wires from the power switch.

202-4. Remove the four (4) screws holding the panel in and remove it. (See Figure 4.)

202-5. Install the power switch and linecord in the new receptacle panel and mount the new panel in the unit.

202-6. Remount the receptacles in the panel (reconnect the receptacle wires on 50 Hz units). Connect the wires to the power switch.

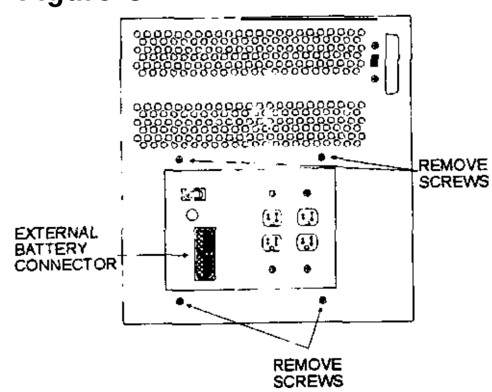

Figure 4

tion 300: Installing the Charger

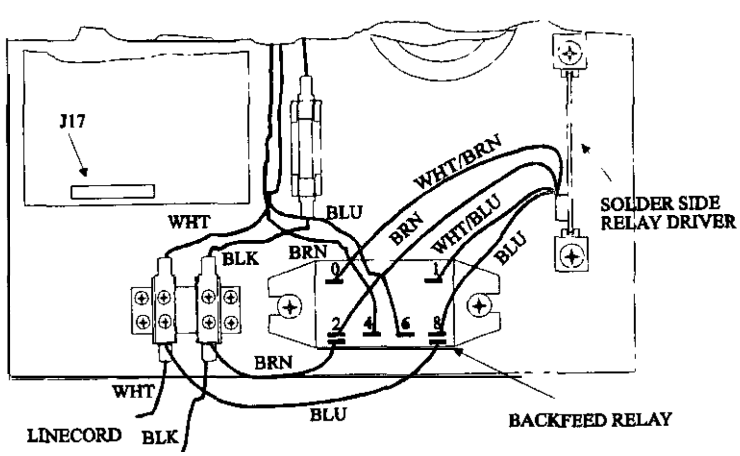

Figure 5

301. Remove the backfeed relay and remount it on the battery charger assembly. (See Figure 5.)

302. Remove the backfeed relay driver board and slide it in the mounting brackets on the charger assembly with the solder side out. (See Figure 5.)

303. Slide the battery charger assembly in the lower compartment of the FERRUPS. Tip the unit slightly and insert the two (2) carriage bolts provided up through the mounting holes in the bottom of the unit and in the battery charger assembly mounting tray. Secure the bolts with the two (2) hex nuts provided.

304. Reconnect the wires and linecord to the backfeed relay. (See Figure 5 on page 3.)

305. Mount the battery connector to the mounting bracket with the two (2) bolts provided. (See Figure 4 on page 3.)

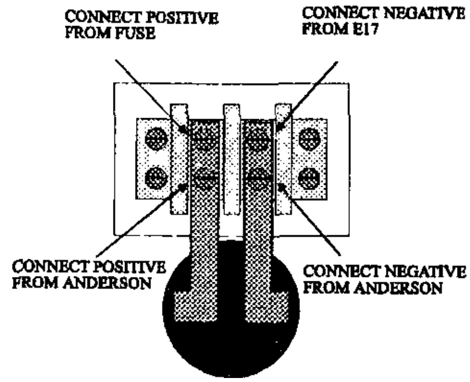

Figure 6

306. Make sure the positive (+) symbol on the filter capacitor is on the same side as the positive (+) connection from the fuse and connect the battery connector cables and and inverter DC input cables as indicated. (See Figure 6.)

307. Route the wire harness from terminal J17 on the charger control board (see Figure 5 on page 3) up through the hole in the bottom of the of the electronic tray to and connect it to J3 on the power board (see Figure 7).

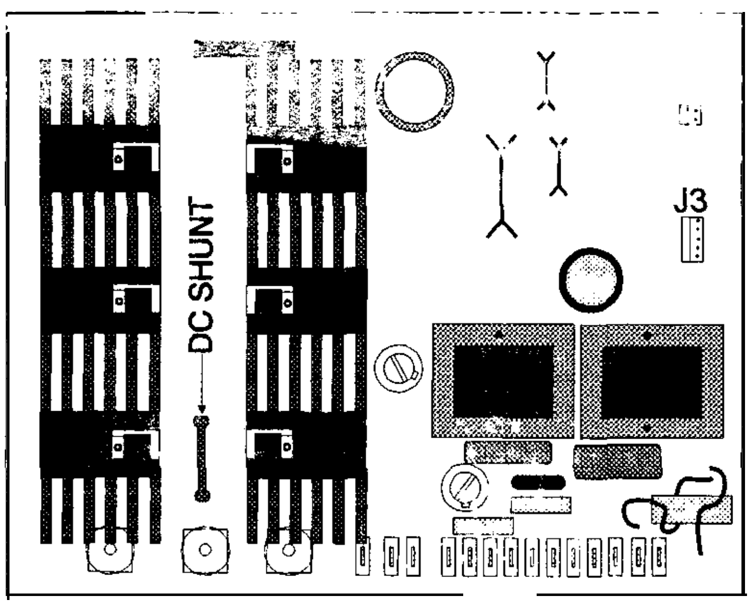

Figure 7

Section 400: Testing the Charger

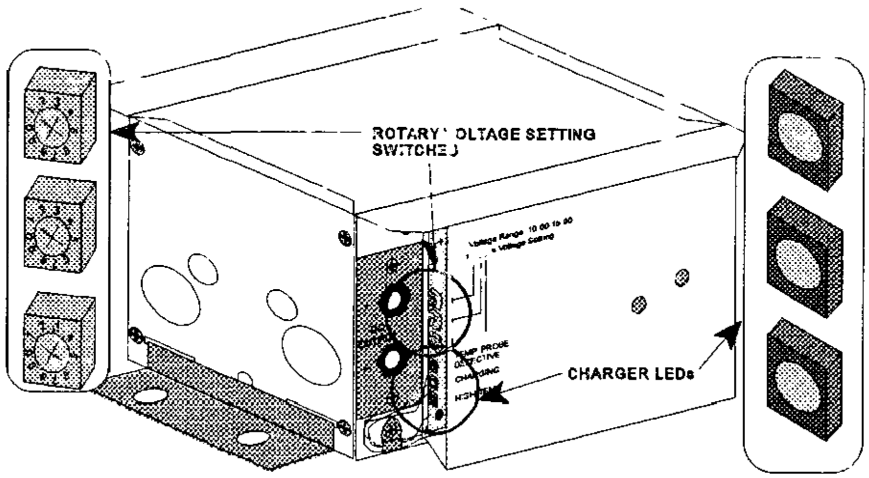

Figure 8

401. Make sure the voltage setting switches on the charger assembly are set for 13.8 VDC and make sure all connections are tight. (See Figure 8.)

402. Check for the correct polarity on the battery bank and connect the batteries

403. Apply AC line and turn the power switch on.

404. Make sure the CHARGER LED on the logic board lights (third green LED from the left).

40.5. Make sure the amber CHARGING LED (the middle LED) on the charger assembly lights. (See Figure 8.)

If the charger LED is blinking, one of the voltage setting switches may be between positions.

If the charger LED **does not light,** make sore the battery voltage is below the start point (generally 12.8 to 13.2 VDC) If it is not, remove AC power for five (5) to ten (10) seconds and reapply it. If the light still does not light to indicate that the charger is operating, call Best Power Worldwide Service.

Section 500: Calibrating the UPS

After you upgrade the charger and/or add external batteries, you need to recalibrate the battery amp-hour and the charger settings to avoid false alarms. For calibration you need a true RMS digital multimeter and a clamp-on AC current probe, We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-400 AC current probe or their equivalents If you do not have these probes or their equivalents, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office.

To perform the calibration commands in this section, you need a hand held Remote Control Panel or a terminal connected to the RS232 port. Go to Section 501 if you have a handheld remote; if you are using a terminal or a computer connected to the FERRUPS RS232 port, go to Section 502.If you have any questions or problems during this procedure, call Best Power Worldwide Service.

501: System Calibration Using a Control Panel

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltage incorrectly could cause alarms, or shut down, for High AC Input. Low AC Input, High AC Output or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

501-1. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I).

501-2. Connect the Remote Control Panel to the RS232 port on the back of the FERRUPS. You will use the Remote Control Panel to enter commands and parameter changes in the following steps.

501-3. Enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER]

501-4. Apply the load to the UPS. Make sure **the** load is more than 50% of full load,

50 1-5. Enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating. look for a battery part number (BAT-*XXXX*) on a label on your batteries **and** use Table 1 to determine the amp-hour rating, If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), I-608-565-2 100, or call your nearest Best Power office for more information.

Now, display parameter 69 (Batt AH), If the amp-hour rating shown matches the amp-hour rating of your batteries. go on to step 50 1-6. If **not,** press [PROGRAM], enter the correct amp-hour rating, and press [ENTER].

Table 1: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0051	200 AH
BAT-0046	75 AH	BAT-0053	31 AH
BAT-0047	75 AH	BAT-0058	17 AH
BAT-0048	100 AH	BAT-0065	33 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH

50 l-6. Display parameter 122 by pressing [DISPLAY] [1] [2] [2] [ENTER] to display the charger type used on the FERRUPS unit. The display should read "0." If your unit **does** not display the proper charger, change the setting to the correct charger by pressing [PROGRAM] [0] [ENTER].

CAUTION: **Failure to select the proper charger setting for your unit's power board listed above will cause incorrect operation of the charger** and **possible system damage.**

501-7. The next two (2) measurements must be done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

501-8. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by typing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by pressing [PROGRAM], entering your DC voltage measurement, and pressing [ENTER].

501-9. To measure DC current, you must use a Fluke 80i-410 DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service at 1-800-356-5737. Set the meter for DC mV, attach the Fluke 80i-410 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current will equal one amp per mV DC measured.

501-10. Display parameter 6 (I Batt) by pressing [DISPLAY] [6] [ENTER]. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the negative battery cable with the probe. The **arrows stamped on the current probe must match the flow of current you are measuring.** (See Figure 9.) If the result is different from the value displayed for parameter 6, change the value of parameter 6 by pressing [PROGRAM], entering yow measured value, and pressing [ENTER].

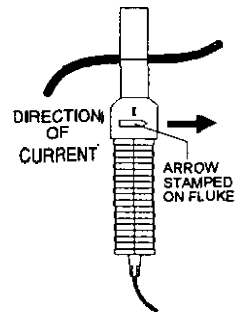

Figure 9

501-11. Clear the Service Password by pressing [CLEAR] twice or until the message "Password Cleared" appears.

501-12. Turn the FERRUPS off; then, remove all AC and DC.

502: System Calibration Using a Terminal or Computer

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms, or shut down, for High AC Input, Low AC Input. High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly **could cause a battery alarm**

In this procedure, you may need to change parameters. To make sure you are able to enter commands, clear the screen now by pressing the <ENTER> key until the => prompt appears. Then, go on to the steps below: if you need to change parameters, the steps tell you what commands to enter. For more information on communication. see TIP 503 in Section 700.

502-1. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I).

502-2. Connect your terminal or computer to the RS232 port on the back of the FERRUPS. You will use the terminal or computer to enter commands and parameter changes in the following steps.

502-3. Enter the Service password by typing pw 2639 and pressing <ENTER>. The prompt should change to "Service=>" to let you know you have entered the password.

502-4. Apply the load to the UPS. Make sure the load is 50% or more of the UPS' KW rating.

502-5. Enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 1 on page 6 to determine the amp-hour rating. If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service.

Now, display parameter 69 (Batt AH) by typing **d** 69 and pressing <ENTER>. If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 502-6. If not, type **pr** at the "Service=>" prompt, enter the correct amp-hour rating at the "=>" prompt, and press <ENTER>.

502-6. Display parameter 122 by typing **d** 122 and pressing <ENTER> to display the charger type used on the FERRUPS unit. The parameter should be set to "0.". If your unit does not display "0," type **pr** at the "Service=>" prompt, enter "0," and press <ENTER>.

CAUTION: **Failure to select the proper charges setting for your unit's power board listed above will cause incorrect operation of the charger and possible system damage.**

502-7. The next two (2) measurements must be done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

502-8. Measure the battery string voltage with the digital muhiieter. Then, display parameter 7 (V Batt) on the control panel **by** typing d 7 and pressing <ENTER>. If your measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by typing **pr** at the "Service =>" prompt, entering your DC voltage measurement at the "=>" prompt, and pressing <ENTER>.

502-9. To measure DC current, you must use a Fluke 8Oi-4 10 DC/AC Current Probe or equivalent, If you do not have this probe or its equivalent. call Best Power Worldwide Service at l-800-356-5737. Set the meter for DC mV, attach the Fluke 80i-410 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current will equal one amp per mV DC measured.

502-I 0. Display parameter 6 (I Batt) by typing d 6 and pressing <ENTER>. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the negative battery cable with the probe. The arrows **stamped on the current probe must match the flow of current you are measuring. (See** Figure 9 page 7.) If the result is different from the value displayed for parameter 6. change the value of parameter 6 by typing **pr** at the "Service=>" prompt, entering your measured value at the "=>" prompt, and pressing <ENTER>.

502-l 1. Clear the Service Password by typing pw and pressing <ENTER>. The prompt should change back to "=> "

502-12. Turn the FERRUPS off; then, remove all AC and DC

Section 600: Putting the Cover Back on and Restarting the Unit

601. Slide the cover back on **and** tighten the screw on the front of unit.

602. Install the grounding screw on the top back of unit. (See Figure 1 on page 2.)

603. Apply the safety label (LAB-0905: "Caution! **Risk** of Electric Shock!") to the back of unit.

604. Apply the new product ID label the over old product ID label on the back of the unit and mark the proper input voltage.

605. Start up your FERRUPS following the procedure ***in the FERRUPS*** User ***Manual,*** startup all load equipment, and return the unit to normal operation.

Charger Upgrade and/or Adding External Batteries to FERRUPS FE/QFE 1.15 to 1.4 KVA Models

This Technical Information Publication (TIP) describes how to upgrade the charger and add external batteries to the FERRUPS® FE and QFE 1.15 and 1.4 KVA models. A qualified service person familiar with the FERRUPS unit must perform these procedures, If you have any questions or problems during these procedures, call Best Power Worldwide Service at 1-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your local Best Power office

Tools Needed – Use Insulated Tools:

Safety Equipment Required by Local Code	Two (2) 7/16-inch Wrenches	# 1 Phillips Screwdriver
Handheld Remote Control Panel or Terminal	Needlenose Pliers	#2 Phillips Screwdriver
Torque Wrench Calibrated to In/Lbs or N/m	1/4-inch Nutdriver	Regular Screwdriver
Petroleum Jelly or Battery Terminal Spray	Digital Voltmeter	

Parts Needed:

SSEBK-0002	Extended Runtime Kit	*WIA-0638*	WIA-0778
BCA-0004	Lester Battery Charger; 12-volt, 15-amp	MA-0639	WIA-0801
LAB-0905	Safety Label	*WA-0777*	*WIA-0802*

CAUTION!

[illegible]s procedure must be performed by qualified service. personnel ONLY! FERRUPS units are designed to provide powe under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed **TEST BEFORE TOUCHING!**

Turn off the FERRUPS according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the *FERRUPS User Manual (Section 308).* Make sure that the FERRUPS batteries and the AC input are off or disconnectec before you replace the main DC fuse.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may caus severe damage to the electrical circuitry.

FERRUPS batteries are high current sources, Shorting battery terminals can cause severe arcing, equipment damage. and injury. A short circuit can cause a battery to explode.

Best Power recomments the following for qualified service personnel servicing the FERRUPS unit:

A) **Remove rings, watches, and other jewelry before servicing the FERRUPS unit.**
B) **Always wear protective clothing and eye protection and use insulated tools when working near batteries.**
C) **Whenever servicing an energized unit with the doors open, electric shock is possible; follow all local safety codes.**

LPT-0701C

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Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS

> **CAUTION!**
>
> **Make sure the On/Off switch on the back of the UPS is OFF, and make sore all AC and DC power to the unit is off.**

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1.)

104. Next, fmd the sticker in the lower right comer of the front panel with the BEST logo. Remove the sticker, save the sticker, and loosen the #2 Phillips screw behind the sticker five (5) or six (6) turns to loosen (but not remove) it.

105. Slide the cover forward until it is completely off the UPS.

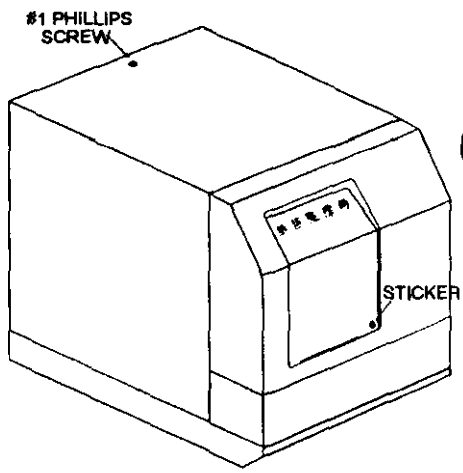

Figure 1

Section 200: Installing the External Battery Option

201: Removing the Internal Battery

201-I. Locate the battery in the lower compartment.

201-2. Disconnect the battery cable from the negative (-) battery terminal and insulate the cable; then, disconnect the battery cable from the positive (+) battery terminal.

201-3. Remove the four (4) bolts on the battery brackets and remove the bracket and the internal battery from the unit.

202: Installing the External Battery

202-1. Find the DC filter capacitor, the triangular mounting bracket, and the round mounting bracket provided in your kit. Install the round mounting bracket around the base of the filter capacitor if it is not attached.

a

202-2. Mount the red termination bracket to the top of the capacitor. (See Figure 2.)

202-3. Tilt the unit up slightly and place the biangular bracket up through the bottom of tbe chassis. (See Figure 2.)

202-4. Mount the DC filter capacitor to the chassis. (See Figure 2.)

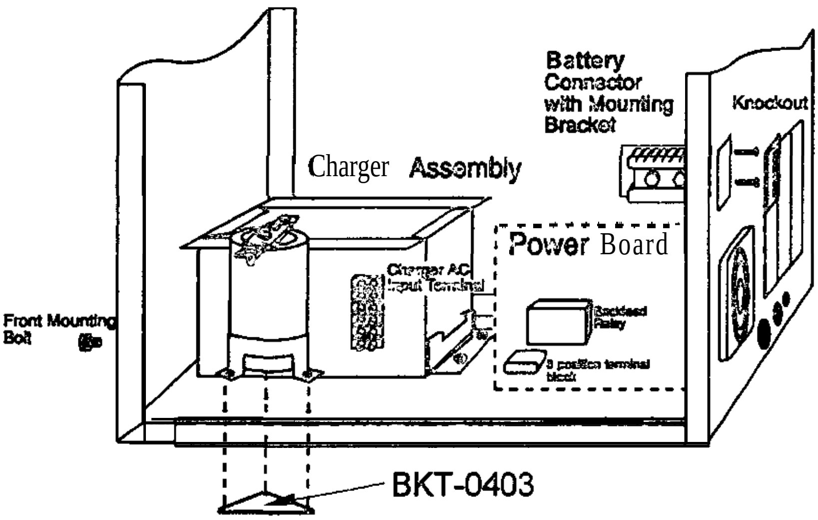

Figure 2

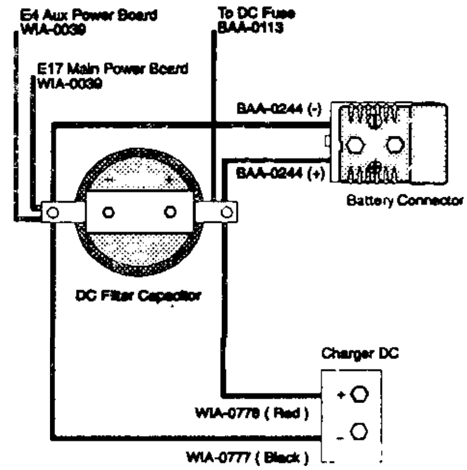

Figure 3

202-5. Remove the knockout for the external battery connection and mount the battery connector mounting bracket with two (2) 6-32x3/8 screws. Mount the battery connector with two (2) 1/4-20x I 3/8 bolts and two (2) 1/4-20 hex head keps nuts. (See Figure 2.)

202-6. Connect the battery cables. (See Figure 3.) If you are **not** installing a 15-amp optional charger, ignore the charger DC output connection and go to Section 600.

Section 300: Installing the Optional 15-amp Charger

301. Locate the 15-amp charger assembly provided Mount the charger assembly using two (2) 1/4-20x 1 carriage bolts up through the bottom of the chassis and secure with two (2) 1/4-20 hex head keps nut. Install the front 1/4-20x1 hex head mounting bolt. (See Figure 2.)

302. **FE 60 Hz units:** Mount the three (3) position terminal block with two (2) nylon standoffs. (See Figure 2 and Figure 4 on page 4; Figure 4 shows the terminal block connections for 50 Hz units.) Connect the linecord at the terminal block line input. Connect the wires shown to El and E4 directly on the terminal block. Connect the wires to the correct charger AC input terminals based on the nominal AC input voltages shown on the charger silkscreen label.

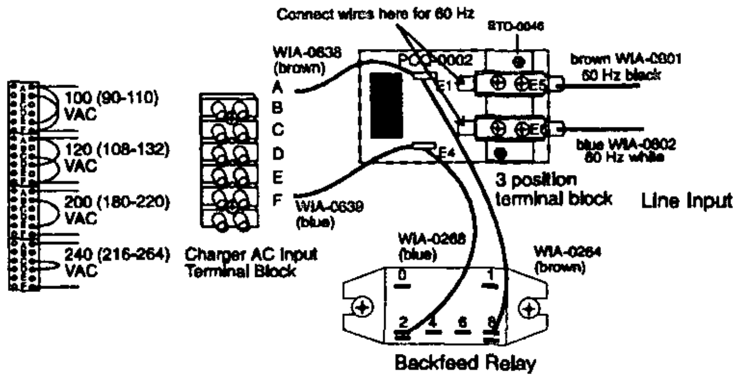

Figure 4

QFE 50 Hz units: Connect the wires provided **as shown** in **Figure** 4.

Section 400: Replacing the Linecord on 100-120 VAC Input Units

401. Disconnect the **linecord from** the **terminal** strip. poll the **linecord** grommet **and** the **linecord** out of the back of unit.

402. Mount the grommet on the new **linecord.**

403. Install the new **linecord.** Connect the **linecord** to the terminal **strip**. **(See** Figure 4.)

Section 500: Testing the Charger

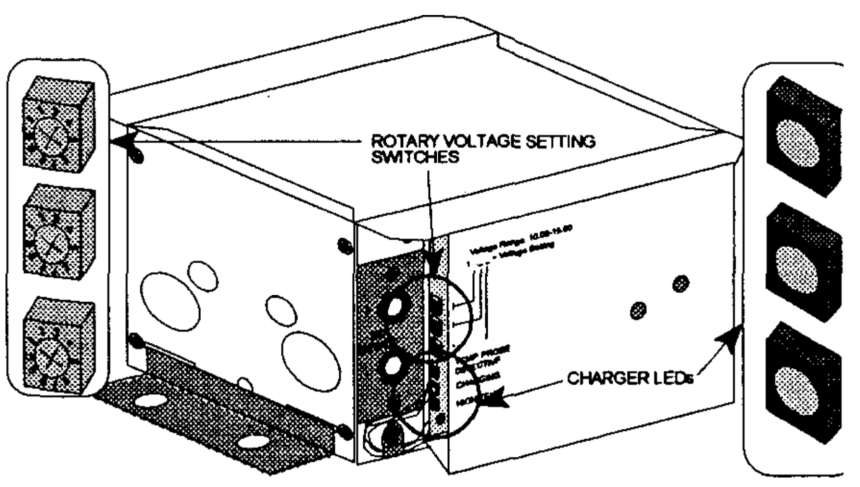

Figure 5

501. Make **sure** the **rotary** voltage setting switches on charger **control** are set at 13.8 **VDC** and make sure **all** connections are tight. (See Figure 5.)

502. Check for correct polarity on the battery bank and connect the batteries

503. Apply AC power and turn the power stitch on.

504. Make sure the CHARGER LED on the logic board (the third green LED from the left) lights

505. Make sure the amber CHARGING LED on the charger assembly lights, (See Figure 5 on page 4.)

If the amber CHARGER LED is blinking, one of the voltage setting switches may be between positions.

If the amber CHARGER LED does not light, make sure the battery voltage is below the start point, generally 12.8 to 13.2 VDC. If it is not, remove AC power for five (5) to ten (10) seconds and then reapply it. If the charger still does not operate, call Best Power Worldwide Service.

Section 600: Calibrating the UPS

After you upgrade the charger and/or add external batteries, you need to recalibrate the battery amp-hour and the charger settings to avoid false alarms. For calibration you need a true RMS digital multimeter and a clamp-on AC current probe We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-4 10 DC/AC current probe or their equivalents. If you do not have these probes or their equivalents, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office..

To perform the calibration commands in this section, you need a hand held Remote Control Panel or a terminal connected to the RS232 port. Go to Section 401 if you have a handheld remote; if you are using a terminal or a computer connected to the FERRUPS RS232 port, go to Section 402. If you have any questions or problems during this procedure, call Best Power Worldwide Service.

601: System Calibration Using a Control Panel

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms, or shut down, for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

601-l. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I)

601-2. Connect the Remote Control Panel to the RS232 port on the back of the FERRUPS. You will use the Remote Control Panel to enter commands and parameter changes in the following steps.

601-3. Enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

601-4. Apply the load to the UPS. Make sure the load is more than 50% of full load.

60 1-5. Enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 1 on the next page to determine the amp-hour rating. If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service for more information.

Now, display parameter 69 (Batt AH). If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 601-6. If not, press [PROGRAM], enter the correct amp-hour rating, and press [ENTER].

Table 1: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0051	200 AH
BAT-0046	75 AH	BAT-0053	31 AH
BAT-0047	75 AH	BAT-0058	17 AH
BAT-0048	100 AH	BAT-0065	33 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH

601-6. Display parameter 122 by pressing [DISPLAY] [1] [2] [2] [ENTER] to display the charger type used on the FERRUF'S unit. The display should read "0." If your unit does not display the proper charger, change the setting to the correct charger by pressing [PROGRAM] [0] [ENTER].

⚠ CAUTION! Failure to select the proper charger setting for your unit's power board listed above causes incorrect operation of the charger and possible system damage.

601-7. The next two (2) measurements must be. done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

601-8. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by typing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7., change the parameter to the value of your measurement by pressing [PROGRAM], entering your DC voltage measurement, and pressing [ENTER].

601-9. To measure DC current, you must use a Fluke 80i-410 DC/AC Current Probe or equivalent, If you do not have this probe or its equivalent, call Best Power Worldwide Service at 1-800-356-5737. Set the meter for DC mV, attach the Fluke 80i-410 current probe, and clamp the probe. on the positive (+) battery cable. Then, read the measurement. DC current will equal one amp per mV DC measured.

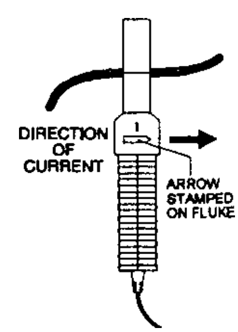

Figure 6

601-10. Display parameter 6 (I Batt) by pressing [DISPLAY] [6] [ENTER]. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the negative battery cable with the probe The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 6.) If the result is differed from the value displayed for parameter 6, change the value of parameter 6 by pressing [PROGRAM], entering your measured value, and pressing [ENTER].

601-11. Clear the Service Password by pressing [CLEAR] twice or until the message "Password Cleared" appears.

601-12. Turn the FERRUPS off, then, remove all AC and DC.

602: System Calibration Using a Terminal or Computer

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alms, or shut down, for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

In this procedure, you may need to change parameters. To make sure you arc able to enter commands, clear the screen now by pressing the <ENTER> key until the => prompt appears. Then, go on to the steps below; if you need to change parameters, the steps tell you what commands to enter. For more information on communication, see TIP 503.

602-l. Reapply AC and DC to the UPS. Turn the switch on the back of the unit ON (I).

602-2. Connect your terminal or computer to the RS232 port on the back of the FERRUPS. You will use the terminal or computer to enter commands and parameter changes in the following steps.

602-3. Enter the Service password by typing **pw** 2639 and pressing <ENTER>. The prompt should change to "Service=>" to let you know you have entered the password.

602-4. Apply the load to the UPS. Make sure the load is 50% or more of the UPS' KVA rating

602-5. Enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 2 to determine the amp-hour rating. If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do **not** have a part number, call Best Power Worldwide Service for more information.

Now, display parameter 69 (Batt AH) by typing **d** 69 and pressing <ENTER>. If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 602-6. If not, type **pr** at the "Service=>" prompt, enter the correct amp-hour rating at the "=>" prompt, and Press <ENTER>.

Table 2: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0051	200 AH
BAT-0046	75 AH	BAT-0053	31 AH
BAT-0047	75 AH	BAT-0058	17 AH
BAT-0048	100 AH	BAT-0065	33 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH

602-6. Display parameter 122 by typing **d 122** and pressing <ENTER> to display the charger typo used on the FERRUPS unit. The parameter should be set to "0.". If your unit does not display "0," type **pr** at the "Service=>" prompt, enter "0," and press <ENTER>.

⚠ CAUTION! **Failure to select the proper charger setting for your unit's power board listed above causes incorrect operation of the charger and possible system damage.**

602-7. The next two (2) measurements must be done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

602-8. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by typing d 7 and pressing <ENTER>. If your measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by typing pr at the "Service =>" prompt, entering your DC voltage measurement at the "=>" prompt, and pressing <ENTER>.

602-9. To measure DC current, you must use a Fluke 80i-4 10 DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service at l-800-356-5737. Set the meter for IX mV, attach the Fluke 80i-410 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current will equal one amp per mV DC measured.

602-10. Display parameter 6 (I Batt) by typing d 6 and pressing <ENTER>. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the negative battery cable with the probe. The arrows stamped on the current probe most match the flow of current you are measuring. (See Figure 6 on page 6.) If the result is different from the value displayed for parameter 6, change the value of parameter 6 by typing pr at the "Service=>" prompt, entering your measured value at the "=>" prompt, and pressing <ENTER>.

602-l 1. Clear the Service Password by typing pw and pressing <ENTER>. The prompt should change back to "=>."

602-12. Turn the FERRUPS off; then, remove all AC and D-C.

Section 700: Putting the Cover on the UPS

701. Apply label LAB-0905 ("Caution! Risk of Electric Shock") to the back of the unit.

702. Apply the new product ID label over the old product ID label on the back of the unit.

703. Using the slide rails on each side of the unit, slide the cover on the UPS.

704. At the front of the UPS, tighten the screw in the lower right corner of the front panel. Cover the screw with the round sticker you removed. (See Figure 1 on page 2.)

705. Put the screw back in the top of the UPS and tighten the screw. (See Figure 1 on page 2.)

706. Reapply AC and DC power to the UPS.

707. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

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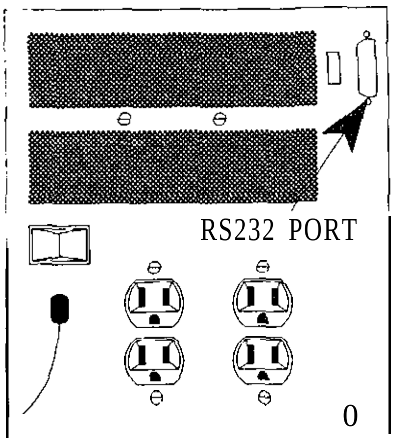
[redacted]

TIP 705
1
April 2, 1997

FE Series Calibration through the RS232 Port

This Technical Information Publication (TIP) gives instructions for calibrating the FERRUPS FE models through the RS232 port on the back of each unit. You can use an additional hand held Remote Control Panel. a terminal or a computer. Go to Section 200 if you arc using an additional hand-held Remote Control Panel; go to Section 300 if you are using a terminal or a computer connected to the FERRUPS RS232 port Refer to TIP 407 (Remote Control Panel Options) or TIP 503 (The FE Series RS232 Communication Port). For calibration you need a true RMS digital multimeter and a clamp-on AC current probe. We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-400 AC current probe or their equivalents. If you do not have these probes or their equivalents. or you have questions about these procedures: call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or I-608-565-2100, or call your nearest Best Power office.



F re 1 500-850 VA

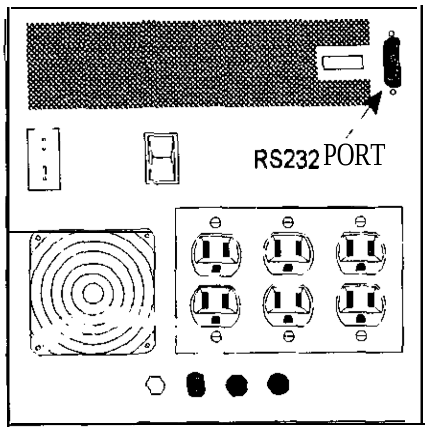
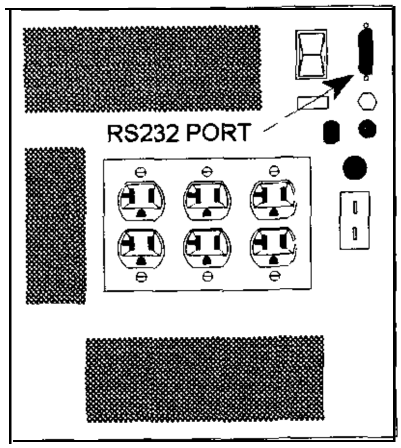


Figure 2 1.15 & 1.4 KVA



Fiigure 3 1.8-3.1 KVA

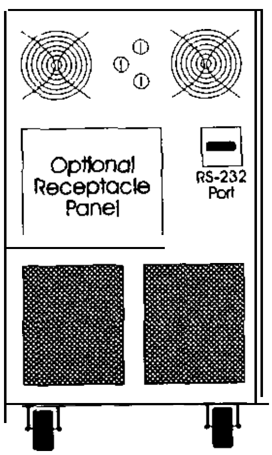


Figure 4 4.3, 5.3 KVA

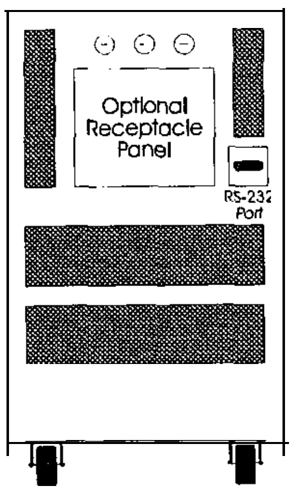


Figure 5 7-18 KVA

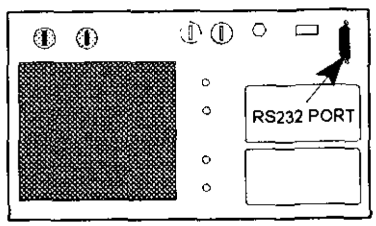


Figure 6 FES850VA-1.4KVA

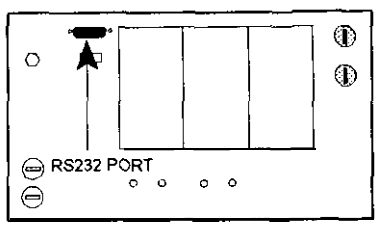


Figure 7 FER 1.8-3.1 KVA

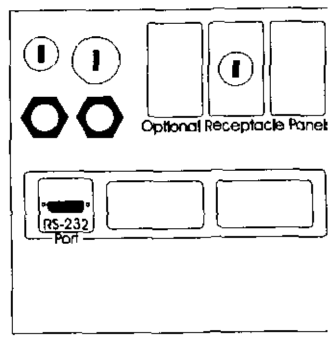


Figure 8 FER4.3-7

LPT-07056

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N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Tools Needed -- Use insulated Tools

Safety Equipment Required by Local Codes
Fluke 80i-4 10 Current Probe or Equivalent
Hand-held Remote or Terminal
Phillips Screwdriver
True RMS AC Voltmeter

Table of Contents

Section 100: Removing the Cover

101 Removing the Cover on 4.3-18KVA Upright Units

101-1. Shut down all load equipment plugged into, or hardwired to, the UPS.

CAUTION

Make sure the On/Off switch on the front of the UPS is OFF, and follow the steps below to make sure all AC and DC power to the unit is off.

101-2. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

101-3. Use the FERRUPS key to unlock the lock in the middle of the front panel. (See Figure 9.) Remove the panel. Turn off the DC switch behind the front panel. Put the panel back on the UPS. **If your UPS has one (1) or more separate battery cabinets, turn off the** DC switch at each battery cabinet or rack.

101-4. Loosen the three (3) Phillips screws on the **bar** across the top of the UPS. (See Figure 9.)

101-5. Remove the Phillips screws on each side of the UPS. (See Figure 9.)

101-6. Slide each cover out from under the bar and lift the cover to remove it from the UPS.

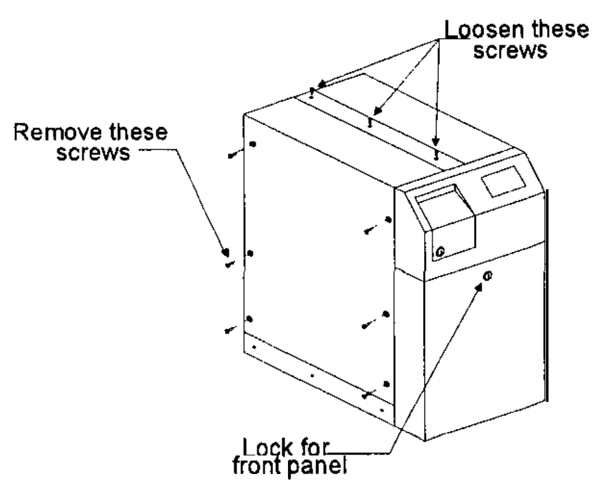


Figure 9

102 Removing the Cover on 500VA-3.1KVA Upright Units

102-I. Shut down all load equipment plugged into (or hard-wired to) the UPS.

CAUTION!

Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102-2. Turn off the UPS. If the UPS has an AC input plug. unplug it. If not, make sure the unit cannot receive AC power.

102-3. Remove the # 1 Phillips screw on the top of the UPS. See Figure 10 or Figure 11.

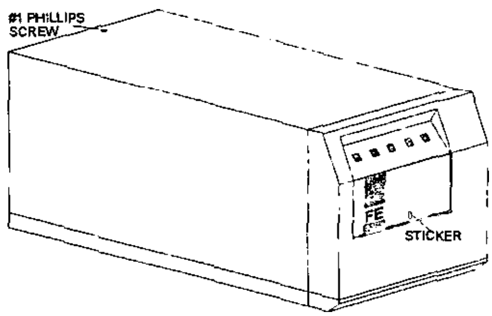


Figure 10 500-850VA

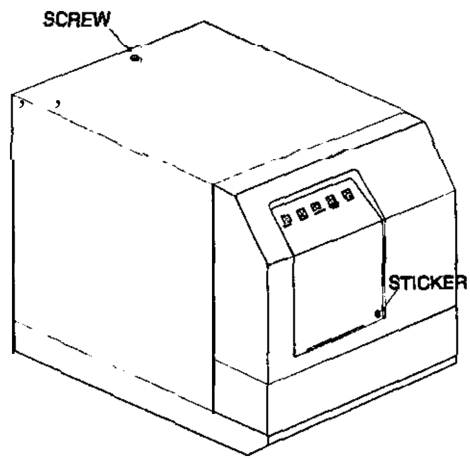


Figure 11 1.15-3.1KVA

102-4. Next. find the sticker in the front panel with the BEST logo. Remove the sticker. and loosen (but not remove) the #2 Phillips screw behind the sticker. Save the sticker.

102-5. Slide the cover forward until it is completely off the UPS.

103 Removing the Cover on Rackmount Units

103-l. Shut down all load equipment plugged into (or hardwired to) the UPS.

CAUTION!

Make sure the On/Off (l/O) key on the front of the UPS is turned to Off(O), and make sure all AC and DC power to the unit is off.

103-2. Tom off the UPS. If the UPS has an AC input plug, unplug it. If not. make sure the unit cannot receive AC power.

103-3. Remove the bolts holding the front panel of you FERRUPS to the rack. (See Figure 12 on the next page.)

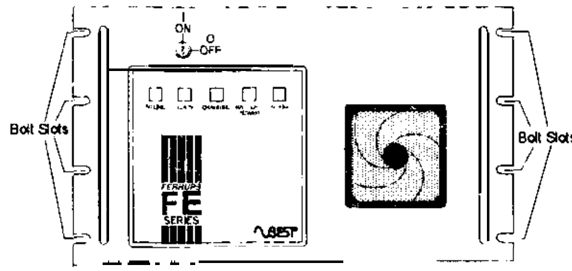


Figure 12

103-4. Slide the UPS out on the rails from the rack assembly.

103-5. Remove the screws holding the top cover in place and remove the cover. (See Figure 13.)

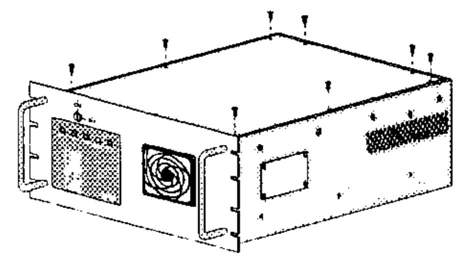


Figure 13

Section 200: Calibrating with a Remote Control Panel Connected to the RS232 Port

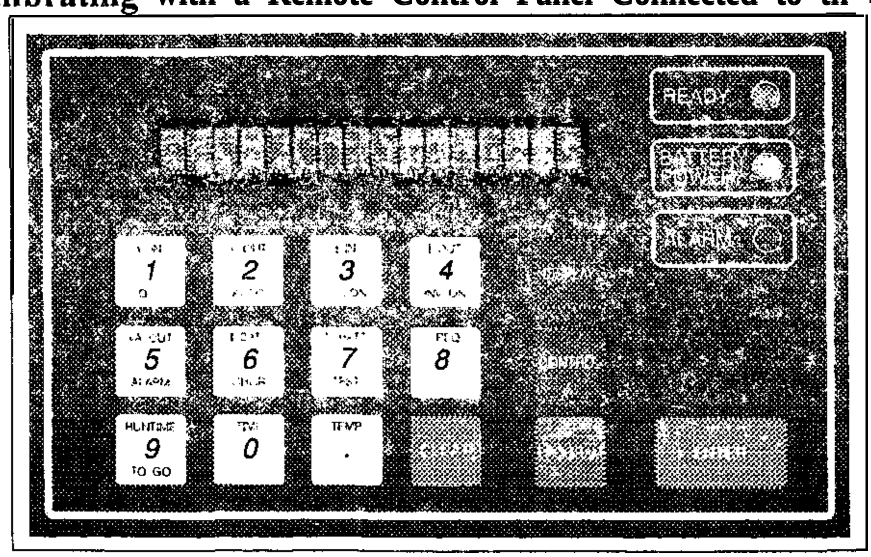


Figure 14 Remote Control Panel

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms, or shut down, for High AC Input, Low AC Input. High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

201. Make sure the covers are off the unit. Apply AC and DC to the UPS. Turn the keyswitch on the front of the unit (4.3-18 KVA and all rackmounts models) or the switch on the back of the unit (500 VA-3.1 KVA models) ON (I). (See Figures 15-20.)

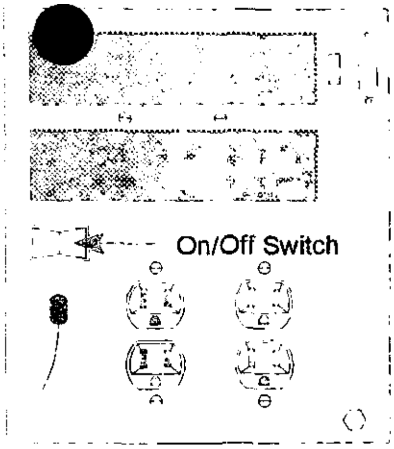


Figure 15 500-850 VA

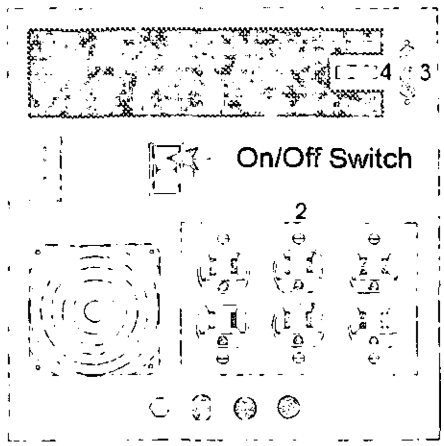


Figure 16 1.15 & 1.4 KVA

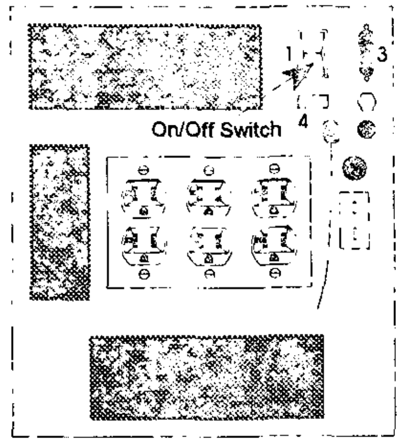


Figure 17 1.8-3.1 KVA

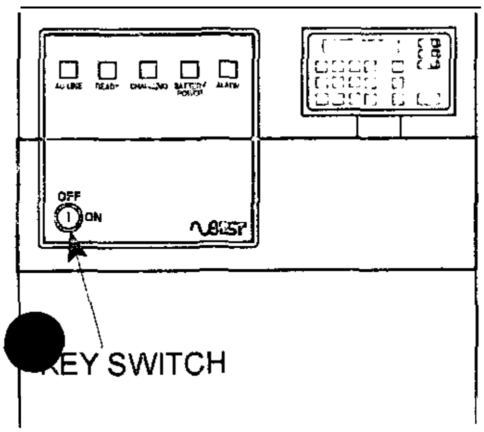


Figure 18 4.3-18 KVA

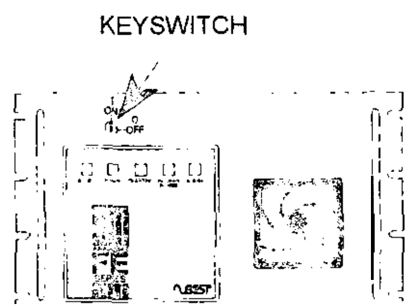


Figure 19 FES500VA-FER3.1KVA

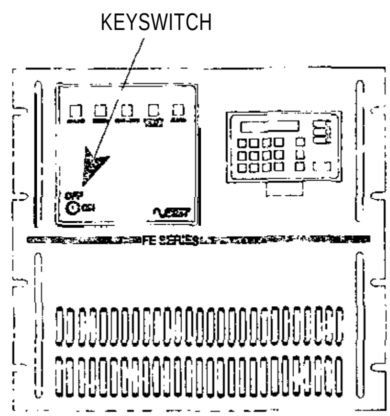


Figure 20 FER 4.3-7KVA

202. Connect the Remote Control Panel to the RS232 port on the back of the FERRUPS. You will use the Remote Control Panel to enter commands and parameter changes in the following steps.

203. Enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

204. Apply the load to the UPS. Make sure the load is more than 50% of full load.

205. First, check the serial number programmed into the software. To do this, display parameter 40 (Serial Number) by pressing [DISPLAY] [4] [0] [ENTER]. Compare the display to the serial number on your unit's ID label (on the right side of the unit when you face the front). If the parameter 40 display is correct, go on to step 206. If it is **not** correct, follow these steps to enter the correct serial number:

a. Press [CLEAR] to return to the normal display.

b. Before you can enter the new serial number, you must enter the Factory password. To do this. press [PROGRAM] [1] [8] [4] [7] [3] [ENTER].

c. Now, display parameter 40 again by pressing [DISPLAY] [4] [0] [ENTER].

d. Press [PROGRAM].

e. Since the serial number includes letters as well as numbers, you must go into the message editor toe n the new serial number. To do this, press [DISPLAY] and [PROGRAM] **at the same time. The display** will show "Message Editor," then a period.

f. Enter the correct serial number:

Whenever you need to type a letter, press [.] and [3] **together; then,** press [DISPLAY] to scroll through the alphabet until you reach the letter you need. Once you reach the correct letter, press [PROGRAM] to go to the next character.

Whenever you need to type a number, press [.] and [2] **together; then,** press **[DISPLAY] to scroll** through the numbers until you reach the one you need. Once you reach the correct number, press [PROGRAM] to go to the next character.

When you have entered the complete serial number, press [ENTER]. The new serial number will scroll across the display. Press (ENTER] again to go back to the parameter display.

Table 1: Using the Message Editor

To do this in the message editor...	...do this.
Enter the message editor.	Press [DISPLAY] and [PROGRAM] **together.**
Type a letter.	**Press** [.] and [3] **together,** then press [DISPLAY] until you reach the correct letter.
Type a number.	Press [.] and [2] together, then press [DISPLAY] until you reach the correct number.
Save a character and go to the next charactrr.	Press [PROGRAM].
Save the serial number and exit the message editor.	Press [ENTER], check the scrolling display, and press [ENTER] again.
Reverse letters or numbers.	Press [CONTROLJ.

206. Next, you must set the unit's mode1 size. To do this. display parameter 41 (Model Index). Compare the display to the model number shown on your unit's ID label. If the display shows the correct model number, go on to step 207. If not, press [PROGRAM], enter the setting for your model's size, and press [ENTER]:

1 = FE500VA	2 = FE700VA	3 = FE850VA	4 = FE1.15KVA	5 = FE1.4KVA
6 = FE1.8KVA	7 = FE2.1KVA	8 = FE3.1KVA	9 = FE4.3KVA	10 = FE5.3KVA
11 = FE7KVA	12 = FE10KVA	13 = FE12.5KVA	14 = FE18KVA	

The prefix for the 50 Hz models is "QFE" in the mode1 index.

207. Now. you must enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 2 to determine the ampere-hour rating. If you have more than one string of batteries, add the amp-hour rating of the battery strings. If they do **not** have a part number. call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your nearest Best Power office for more information.

Now, display parameter 69 (Batt AH). If the amp-how rating shown matches the amp-hour rating of your batteries, go on to step 208. If not, press (PROGRAM]. enter the correct amp-hoar rating, and press [ENTER].

Table 2: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0053	31 AH
BAT-0046	75 AH	BAT-0058	17 AH
BAT-0047	75 AH	BAT-0065	33 AH
BAT-0048	100 AH	BAT-0071	26 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH
BAT-0051	200 AH		

208. Display parameter 122 by pressing [DISPLAY] {1] [2] [2] [ENTER] to display the charger type used on the FERRUPS unit. Use the table below for the settings. If your unit does not display the proper charger. change the setting to the correct charger by pressing [PROGRAM], entering the number for the correct charger, and pressing [ENTER].

Table? 3: Setting Parameter 122 for Your Unit's Charger Type

Setting	Charger and Charger Operation
0	*Hardware Charger:* Voltage settings are all hardware controlled.
1	*Float Charger:* Voltage level is programmed in parameter 125. To display parameter 125, press [DISPLAY] [1] [2] [5] [ENTER]. To change parameter 125, press [PROGRAM], enter the correct voltage level, and Press [ENTER].
2	*Hysteresis Charger;* Parameter 124 determines when the charger turns on: parameter 126 determines when the charger turns off. · To display parameter 124, press [DISPLAY] [I] [2] [4] [ENTER]. To change the low voltage when the charger should turn on, Press [PROGRAM], enter the new setting, and Press [ENTER]. · To display parameter 126, press [DISPLAY] [I] [2] [6] [ENTER]. To change the high voltage when the charger should turn off, press (PROGRAM], enter the new setting, and press (ENTER].
3	The charger is disabled. An external charger must be used to charge batteries if parameter 122 is set to "3."

CAUTION! **Failure to select the proper charger setting for your unit's power board listed above** will cause **incorrect operation *of* the charger and possible *system damage.***

209. Display parameter 123 by pressing [DISPLAY] [I] [2] [3] [ENTER]. This displays the charger amp-hour rating. If your unit **does not** display the proper charger amp-hour rating, change the setting to the correct charger amp-hour rating by pressing [PROGRAM], entering the number for the correct charger, and pressing [ENTER].

210. Find the terminal block inside the unit. Measure the input AC voltage at the terminal block with the digital multimeter.

211. Display parameter 1 (V In) on the control panel by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value by pressing [PROGRAM], entering your voltage measurement, and pressing [ENTER].

222. Display parameter 12X (Charger On Delay) again by pressing [DISPLAY] [I] [2] [8] [ENTER]. Change this parameter value back to its original value of 240 seconds by pressing [PROGRAM] [2] [4] [0] [ENTER].

223. Clear the Service Password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

Section 300: Calibrating With a VT-100 Type Terminal or Computer Connected tc the RS232 Port

This procedure is for calibrating the FERRUPS using a terminal or a computer connected to the FERRUPS RS232 port. Refer to TIP 407 (Remote Control Panel Options) or TIP 503 (The FE Series RS232 Communication Port) in Section 700. If you have any questions or problems during this procedure. call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100. or call your nearest Best Power office.

Important: In the steps below. measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms, or shut down, for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

In this procedure, you may need to change parameters. To make sure you are able to enter commands, clear the screen now by pressing the <ENTER> key until the => prompt appears. Then. go on to the steps below; if you need to change parameters, the steps tell you what commands to enter. For more information on communication, see TIP 503.

301. Make sure the covers are off the unit. Apply AC and DC to the UPS. Turn the keyswitch on the front of the unit (4.3-18 KVA and all rackmounts models) or the switch on the back of the unit (500 VA-3. 1 KVA models) ON (I). (See Figures 15-20 on page 5.)

302. Connect the terminal or computer to the RS232 port on the back of the FERRUPS. You will use the terminal or computer to enter commands and parameter changes in the following steps.

303. Enter the Service password by typing pw 2639 and pressing <ENTER>. The prompt should change to "Service=>" to let you know you have entered the password.

304. Apply a load to the UPS. Make sure the load is 50% or more of full load.

305. First. check the serial number programmed into the software. To do this, display parameter 40 (Serial Number) by typing d 40 and pressing <ENTER>. Compare the display to the serial number on your unit's ID label (on the right side of the unit when you face the front). If the parameter 40 display is correct, go on to step 306. If it is not correct. enter the correct serial number by typing pr at the "Service=>" prompt and pressing <ENTER>. The screen then shows a "->" prompt. You must enter the Factory password to change the serial number. At the "=>" prompt, type pw 18473 and pressing <ENTER>. Type pr at the "Factory=>" prompt and press <ENTER>. A "=>" prompt should appear for the new value. Type in the correct serial number and press <ENTER>.

306. Next, you must set the unit's model size. To do this, display parameter 41 (Model Index) by typing **d 41** and pressing <ENTER>. Compare the display to the model number shown on your unit's ID label. If the display shows the correct model number, go on to step 307. If not, type **pr** at the "Service=>" prompt, enter the setting for your model's size at the "=>" prompt, and press <ENTER>:

1 = FE500VA	2 = FE700VA	3 = FE850VA	4 = FE1.15KVA	5 = FE1.4KVA
6 = FE1.8KVA	7 = FE2.1KVA	8 = FE3.1KVA	9 = FE4.3KVA	10 = FE5.3KVA
11 = FE7KVA	12 = FE10KVA	13 = FE12.5KVA	14 = FE18KVA	

The prefix for the 50 Hz models is "QFE" in the model index.

307. Now, you must enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 4 to determine the amp-hour rating. If you have more than one (1) string of batteries, add the amp-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service at 1-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your nearest Best Power office for more information.

Now, display parameter 69 (Batt AH) by typing **d 69** and pressing <ENTER>. If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 308. If not, type **pr** at the "Service=>" prompt, enter the correct amp-hour rating at the "=>" prompt, and press <ENTER>.

Table 4: Amp-Hour Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0053	31 AH
BAT-0046	75 AH	BAT-0058	17 AH
BAT-0047	75 AH	BAT-0065	33 AH
BAT-0048	100 AH	BAT-0071	26 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH
BAT-0051	200 AH		

308. Display parameter 122 by typing **d 122** and pressing <ENTER> to display the charger type used on the FERRUPS unit. Use Table 5 on the next page for the settings. If your unit does not display the proper charger, change the setting to the correct charger by typing **pr** at the "Service=>" prompt and entering the number for the correct charger, and pressing <ENTER>.

Table 5: Setting Parameter 122 for Your Unit's Charger Type

Setting	Charger and Charger Operation
0	*Hardware* Charger: Voltage settings are all hardware controlled.
1	*Float Charger:* Voltage level is programmed in parameter 125. To display parameter 125, type **d 125** and press <ENTER>. To change parameter 125, type pr, enter the correct voltage level, and press <ENTER>.
2	*Hysteresis Charger:* Parameter 124 determines when the charger turns on: parameter 126 determines when the charger turns off. • To display parameter 124, type d124 and press <ENTER>. To change the low voltage when the charger should turn on. type pr, enter the new setting. and press <ENTER>. • To display parameter 126, type d 126 and press <ENTER>. To change the high voltage when the charger should turn off, type pr, enter the new setting, and press <ENTER>.
3	The charger is disabled. An external charger must be used to charge batteries if parameter 122 is set

CAUTION! **Failure** to **select the proper charger setting** for **your unit's power board listed** above will **cause incorrect** operation of the **charger and** possible **system damage.**

309. Display parameter I23 by typing d **123** and pressing <ENTER>. This displays the charger amp-hour rating. If your unit does not display the proper charger amp-hour rating, change the setting to the correct charger amp-hour rating by typing **pr**, entering the number for the correct charger, and pressing <ENTER>.

310. Find the terminal block inside the UPS. Measure the input AC voltage on the AC input terminal block with the digital multimeter.

311. Display parameter 1 (V In) on the control panel by typing **d 1** and pressing <ENTER>. If your measurement does not match the value displayed for parameter 1. change the parameter value by typing **pr** at the "Service=>" prompt, entering your voltage measurement at the "=>" prompt, and pressing <ENTER>.

312. Display parameter 44 (NomVOut) by typing d 44 and pressing <ENTER> to check the nominal output voltage. The nominal output voltage determines where you will measure output voltage in step 313.

Note: In 60 Hz units, the default output voltage is 120 VAC even if you are using 208 or 240 VAC output Parameter 2 monitors the 120 VAC output.

313. With the digital multimeter, measure the output AC voltage at the AC output terminal block points for the nominal output voltage.

314. Display parameter 2 (V Out) by typing d 2 and pressing <ENTER>. If your measurement does not match the value displayed for parameter 2, change the parameter value by typing pr at the "Service=>" prompt, entering your voltage measurement at the "=>" prompt, and pressing <ENTER>. **Make sure the measured** value you enter into parameter 2 is acceptable for the nominal value you displayed in parameter 44.

315. Next. calibrate output current. Display parameter 4 (I Out) by typing d 4 and pressing <ENTER>. Then, measure the output current at the wires that run out of "L1out" on the output terminal with the amp meter. If the display does not match your measurement, change parameter 4 by typing **pr** at the "Service=>" prompt, entering your AC output current measurement at the "=>" prompt, and pressing <ENTER>.

316. The next two (2) measurements must be done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

317. Measure the battery string voltage with the digital multimeter. Then. display parameter 7 (V **Batt)** on the control panel by typing d 7 and pressing <ENTER>. If you measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by typing **pr** at the "Service =>" prompt, entering your DC voltage measurement at the "=>" prompt. and pressing <ENTER>.

318. To measure DC current, you must use a Fluke 80i-4 IO DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service at l-800-356-5737. Set the **meter** for DC mV, attach the Fluke 80i-410 current probe, and clamp the probe on the positive (+) battery cable. Then, read the measurement. DC current will equal one amp per mV DC measured.

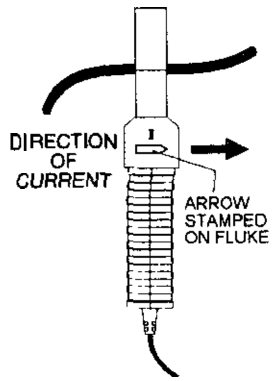


Figure 22

319. Display parameter 6 (I Batt) by typing **d** 6 and pressing <ENTER>. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the negative battery **cable *with* the probe. The arrows stamped on the current probe must match the flow of current you are measuring. (See** Figure 22.) If the result is different from the value displayed for parameter 6, change the value of parameter 6 by typing **pr** at the "Service=>" prompt, entering your measured value at the "=>" prompt, and pressing <ENTER>.

320. **FE/FER/QFE/QFER 4.3-18 KVA models only:** If you have a software-controlled power board in your unit (PCP-0291, PCP-0292, PCP-0289, or PCP-0290), restore AC power and display parameter 128 (Charger On Delay) by typing **d 128** and pressing <ENTER>. Change this parameter value to 10 seconds by typing **pr** 10 and pressing <ENTER>. Once the CHARGING LED lights. the charger current can be calibrated.

Note: On some models. the CHARGING LED only lights briefly when the unit begins to charge the batteries. The unit is still charging the batteries even after the LED turns off.

If your unit has the optional IO-amp or 20-amp charger assembly. follow the instructions for the IO-amp or 20-amp charger. If not, follow the instructions for the 5-amp charger.

> **CAUTION!**
>
> **When you make the measurement at the power board, do not contact other power board components. Power board components contain dangerous voltages that could cause equipment damage or personal injury. Use caution when making this measurement.**

For units with a **5-amp** charger: measure DC current with the Fluke 80i-4 10 current probe on the negative (-) battery cable. The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 22.)

If you don't have an 80i-410 current **probe.** measure across R24 or R25 (on power board PCP-0291) or across R50 or R51 **(on** power board PCP-0289). ***Then, multiply your MILLIVOLT measurement by 0.04 to convert to the amperage of the charger output. Do NOT convert the measurement to VOLTS before multiplying.***

Example: *If you measure 120 mV across R24, multiply 120 x 0.04 = 4.8. Parameter 6 should be set to* 4.8 amps.

For units with a **10-amp** or 20-amp charger: measure DC current with the 80i-410 current probe on the negative (-) battery cable. The arrows stamped on the current probe most match the flow of current you are measuring. (See Figure 22 on the previous page.)

If you don't have an 80i-410 current probe. follow these steps:

a. Measure across the charger shunt on the charger assembly

b. To determine what size charger your UPS has, see the fuse on the charger assembly. (See Figure 18 on page 400-7.) If the fuse is a 30-amp fuse, the unit has a lo-amp charger. If the fuse is a 60-amp fuse, the unit has a 20-amp charger.

c. Multiply your MILLIVOLT measurement by the amount shown for your unit's charger size. Do NOT convert millivolts to volts before multiplying.

IO-amp charger:	Multiply by 0.2
20-amp charger:	Multiply by 0.4

321. In this step. you will calibrate parameter 6 again. Calibrating parameter 6 on line calibrates charger current; this calibration will not affect what you did in step 319. Display parameter 6 by typing d 6 and pressing <ENTER>. If your calculated current does not match the value displayed in parameter 6, change the parameter value by typing pr, entering your measured value, and pressing <ENTER>.

Note: If the charging current is too low, FERRUPS does not let you program this parameter. If the control panel displays "Cannot Program" when you try to change the parameter value, run the UPS on invert longer until the charger current is higher.

322. Display parameter 128 (Charger On Delay) again by typing d 128 and pressing <ENTER>. Change this parameter value back to its original value of 240 seconds by typing pr 240 and pressing <ENTER>.

323. Clear the Service Password by typing pw and pressing <ENTER>. The prompt should change back to "=>."

Section 400: System Test

FERRUPS automatically does a system test every seven days (or the interval you set in parameter 72). If you need to start the test manually, you can start it from a control panel or a terminal connected to the FERRUPS RS232 port.

To start the test from a control panel:	Press [CONTROL] [7] [ENTER] [ENTER].
To start the test from a terminal:	Enter the systemtest command.

The FERRUPS tests the logic first, then the inverter, and then the batteries. (Parameter 7 1 controls which parts of the test the FERRUPS does.) If the FERRUPS fails any part of the test. the unit does not do the next part of the test. The paragraphs below describe each part of the test.

Logic Test: This part of the test makes sure the memory and the central processing unit are operating correctly. To do this. the FERRUPS computes the additive checksum of the ROM and the nonvolatile battery-backed section of RAM: then, it compares the values to parameters 12 l and 122. If the computed values do not match the parameter values. the FERRUPS fails the logic test, cancels the inverter and battery tests. and starts a Memory Check alarm

Inverter **Test:** The Inverter Test makes sure both inverter gates can draw enough current. To do this. the FERRUPS fires the left gate and then the right gate and monitors the peak current draw from the batteries. The FERRUPS then compares the current peaks to l/2 of parameter 74 (NomILimit). If either gate draws less than l/2 NomILimit, the FERRUPS fails the inverter test. cancels the battery test, and starts a Check Inverter alarm.

Battery Test: The Battery Test makes sure the batteries can supply enough power to run the load longer than the number of minutes set in parameter 68 (Low Runtime). To do this, the FERRUPS runs the UPS on inverter for the number of seconds specified in parameter 75: it then compares the estimated runtime shown in parameter 9 to the Low Runtime setpoint in parameter 68. If parameter 9 is less than parameter 68. the FERRUPS fails the battery test and starts a Check Battery alarm.

Parameter 26 displays the results of the last system test. A sample parameter 26 display may look like this:

26 Test Results		
14:34	05/23/93	(24-hour time and **date** of last test)
Logic:	PASSED	(Results of logic test)
RA=FA41	RO=13D6	(ROM/nonvolatile RAM checksums)
Inverter:	PASSED	(Results of inverter test)
Gate L=341/R=345		(Left/right inverter gate peak current draw)
Battery:	FAILED	(Results of battery test)
RT=--2/DC=12.76		(Runtime/DC voltage at end of battery test)

For each part of the test, the display shows "PASSED," "FAILED," or "NotDone." Parameter 71 controls which parts of the test arc done. Parameter 72 controls how often the automatic system test is done, parameter 73 controls the time of day.

Section 500: Putting the Covers on the UPS

501. Shut down the UPS. Make sure that all AC power is disconnected from the UPS

502. Put all covers back in place,

503. Reapply AC power to the UPS

504. **Startup** the UPS according to the instructions in the *FERRUPS User Manual*. Then, **startup** the load equipment connected to the UPS.

Best Power
NINTERRUPTIBLE
OWER SYSTEMS

TIP 706
2345
March 24, 1997

Extended Runtime Modification for the FERRUPS FE/QFE Series Models

This Technical Information Publication (TIP) explains how to extend the runtime for the FERRUPS FE and QFE models. This TIP is intended for use by a qualified service person familiar with the FERRUPS" unit. A qualified service person must perform this procedure. If you have any problems or questions during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only). I-608-565-2 100. or call your local Best Power office.

Tools Needed – Use Insulated Tools:

Remote Control Panel or VT- 100 Type Terminal	Two (2) 7/1 6-inch Wrenches	1/2-inch Wrench
Safety Equipment Required by Local Codes	5/16-inch Nutdriver	Needlenose Pliers
Torque Wrench Calibrated in In./Lbs or N/m	Petroleum Jelly	#1 and #2 Phillips Screwdriver

CAUTION!

These procedures must be performed by qualified service personnel ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the *FERRUPS User Manual*. Make sure that the UPS batteries and AC input are off or disconnected before you change the runtime.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals or the DC terminal strip can cause severe arcing equipment damage and injury. A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the FERRUPS:
A) **Remove rings, watches, and other jewelry before servicing the UPS.**
B) **Always wear** protective **clothing and eye protection and use insulated tools when working near batteries**
C) **Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.**

LPT-0706A

RESTRICTED

N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

⚠ CAUTION!

Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.

A qualified electrician who is familiar with battery systems and required precautions must install and service the batteries. Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Cabinets are designed to be used with, and batteries must be replaced with Best Power battery number BAT-XXXX or equivalent. The installation must conform to national and local codes as well. Keep unauthorized personnel away from batteries.

The electrician must take these precautions:

1. Wear protective clothing and eye wear. For 120-volt battery systems, wear rubber gloves and **boots.** Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Don't carry metal objects in your pockets where the objects can fall into the battery cabinet.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at my time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

3. Install the batteries as shown on the drawing provided with the batteries. When connecting cables, never allow a cable to short across a battery's terminals, the string ofbatteries, or to the cabinet.

4. Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

5. Install the battery cables so they cannot **be** pinched by the battery cabinet or UPS doors.

6. Make sure the fuse is positioned so that it will not contact any cabinet parts or other battery posts if the batteries should move. Make sure that there is enough clearance when the cabinet door closes.

7. Battery cabinet chassis (ground or earth) must be connected to the UPS chassis (ground or earth). If you use conduit, this ground conductor must be routed in the same conduit as the battery conductors.

8. Where conductors may be exposed to physical damage. protect the conductors in accordance with ANSI/NFPA 70-1993.

9. If you are replacing batteries or repairing battery connections, follow the procedure in the FERRUPS User Manual **to** shut off your UPS and remove **both AC** and DC input power.

101. Size the battery cable. The battery cable or wire used is No. 1 AWG (42.11 mm^2) for all applications with the following exceptions:

A) 18 KVA models use no. l/O (53.49 mm’) battery cables.

B) If the batteries mast be some distance from thc UPS. you may need to install larger battery cables between the battery cabinets and the UPS. Using long cable runs and larger diameter cables may require modifications inside the UPS: call Best Power Worldwide Service if you did not order the longer. larger-diameter cable with the UPS. In the U.S.A. and Canada, call l-800-356-5737 or l-608-565-2100; in other areas, call your local Best Power office.

102. UPS units must have a DC disconnect switch so you can disconnect the external batteries from the UPS.

FE/QFE 500VA to 3.1KVA models have a removable plug at the UPS; the battery cabinet may also have a DC switch.

Most FE/QFE 4.3 to 18KVA models have a DC switch at the battery cabinet(s). However, some may have a removable plug at the cabinet or between the UPS and the batteries. and others may have an external DC switch, FE/QFE 4.3 to 7KVA models also have a DC switch behind the front panel.

Section 200: Removing the UPS Covers

201. Shut down all load equipment plugged into. or hardwired to. the UPS,

> **CAUTION!**
>
> **Make sure the On/Off switch on the front of the UPS is OFF, and follow the steps below to make sure all AC and DC power to the unit is off.**

202. Turn off the UPS. If the UPS has an AC input plug. unplug it. If not. make sure the unit cannot receive AC power.

203. **4.3 to 18 KVA models:** Use the FERRUPS key to unlock the lock in the middle of the front panel. (See Figure 1.) Remove the panel. If the unit has a DC switch behind the front panel, turn it off. Turn off tbe DC switch at each battery cabinet.

204. **4.3 to 18 KVA models:** Loosen the three (3) Philips screws on the bar across the top of the UPS. (See Figure 1.)

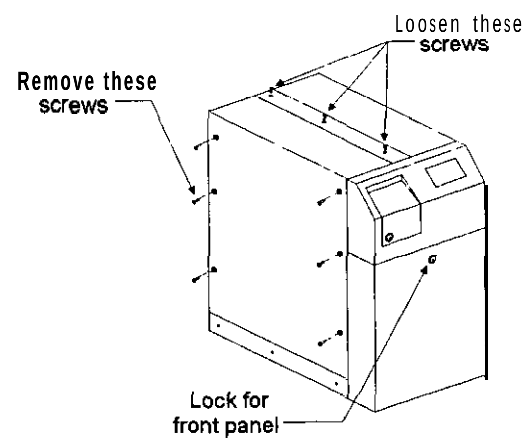


Figure 1

205. Remove the cover(s) from the UPS.

500VA to 3.1KVA: Remove the grounding screw at the top of the UPS and loosen (but not remove) the front screw. (Sec. Figure 2.) Slide the cover off the unit.

4.3KVA to 18KVA: Remove the screws on each side of the UPS. (See Figure 1 on page 3.) Slide each cover out from under the bar and litt the covers to remove them from the UPS.

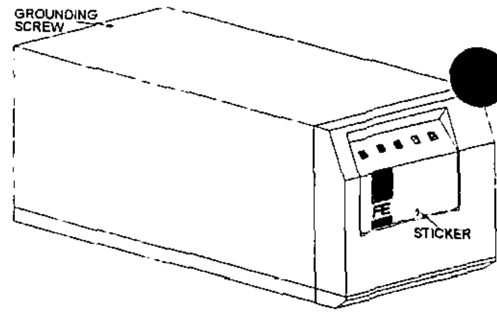


Figure 2

CAUTION! **Make sure you have turned off AC power and the DC switch. (See step 203.) If you do not disconnect the batteries, parts could be damaged in modifying the runtime.**

Section 300: Installing and Connecting the Batteries

IMPORTANT! Modifying the runtime in your UPS usually includes adding extra batteries. If your UPS does not have a 10-, 15-, or 20-amp charger. you may need to upgrade your charger. See the Service Manual for the parts and TIP needed to upgrade the charger in your unit or call Best Power Worldwide Service.

301. Find the battery installation diagram that came with your FERRUPS batteries and battery cabinet(s).

302. Move the battery cabinet(s) to the location where you will install the batteries.

IMPORTANT: Install the batteries in a clean, cool, dry place, with normal ventilation for human habitation and with level floors. Make sure the floor can support the weight of the batteries, the cabinet. and any other necessary equipment. Your Best Power service technician can tell you the size and weight of external batteries.

The temperature should be below 77° F (25” C) for the best battery performance. Batteries are less efficient at temperatures below 65° F (18 ° C), and high temperatures reduce battery life. Typically, at about 95” F (35” C), battery life is half of what it would be at a normal temperature of 77” F (25° C). At about 113” F (45° C), battery life is one-fourth of normal.

Make sure that heaters, sunlight, air conditioners, or outside air vents arc not directed toward the batteries. These problems can make the temperature within battery strings vary. which can cause differences in the batteries’ voltages; eventually, the problem could affect battery performance.

Remember that the batteries should be as close as possible to the UPS to reduce DC wiring costs and improve battery performance.

Note: If you are installing the batteries in a place where there may be seismic activity, you should anchor the UPS and battery cabinets to the floor. Anchoring kits are available from Best Power.

303. **Wherever conductors** may be exposed to physical damage. you must protect the conductors in accordance with National Electrical Code ANSI/NFPA 70-1993. This includes battery cables between the UPS and the battery cabinet and cables between battery cabinets (if you have more than one).

We suggest routing battery cables through flexible conduit. For models with a removable DC plug at the UPS end of the **cables.** we suggest routing the cables through the **conduit** to within about one foot (305 mm) of the UPS because the connector or plug does not connect to flexible conduit. Install flexible conduit for battery cables according to local or national code.

304. The battery cabinet ground (or earth) **must be** connected to the UPS chassis ground (or earth)

You must make a good connection to the battery cabinet chassis ground (or earth). Make the ground connection at the terminal strip ground (or earth) lug inside the cabinet.

305. The procedure for connecting ground depends on your model.

500VA to 3.1KVA: At the UPS, connect the ground wire to the ground lug. This UPS ground (or earth) is marked with the label shown in Figure 3.

Figure 3

4.3KVA to 18KVA: At the UPS. find the green/yellow terminal block next to the UPS battery terminals labeled “GROUNDING ELECTRODE TERMINAL” with the ground or earth symbol show in Figure 4. Connect the ground wire to this ground terminal.

Note: This symbol may have a circle around it.

Figure 4

CAUTION!

Do not make connections to the RS232 communications port if the UPS is connected to a positive ground battery system. The RS232 ground must be isolated or equipment damage will result. For assistance, call **Best Power Worldwide Service at l-800-356-5737 or l-608-565-2100 or call your local Best Power office.**

306. Arrange the batteries in the cabinet. If optional straps are included. install the straps as shown in the battery installation diagram that was packed with your batteries.

CAUTION! **Never install the batteries in an air-tight enclosure.**

IMPORTANT: Arrange the batteries so there is as much air flow as possible around the batteries and so the batteries can be cooled as much as possible. Some battery cabinets have cooling slots cut in the shelves to increase air flow. Arrange the batteries so these slots are not blocked. Some larger batteries must sit with the longest battery dimension in the s direction as the longest shelf dimension. These batteries partly block the cooling sl Place the batteries next to the outside edge of the shelf to leave as much space between the batteries as possible.

307. Connect the DC fuse(s) as shown in the battery installation diagram. (See Figure 5. The fuse may be on the terminal strip.)

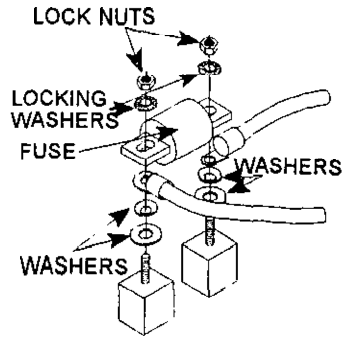


Figure 5

308. Run the battery cables through conduit, but **do not** connect the cables to the UPS or the battery cabinets yet. Find the battery cable assembly that connects to the UPS.

Note: If you have an external DC disconnect switch between the UPS and batteries, see the instructions that came with your disconnect switch.

If you have a removable DC plug at the UPS end, this end of the cables does not go through the conduit or connect to it.

309. *If you we adding more than one (I) external battery cabinet,* find the battery cable assembly that connects the battery cabinets. Pull the cables through the conduit that you installed between the cabinets.

310. Clean the cable and battery post (terminal) before you make the battery connection.

311. Apply a thin coating ofhigh-temperature conductive grease on the post and cable terminals to slow corrosion.

Note: If you use a nonconductive grease like petroleum jelly, do not apply any grease before you **make** connections. Instead, make the connection first; then. torque it to the torque values shown below for your battery. When you make the connection, apply a coating of the nonconductive grease to the hardware at the battery terminals.

312. Connect all the battery **cables between batteries** as shown in **the** battery installation diagram. (See Figure 6.) **Do not** connect the cables between battery strings or between the UPS and the batteries yet. Use the torque wrench to tighten the battery terminal connections securely. For most batteries, you can find out what torque value to use by finding the battery number (BAT-*XXXX*) on the top of the battery and finding the torque value in Table 1 below.

Table 1

Battery	Torque
BAT-0007	Torque to 65 inch-pounds or 7.3 newton-meters.
BAT-0046	Torque to 65 inch-pounds or 7.3 newton-meters.
BAT-0048	Torque to 65 inch-pounds or 7.3 newton-meters.
BAT-0050	Torque to 75 inch-pounds or 8.4 newton-meters.
BAT-0053	Torque to 40 inch-pounds or 4.5 newton-meters.

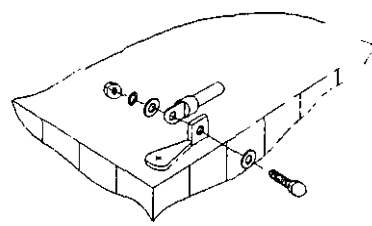
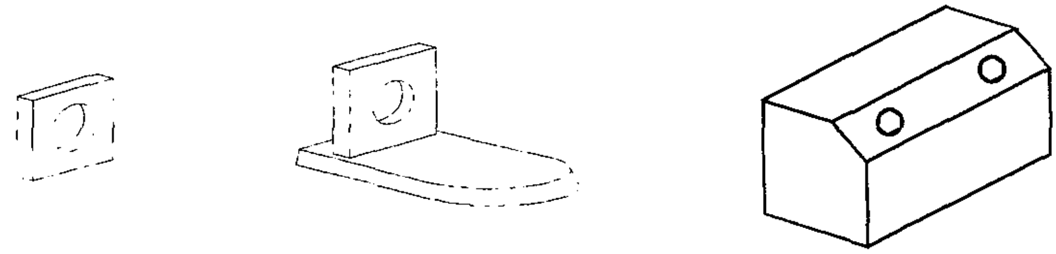


Figure 6

If your battery does not have a number on the top, usc Figure 6 to find the torque value for your batteries.



Square: Torque to 17 inch-pounds or 1 .9 newton-meters. (BAT-0056)

Modified Square: Torque to 35 inch-pounds or 3.9 newton-meters. (BAT-0065)

Screw **Posts:** Torque to 65 inch-pounds or 9.6 newton-meters. (BAT-0071)

Figure 6

313. Connect the most positive (+) cables between strings as shown in the battery installation diagram

314. Use the voltmeter to check the DC voltage between the most negative (-) terminals of the strings. The measured voltage should be less than three (3) volts. If it is more than three (3) volts. correct any wiring errors before you go on.

315. Use the cables provided to connect the most negative (-) battery terminals of the battery strings as shown in the battery installation diagram. If the battery cabinet has a DC switch, the DC switch has been installed at the factory.

316. Make sure the UPS DC Switch is OFF.

317. Find the battery cables that you will connect between the UPS and the batteries or battery cabinet(s).

318. Strip 0.5 inches (13 mm) of insulation from the end of the negative (-) and positive (+) cables.

319. Connect the negative (-) cable to the negative (-) terminal on the UPS terminal strip.

320. Connect the positive (+) cable to the positive (+) terminal on the UPS terminal strip. Tighten the terminal connections securely.

321. Find the positive (+) and negative (-) cables that come from the UPS and ship 0.5 inches (13 mm) of insulation from the end of each cable.

322. Insert the positive (+) cable into the positive (+) terminal at the back of the battery cabinet.

323. Next, connect the negative (-) cable to the negative (-) terminal at the back of the battery cabinet. Tighten the terminal connections securely.

Note: If you have an external DC disconnect switch, see the instructions that came with your disconnect switch.

324. Now, turn the DC On/Off switch at **the battery** cabinet(s) to ON. Leave the UPS DC switch **OFF.**

Section 400: Calibrating the Unit and Checking the DC Voltage

After modifting the runtime in your FERRUPS, you must recalibrate the unit. You must also check the parameter for the unit's battery amp-hour. For calibration you need a true RMS digital multimeter and a clamp-on AC current pr We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-400 AC current probe or their equivalen t you do not have these probes or their equivalents. call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100. or call your nearest Best Power office.

To perform the calibration commands, use the hand-held front control panel (4.3 to 18KVA models) or attach a remote control panel, VT-100 type terminal. or computer to the RS232 port on the back of the UPS. Refer to TIP 407 (Remote Control Panel Options), TIP 503 (The FE Series RS232 Communication Port), or TIP 705 (FE Series Calibration through the RS232 Port). If you have any questions or problems during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2100, or call your nearest Best Power office.

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectlv could cause alarms. or shut down, for High AC Input. Low AC Input. High AC Output, or Low AC Output. Measuring battery voltages or battery current incorrectly could cause a battery alarm.

401. Reapply AC to the UPS. Turn the DC switch on. Turn the kcyswitch to ON.

402. At the control panel, enter the Service password.

On a ***control panel,*** press [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

From a terminal or ***computer,*** type pw 2639 and press <ENTER>.

403. Apply the load to the UPS. Make sure the load is more than 50% of full load.

404. Use the meter to check for proper nominal DC voltage at the UPS end of the cable. Make sure the pol ar agrees with the markings on the UPS batter) terminals. The nominal battery voltage should be 120 VD)C

405. Now, you must enter the amp-hour rating for your unit's batteries. To determine the amp-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries and use Table 2 on the next page to determine the amp-hoar rating. If you have more than one string of batteries, add the ampere-hour rating of the battery strings. If they do not have a part number, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), l-608-565-2100; or call your nearest Best Power office for more information.

Now, display parameter 69 (Batt AH).

On a control panel, press [DISPLAY] [6] [9] [ENTER].

From a terminal or computer, type d 69 and press <ENTER>.

If the amp-hour rating shown matches the amp-hour rating of your batteries, go on to step 406. If not, change the value of parameter 69.Batt AH).

On a control panel, press [PROGRAM], enter the correct amp-hour rating, and press [ENTER],

From a terminal or computer, type **pr**, type the correct amp-hour, and press <ENTER>.

Table 2: Amp-Hour (AH) Rating Chart

Battery Part Number	Battery AH Rating	Battery Part Number	Battery AH Rating
BAT-0007	55 AH	BAT-0053	31 AH
BAT-0046	75 AH	BAT-0058	17 AH
BAT-0047	75 AH	BAT-0065	33 AH
BAT-0048	100 AH	BAT-0071	26 AH
BAT-0049	100 AH	BAT-0103	75 AH
BAT-0050	200 AH	BAT-0122	100 AH
BAT-0051	200 AH		

406. Display parameter 122.

On a control panel, press [DISPLAY] [1] [2] [2] [ENTER].

From** a **terminal** or **computer, type **d** 122 and press <ENTER>.

Check the model number on a white patch in the comer of your power board. Use Table 3 below for the settings. If your unit does not display the proper charger, change the setting to the correct charger.

On a control panel, press [PROGRAM], enter the number for the correct charger, and press [ENTER].

From a terminal or computer, type **pr**, enter the correct number, and press <ENTER>

Table 3: Setting Parameter 122 for Your Unit's Charger Type

Setting	Used With These Power Boards	Charger and Charger Operation
0	PCP-0078, PCP-0080, PCP-0082. PCP-1086. PCP-0092. PCP-0095, PCP-0099. PCP-0134, PCP-0135, PCP-0136 PCP-0137, PCP-0145. PCP-0146, PCP-0166, PCP-0167, and PCP-0219.	*Hardware Charger:* Voltage settings are all hardware controlled.
1	PCP-0289, PCP-0290, PCP-0291, and PCP-0292	*Float Charger:* Voltage level is programmed in parameter 125. To display parameter 125, press [DISPLAY] [I] [2] [5] [ENTER]. To ***change parameter 125,*** press [PROGRAM], enter the correct voltage level. and press [ENTER].
2	PCP-0289. PCP-0290. PCP-0291, and PCP-0292.	*Hysteresis Charger:* Parameter 124 determines when the charger turns ***on:*** parameter ***126*** determines when the charger turns off. • To display parameter 124, press [DISPLAY] [I] [2] [4] [ENTER]. To change the low voltage when the charger should turn on, press [PROGRAM], enter the new setting, and press ENTER]. • To display parameter 126, press [DISPLAY] [I] [2] [6] [ENTER]. To change the high voltage when the charger should turn off, press [PROGRAM], enter the new setting, and press [ENTER].
3	PCP-0078, PCP-0080, PCP-0082; PCP-***1086,*** PCP-0092, PCP-0095, PCP-0099, PCP-0134. PCP-0135, PCP-0136, PCP-0137, PCP-0145, PCP-0146, PCP-0166, PCP-0167, PCP-0219, PCP-0289. PCP-0290, PCP-0291, and PCP-0292.	The charger is disabled. An external charger must be used to charge batteries if parameter 122 is set to "3."

CAUTION! **Failure** to select the proper charger **setting for your unit's power board listed above will cause incorrect operation of the charger and possible system damage.**

407. Display parameter 123.

On a control panel, [DISPLAY] [1] [2] [3] [ENTER].

From a terminal or computer, type **d 123** and press <ENTER>.

This displays the charger amp-hour rating. If your unit does not display the proper charger amp-hour, change the setting to the correct charger amp-hour.

On a *control panel,* press [PROGRAM]. enter the number for the correct charger, and press [ENTER].

From a terminal or computer, type **pr**, type in the correct charger number, and press <ENTER>.

CAUTION! An **incorrect setting of the charger rating can cause damage to the system.**

408. The next two (2) measurements are done while the UPS is running on inverter. Remove AC input power and let the unit run for approximately one (1) minute before you go on.

409. Measure the battery voltage with the digital multimeter. Measure from the DC fuse to the DC shunt

410. Next, display parameter 7 (V Batt).

On a *control panel,* press [DISPLAY] [7] [ENTER]

From a terminal or computer, type d 7 and press <ENTER>.

If your measurement does not match the value displayed for parameter 7, change the parameter value to your measurement.

On a *control panel,* press [PROGRAM]. enter your voltage measurement, and press [ENTER].

From a terminal or computer, type **pr**, enter the voltage measurement, and press <FNTER>.

411. Display parameter 6 (I Batt).

On *a control panel,* press [DISPLAY] [6] [ENTER].

From a terminal or computer, type **d** 6 and press <ENTER>.

412. Using the clamp-on AC/DC probe, set the digital multimeter for mV. Measure at the **negative (–) battery cable with the probe. The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 7.) If the result is** different from the value displayed for parameter **6, change the value of parameter 6.**

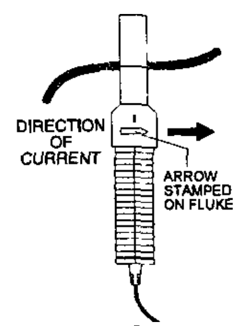


Figure 7

On a control panel, press [PROGRAM], enter your measured value, and press [ENTER].

From a terminal or computer, type **pr**, enter the measured value, and press <ENTER>.

413. **500VA** to **3.1KVA** models: Restore AC power and go to step 417.

4.3 to **18KVA** models: Check the part number on your power board. It is on a white patch on the right side of the power board reading "PCP-XXXX."

If you have power board PCP-0134, PCP-0135, PCP-0136, or PCP-0137 restore AC power: then go to step 417.

If you have power *board PCP-0291 or PCP-0292,* you will need to calibrate the battery charger. Continue to let the UPS run on inverter until the battery voltage is below 120 VDC. To monitor battery voltage, display parameter 7 by pressing [DISPLAY] [7] [ENTER].

414. Restore AC power and display parameter 128 (Charger On Delay) by pressing [DISPLAY] [I] [2] [8] [ENTER]. Change this parameter value to 10 seconds by pressing [PROGRAM] [1] [0] [ENTER]. Once the CHARGING LED lights. the charger current can be calibrated.

If your unit has the optional charger assembly as shown in Figure 8 or 9, follow the instructions for the IO-amp or 20-amp charger. If not, follow the instructions for the 5-amp charger.

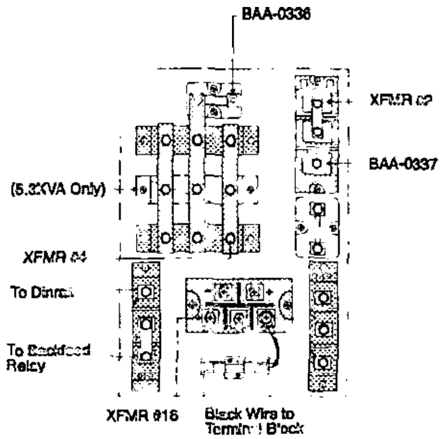


Figure 8: 4.3, 5.3KVA

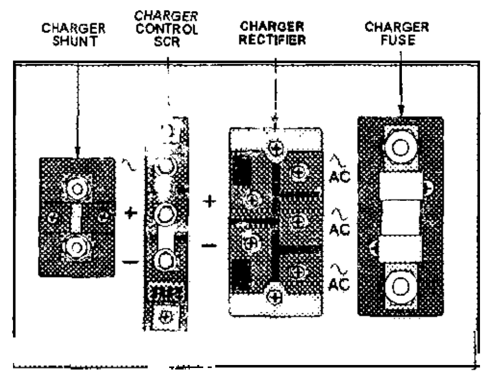


Figure 9: 7-18KVA

CAUTION!
When you make the measurement at the power board, do not contact other power board components. Power board components contain dangerous voltages that could cause equipment damage or personal injury. Use caution when making this measurement.

For units with a **5-amp** charger: measure DC current with the Fluke 8Oi-4 10 current probe on the negative (-) battery cable. The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 11.)

If you don't have an 80i-410 current probe. measure across R24 or R25 on power board PCP-0291 or *across* R50 *or* R5 1 *on* power board PCP-0289. *Then. multiply your MILLIVOLT measurement by 0.04 to convert to the amperage of the charger output. Do NOT convert the measurement to VOLTS before multiplying.*

Example: *If you measure 120 mV across R24, multiply 120 x 0.04 = 4.8. Parameter 6 should be set* to 4.8 *amps.*

For units with a 10-amp or 20-amp charger: measure DC current with the 80i-410 current probe on the negative (-) battery cable. The arrows stamped on the current probe must match the flow of current you are measuring. (See Figure 11.)

If you don't have an 80i-410 current probe, follow these steps:

a. Measure across the charger shunt on the charger assembly. See Figure 8 or 9 on page 10 to find the shunt.

b. To determine what size charger your UPS has, see the fuse on the charger assembly. (See Figure **8 or 9** on page 10.) If the fuse is a 30-amp fuse, the unit has a IO-amp charger. If the fuse is a 60-amp fuse, the unit has a 20-amp charger.

c. Multiply your MILLIVOLT measurement by the amount shown for your unit's charger size. Do NOT convert millivolts to volts before multiplying.

10-amp charger:	Multiply by 0.2
20-amp charger:	Multiply by 0.4

415. In this step, you will calibrate parameter 6 again. Calibrating parameter 6 on line calibrates charger current; this calibration will not affect what you did in step 418. Display parameter 6 by pressing [DISPLAY] [6] [ENTER]. If your calculated current does not match the value displayed in parameter 6, change the parameter value by pressing [PROGRAM], entering your measured value. and pressing [ENTER].

Note: If the charging current is too low, FERRUPS does not let you program this parameter. If the control panel displays "Cannot Program" when you try to change the parameter value, run the UPS on inverter longer so the charger current will be higher.

416, Display parameter 128 (Charger On Delay) again by pressing [DISPLAY] [1] [2] [8]. Change this parameter value back to its original value of 243 seconds by pressing [PROGRAM] [2] [4] [0] [ENTER].

417, Clear the Service Password.

On a ***control panel,*** press [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

On a ***terminal or computer,*** type pw and press <ENTER>. The "=>" prompt should appear.

418 Turn the FERRUPS off; then, remove all AC. If the UPS has a DC switch, turn it off, Turn the DC switch off at each battery cabinet.

Section 500: Putting the Covers Back on the Battery Cabinet and the UPS

501. Put the side covers back in place and reattach the screws on each side of battery cabinets "N," "P," and "Q." (See Figure 10.) For battery cabinet "M," slide the cover on the rails and attach the screw on the top.

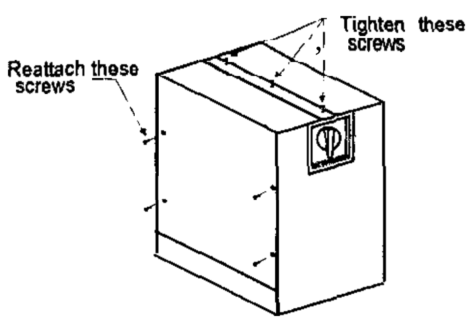


Figure 10

502. Tighten the screws on the bar across the top of battery cabinets "N," "P," and "Q." (See Figure 10.)

503. Reattach the covers to the UPS

500VA to 3.1KVA: Slide the cover on the UPS rails. Tighten the front screw and reattach the grounding screw. Reattach the sticker over the front screw. (See Figure 2 on page 4.)

4.3KVA to 18KVA: Reattach the Phillips screws on each side of the UPS. Tighten the screws on the bar across the top of the UPS. (See Figure 1 on page 3.)

504. Reapply AC power to the UPS. Reconnect the battery cable(s) and turn on the DC switch(es).

505. **4.3KVA to 18KVA:** Replace the front panel to the UPS and turn the key to lock the panel in place. (See Figure 1 on page 3.) Return the key to the keyswitch.

506. Startup the UPS according to the instructions in the *FERRUPS User Manual*. Then, startup the load equipment connected to the UPS.

Programming the FE Series FERRUPS for Use with a Generator

This Technical Information Publication describes how to program FE Series PERRUPS models to accept generator power. A qualified technician who is familiar with the FBRRUPS must program the unit. If you encounter problems during this procedure, please contact BEST's Technical Support Center at l-800-356-5737.

FERRUPS units automatically adjust to the input power available; this means that a FERRUPS using input power from a generator probably will not need reprogramming. However, in some cases, the PERRUPS unit will not accept generator power because it is relatively unstable. To help the PERRUPS work with the input from the generator, you must follow steps 1 through 5 below to reprogram some parameters.

You must have. communication set up through either a control panel or a terminal *(or* computer), and you must know how to display and program parameters. If you need more information, see the User Manual if you are using the control panel or TIP 503 if you are using a terminal or computer.

1. Display parameters 51, 52, and 58. The values you display should match the values in the table below; if they don't, change the parameter values.

Parameter	Parameter Value (Setting)
51 (LowFreq)	57.0C
52 (HiFreq)	63.00
58 (XferDly)	1.0s

2, Next, display parameters 53, 54, 55, 56, and 57, and change the parameter values to the ones shown in the table below.

Parameter	New Parameter Value (Setting)	MAXIMUM Parameter Value (Setting)
53 (SlewRate)	200	300
54 (PhaseLk)	1200	2000
55 (FreqGlCnt)	20	20
56 (LineGlCnt)	10	10
57 (LineDelta)	120	160

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3. Now, test the UPS with the generator.

If the UPS does **not** accept the generator power, go on to step 4.

If the UPS accepts the generator power, you can try to "tine tune" the parameters to the lowest acceptable values. To do this, lower each parameter until the system no longer accepts generator power. Then, raise each value just enough to allow the FERRUPS to accept the input from the generator. This ensures that the system will provide the best performance for your application. **Now, monitor the UPS for a period of time to make sure it will continue to accept generator power. If the parameter limits are too narrow for the power your generator is providing, the unit may run on inverter frequently; if this'happens, raise the parameter settings until the problem stops.** Once you have finished fine tuning the parameter values, you have finished this procedure.

4. If your FERRUPS did **not** accept the generator power, increase the values of parameters **53, 54,** and 57 by these amounts:

53: Increase by 20
54: Increase by 100
57: Increase by 10

Next, test the UPS with the generator. If the UPS will not accept the generator power, repeat this step until the UPS can accept the input or until you reach the maximum values shown in the table on page 1. **Do not exceed the maximum value for each parameter.**

5. Ifreprogramming the UPS does not allow it to accept generator power, there are problems in the power your generator is supplying. Your FERRUPS unit can help you diagnose these problems; call BEST's Technical Support Center at l-800-356-5737 for assistance. (Outside of the U.S. and Canada, call your local BEST office.)

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

TIP 709
35
October 30, 1996

Changing the operating Voltage on the FERRUPS FE and QFE 500–850 VA Models

This Technical Information Publication (TIP) describes the procedure to change the operating voltage in the FE and QFE 500 to 850 VA models. This publication is intended for use by a qualified service person familiar with the FERRUPS® FE series unit. If you encounter problems at any time during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or l-608-565-2 100, or call your nearest Best Power office.

Tools Needed – Use Insulated Tools:

Safety Equipment Required by Local Codes	Phillips Screwdriver	Shrink Tubing
Fluke 80i-410 Current Probe or Equivalent	True RMS AC Voltmeter	Needle-nose Pliers
Tie Wraps	Remote Control Panel	Wire Cutter

CAUTION!

This procedure most be performed by a qualified service person. FERRUPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the *RUPS User Manual* (Section 308). Make sure that the FERRUPS batteries and AC input are off or disconnected before perform voltage changes.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

FERRUPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury A short circuit can cause a **battery** to explode.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:

A) **Remove rings, watches, and other jewelry before servicing the FERRUPS unit.**
B) **Always wear protective clothing and eye protection and use insulated tools when working near batteries.**
C) **Whenever you are servicing an energized unit with the cover off, electric shock is possible; follow all local safety codes.**

Make certain the UPS complies with all applicable electrical codes when you have fmished changing the voltage.

Note: If your unit was originally ordered with 120 Input.020 Output, you cannot change the voltage. Check your unit's ID label behind the front panel of the UPS.

You must change the backfeed relay when changing from 120 VAC to 2081240 VAC (or vice versa). See Figure 8 on page 7 to determine which backfeed relay you need for your application.

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Section 100: Removing the Cover from the UPS

CAUTION!

Make sure the On/Off (l/O) key on the front of the UPS is turned to OFF (0), and make sure all AC and DC power to the unit is off.

101. Shut down or bypass all load equipment. Torn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

102. Remove the # 1 Phillips screw on the top of the UPS. (See Figure 1.)

103. Next, find the sticker in the lower right corner of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker. (See Figure 1.)

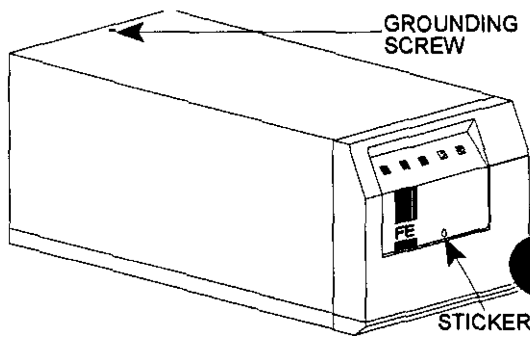


Figure 1

104. Slide the cover forward until it is completely off the UPS.

CAUTION! **Before you perform a voltage change, you must disconnect the batteries by following steps 105 through 107. If you do not disconnect the batteries, parts may be damaged as you perform the voltage change.**

105. If your unit has an external battery cabinet, you must turn off the DC disconnect switch or unplug the connector between the UPS and the battery cabinet.

106. Inside the UPS, find the main DC fuse shown in Figure 2.

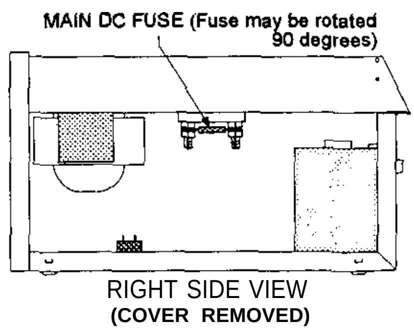


Figure 2

CAUTION!

As you follow the next step, he careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

107. **Use a** 1/2-inch wench **or** nutdriver **to loosen both** nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the battery cable

Section 200: Changing the Operating Voltage for QFE (50 Hz) Models

201. Find the power board at the top of the FERRUPS. (See Figure 3.)

202. Remove the transformer lead from El4 on the power board. Find the AC Input voltage and the new Transformer Lead Number in Table 1. (The transformer leads that are not used are enclosed in an insulated covering and tied back to the transformer. Remove this covering to expose the transformer leads.) Connect this new transformer lead to E14. (See Figure 4 and Table 1.)

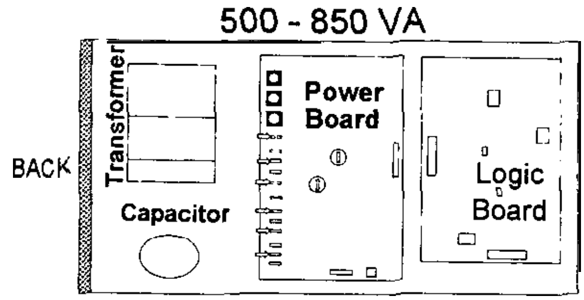


Figure 3

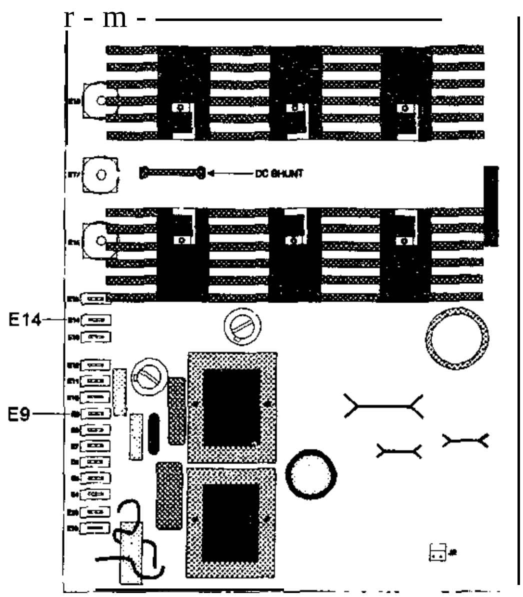


Figure 4

Table 1: Changing the Input Voltage, 50 Hz Models

AC Input	Transformer Lead Number	Power Board Connection
220 VAC	7	E14
230 VAC	6	E14
240 VAC	5	E14

For example: *If the original input voltage was 220 VAC and the new voltage is 240 VAC. remove transformer lead # 7 and connect transformer lead #5 in its place.*

203. Insulate the lead you disconnected with shrink tubing and position it so that it cannot contact any live terminals or ground. Fasten it in place with a tie wrap.

204. Remove the transformer lead from E9 on the power board. Find the AC Output voltage and the new Transformer Lead Number in Table 2 and connect this transformer lead to E9. (See Figure 4 on page 3 and Table 2 below.)

Table 2: Changing the Output Voltage, 50 Hz Models

AC Output	Transformer Lead Number	Power Board Connection
220 VAC	11	E9
230VAC	12	E9
240VAC	13	E9

For example: If the original input voltage was 220 VAC and the new voltage is 240 *VAC, remove transformer lead #1 1 and connect transformer lead #1 3 in its place.*

205. Insulate the lead you disconnected with shrink tubing and position it so that it cannot contact any live terminals or ground. Fasten it in place with a tie wrap.

206. Make sure that the input and output voltage terminal connections are correct. Use Tables 1 and 2 as a guide.

Note: Good connections are essential. Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

Section 300: Changing the Operating Voltage from 120 to 208 or 240 VAC for FE (60 Hz)

Section 301: Replacing the Power Board

301-1. If you are changing the voltage from 120 VAC to 208 VAC or 240 VAC, you must change the power board. Find the power board at the top of the FERRUPS. (See Figure 5.) Look for the part number on a white label on the power board. On **500VA and 700VA models,** power board PCP-0092 must be replaced with power board PCP-0078. On **850VA models,** power board PCP-0099 must be replaced with power board PCP-0080.

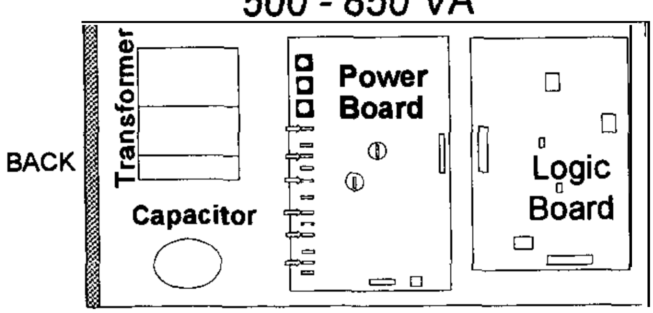


Figure 5

301-2. Label the wires at the following power board connections: J1, J2, J3 (if used), E4, ES, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, and E20. (See Figure 6 on the next page.) Next, disconnect the wires.

Note: To disconnect E16, E17, and E18, you will need a 3/8-inch nutdriver and a 5/16-inch nut d

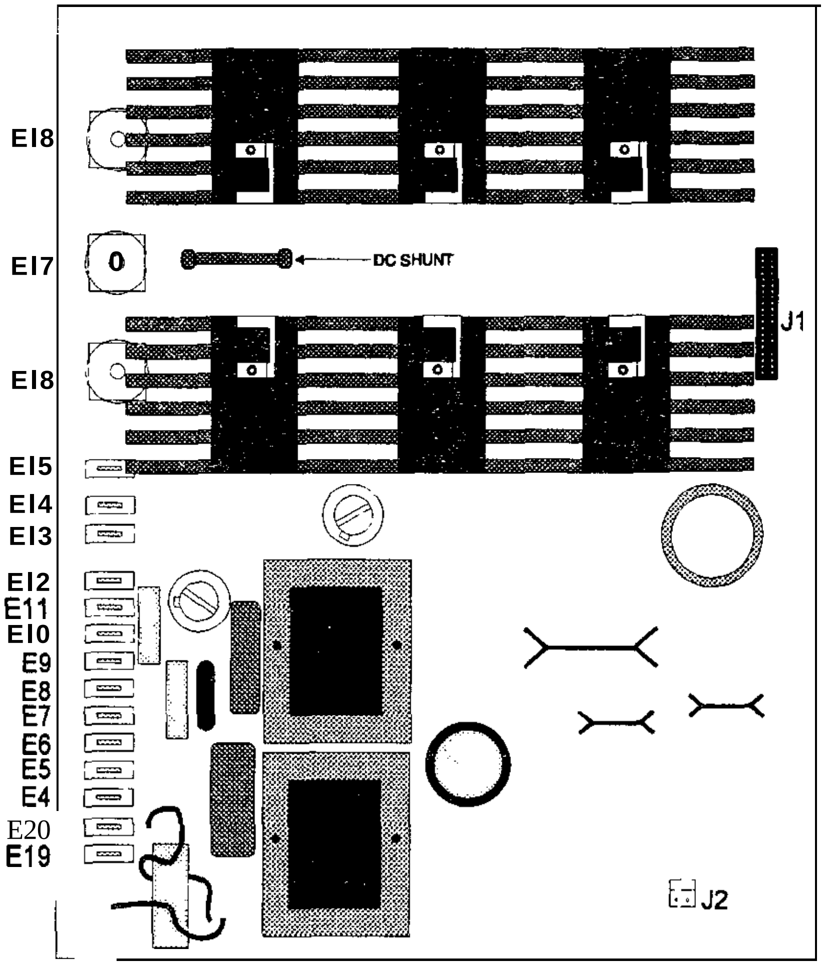


Figure 6

301-3. The power board is held in place by four white plastic standoffs. Press the tab on each standoff and lift the power board over the tab. Remove the power board from the unit.

30 l-4. Place the new power board in place Insert the standoffs through the power board and press gently until they snap into place.

301-5. Reconnect all wires to the power board **except** E4. E8. E9, E12, E14, E19, and E20. Use the labels you attached in step 301-2 to match the wires to the correct connection points on the power board. You can also use Table 3 on the next page as a guide to reconnecting the wires. See Figure 6 above to find the connection points.

Table 3: Power Board Connection Points

Power Board Connection	Wire Description
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
(J3)	(Wire from the optional charger.)
E4	Connect in **later step.**
E5	Wire from one side of the fan.
E6	Transformer lead # 10
E7	Wire from one side of the fan.
E8	No connection.
E9	Connect in **later step.**
E10	Wire from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Connect in later step.
E13	Wiie from backfeed relay terminal 4.
E14	**Connect in later step.**
E15	Wire from the DC fuse
E16	Transformer lead #4
E17	Negative battery cable.
E18	Transformer lead # 1.
E19	**Connect in later step.**
E20	**Connect in later step.**

301-6. Remove the temporary labels from the reconnected wires.

Section 302: Replacing the Backfeed Relay

302-1. Find the backfeed relay at the bottom of the unit. (See Figure 7.)

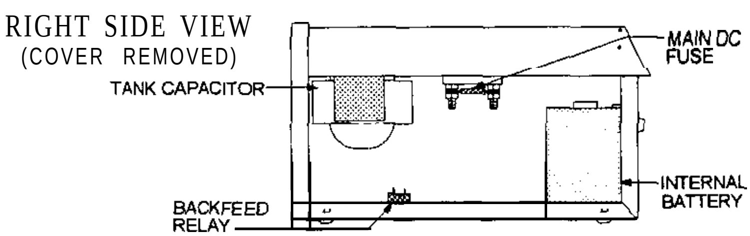


Figure 7

302-2. Label the wires connected to the relay with the terminal numbers they were connected to. Disconnect the wires from the relay. (See Figure 8 on the next page.)

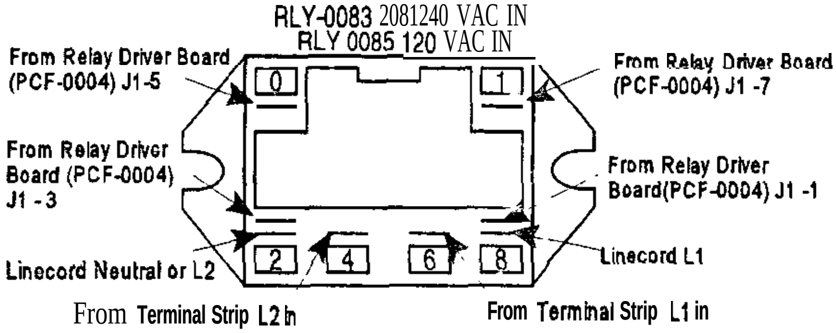
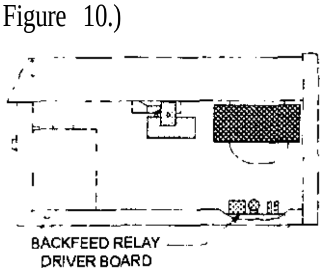


Figure 8

302-3. Remove the two mounting screws and remove the relay from the unit.

302-4. Install the new relay and reconnect the wires as shown in Figure 8. Remove the labels you put on the wires.

302-5. Locate the backfeed relay driver board next to the relay. (See Figure 9.) Move the jumper at J2 to the ≥ 200V position. (See Figure 10.)



LEFT SIDE VIEW
(COVER REMOVED)

Figure 9

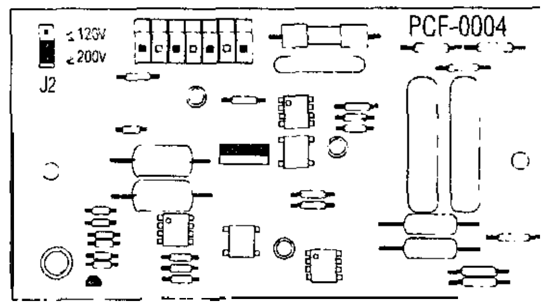


Figure 10

Section 303: Changing the Operating Voltage

303-1. Use the chart to change the input voltage:

	Changing the input voltage from **120 to 208 or 240 VAC**
a.	Find El2 and El4 on the power board. (See Figure 11 on the next page.)
b.	**To change the input voltage to** 208, Reconnect transformer lead #9 to E12 on the power board. Find transformer lead #6 tied back in a bundle at the main transformer. Attach lead #6 to E 14 on the power **board.** Insulate leads #5, #7, and #8 and tie them hack to the main bundle at the main transformer.
c.	**To change the input voltage to 240, reconnect** transformer lead #9 to E 12 and connect transformer lead #5 to E14 on the **power** board. Insulate leads #7 and #8 and tie them back to the main bundle at the main transformer.
d.	If you are changing the output voltage, go to step 303-2. If not, continue with step 303-3.

303-2. Use the appropriate chart to change the output voltage (See Figure 12.):

Changing the output voltage from 120 to 208 or 240 VAC

a. Jumper the grounding wire and transformer lead #11 together. Insulate these wires and tie them back to the bundle at the main transformer.

b. If you are changing your UPS to 208 VAC out, find transformer lead #12 tied to the bundle at the main transformer. Attach lead #12 to E9 on the power board.

If you are changing your UPS to 240 VAC out, find transformer lead #13 tied to the bundle at the main transformer. Attach lead #13 to E9 on the power board.

c. Disconnect the receptacle wire at E4 on the power board. Reattach this wire to E19 on the power board.

d. Install a jumper wire from E4 to E20 on the power board. If you do not have a jumper wire, call Best Power Worldwide Service.

e. Go to step 303-3.

Changing the output voltage from 120 to 120/208 or 1201240 VAC mixed output voltages

a. Jf you are changing to a 120/208 mixed output, find transformer lead #12 tied back to the bundle at the main transformer. Connect lead #I 2 to E 19 on the power board.

If you are changing to a 120/240 mixed output, find transformer lead #13 tied back to the bundle at the main transformer. Connect lead #13 to El9 on the power board.

b. Go to step 303-3.

303-3. Make sure that the input and output voltage terminal connections are correct. Use Table 4 on the next as a guide for input voltage connections and Table 5 on the next page as a guide for output vo connections.

Note: Good connections are essential. Tighten any connections that are loose. by carefully pinching the connector tabs with the needle-nose pliers.

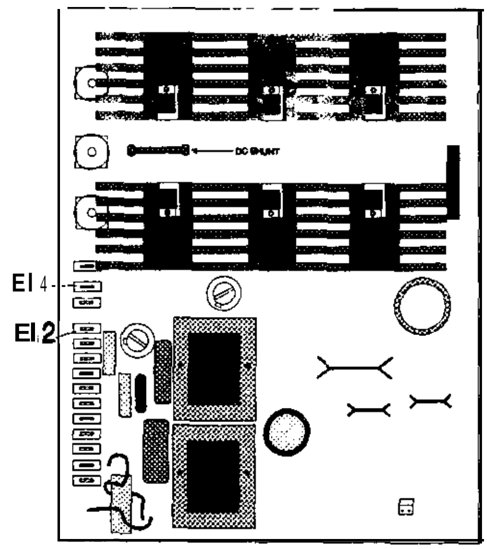


Figure 11

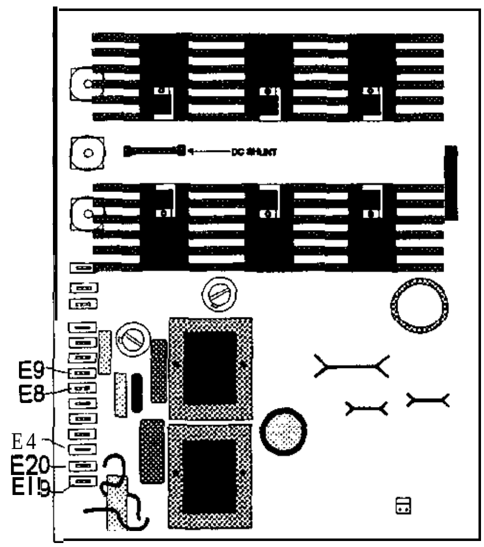


Figure 12

Table 4: Input Voltage Connections

Voltage	Power Board E12	Power Board E14
120 VAC	Transformer leads #7 and #9	Transformer leads #5 and #8
208 VAC	Transformer lead #9	Transformer lead #6
240 VAC	Transformer lead #9	Transformer lead #5

Table 5: Output Voltage Connections

Voltage	Power Board Connection	Wire Description
120 VAC	E4	Black wire from the receptacle.
	E8	Grounding wire.
	E9	Transformer lead #11.
	E19	**120:** Not connected. **120/208:** Transformer lead #12. **120/240:** Transformer lead #13.
	E20	**120:** Not connected. **120/208 or 120/240:** Red wire from the receptacle
208 VAC	E4	Jumper wire to E20.
	E8	No connection.
	E9	Transformer lead #12.
	E19	Black wire from the receptacle.
	E20	Jumper wire to E4.
240 VAC	E4	Jumper wire to E20.
	E8	No connection.
	E9	Transformer lead #13.
	E19	Black wire from the receptacle.
	E20	Jumper wire to E4.

303-4. Check to make sure that you have the correct line cords and receptacles for the new input and output voltages of your unit. Replace any line cords or receptacles that do not match the voltage requirement. Call Best Power Worldwide Service if you need assistance.

Section 400: Changing the Operating Voltage from 208 or 240 to 120 VAC for FE (60 Hz)

401. Find the backfeed relay above the batteries on the shelf in the rear of the unit. (See Figure 13.)

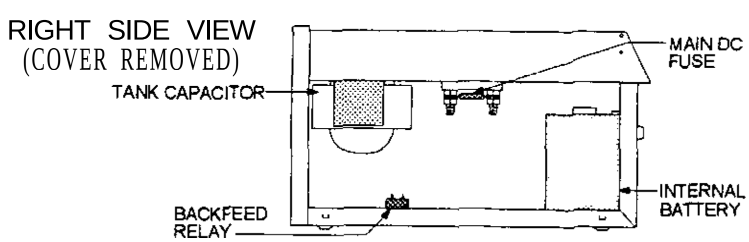


Figure 13

402 Label the wires connected to the relay with the terminal numbers they were connected to. Disconnect the wires from the relay. (See Figure 14.)

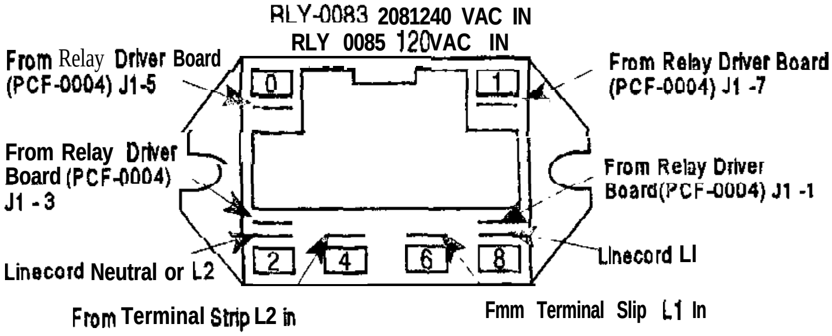


Figure 14

403. Remove the two mounting screws and remove the relay from the unit

404. Install the new relay and reconnect the wires as shown in Figure 14. Remove the labels you put on the wires

405. Locate the backfeed relay driver board next to the relay. (See Figure 15.) Move the jumper at J2 to the ≤ 120V position if you are changing the voltage from 208 or 240 to 120 VAC. (See Figure 16.)

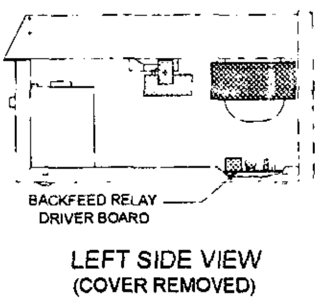


Figure 15

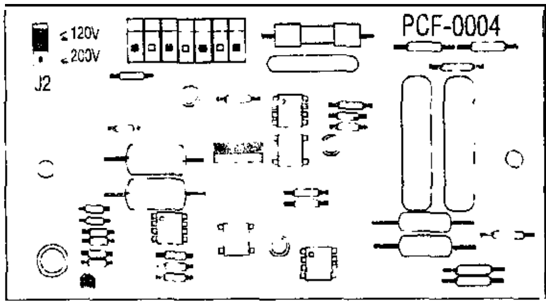


Figure 16

406. Use the appropriate chart to change the input voltage (See Figure 17 on the next page.):

Changing the input voltage from 208 to 240 VAC (or vice versa)	
a.	Find El4 on the power board
b.	To change the input voltage from 208 to 240, disconnect transformer lead #6 from El 4 on the power board. Insulate lead #6 and tie it hack to the transformer. Find transformer lead #5 tied to the bundle at the main transformer. Attach lead #5 to E14 on the power board.
c.	To change the input voltage from 240 to 208, disconnect transformer lead #5 from E 14 on the power board. Insulate lead #5 and tie it back to the transformer. Find transformer lead #6 tied to the bundle at the main transformer. Attach lead #6 to E14 on the power board.
d.	If you are changing the output voltage, go to step 407. If not, continue with step 408.

Changing the input voltage from 208 or 240 to 120 VAC	
a.	Find transformer leads #5, #7, and #8. (If your UPS is at 240 VAC, lead #5 will already be attached to El4 on the power board.)
b.	**If you are changing fmm** 208 **VAC,** disconnect lead #6 from El4 on the power board. Insulate lead #6 and tie it back to the bundle at the main transformer.
c.	Attach transformer leads #5 and #8 to E I4 on the power board and transformer leads #7 and #9 to E I 2 on tbe power board.
d.	If you are changing the output voltage, go to step 407. If not, continue with step 408.

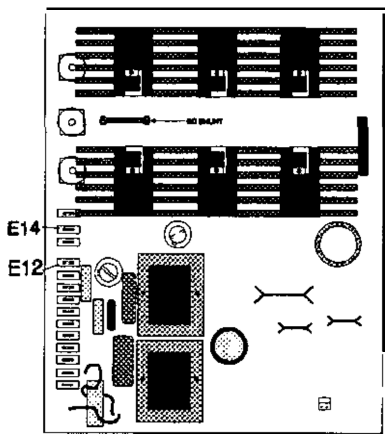


Figure 17

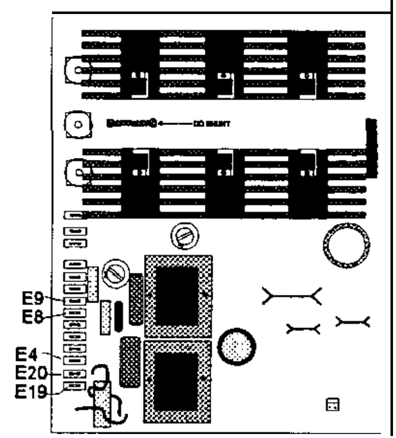


Figure 18

407. **Use** the appropriate. chart to change the output voltage (See Figure 18.):

Changing the output voltage from 208 or 240 to 120, 120/208, or 120/240 mired voltage	
a.	Disconnect transformer lead #12 (208 VAC) or lead #13 (240 VAC) from E9 on the power board.
b.	**If you are converting to a mixed voltage:** Disconnect the red jumper wire at E4 and E20 on the power board from E4. Attach the end of the wire disconnected from E4 to "L2" on the output terminal block. Attach transformer lead #12 (120008) or transformer lead #13 (1201240) to E19 on the power board. Insulate the unused lead and tie it back to the bundle at the main transformer. **If you are converting to straight 120 VAC,** insulate **the** lead you disconnected (12 or 13) and tie it back to the bundle at the transformer. Remove the jumper wire from E4 and E20 on the power board.
c.	Fiid transformer lead #11 tied back to the bundle at the main transformer The ground wire should be attached to lead #11. Separate the wires and connect lead # I 1 to E9 on the power board and the grounding wire to E8 on the power board.
d.	Disconnect the receptacle wire from E 19 on the power board and attach this wire to E4 on the power board. The other end of this wire should be attached to "L1" on the output terminal.
e.	Go to step 408.

Changing the output voltage from 208 to 240 VAC (or vice versa)	
a.	To change the voltage from 208 to 240, remove transformer lead #12 from E9 on the power board. Insulate the lead and tie it back to the bundle at the main transformer. (See Figure 12.) Find transformer lead #13 in this bundle and attach lead # 13 to E9 on the power board. To change the voltage from 240 to 208, remove transformer lead #13 from E9 on the power board. Insulate the lead and tie it back to the bundle at the main transformer Find transformer lead #12 in this bundle and attach lead #12 to E9 on the power board.
b.	Go to step 408.

408. Make sure that the input and output voltage terminal connections are correct. Use Table 6 as a guide for input voltage connections and Table 7 as a guide for output voltage connections.

Note: Good connections are essential. Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

Table 6: Input Voltage Connections

Voltage	Power Board El2	Power Board El4
120 VAC	Transformer leads #7 and #9	Transformer leads #5 and #8
208 VAC	Transformer lead #9	Transformer lead #6
240 VAC	Transformer lead #9	Transformer lead #5

ıble 7: Output Voltage Connections

Voltage	Power Board Connection	Wire Description
120 VAC	E4	Black wire from the receptacle.
	ES	Grounding wire.
	E9	Transformer lead #11.
	E19	**120:** Not connected. **120/208:** Transformer lead #1 2. 1201240: Transformer lead #13.
	E20	120: Not connected. **120/208** or **120/240:** Red wire from the receptacle
208 VAC	E4	Jumper wire to E20.
	ES	No connection.
	E9	Transformer lead #12.
	E19	Black wire from the receptacle.
	E20	Jumper wire to E4.
240 VAC	E4	Jumper wire to E20.
	E8	No connection.
	E9	Transformer lead #13.
	E19	Black wire from the receptacle.
	E20	Jumper wire to E4.

409. Check to make sure that you have the correct line cords and receptacles for the new input and output voltages of your unit. Replace any line cords or receptacles that do not match the voltage requirement. Call Best Power Worldwide Service if you need assistance.

Section 500: Reconnecting DC to the UPS

501. Remove the tape from the disconnected end of the DC fuse: then, move the fuse back into place. Once the fuse is in position, use a 1/2-inch wench or nutdriver to tighten the nuts that hold the cables to the DC fuse.

Important: Make sure the fuse connector is next to the battery cable connector on the bolt: there should not be a washer in between. (See Figure 19.)

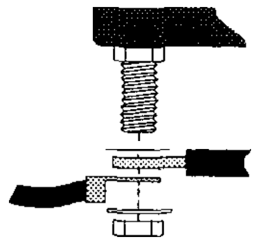


Figure 19

502. If your UPS has external batteries, reconnect it to the batteries or turn on the DC switch.

Section 600: Calibrating the FERRUPS Unit after the Voltage Change

Complete the voltage change procedure by calibrating the FERRUPS. You must recalibrate several parameters to match your new voltage configuration. To do this you will need a handheld Remote Control Panel or a terminal. The steps below are written for a remote control panel. Refer to TIP 407 if you are using the Remote Control Panel and TIP 503 if you are using the communications port and a terminal.

601. With the On/Off (l/O) key in the "OFF" (0) position, connect the UPS to the AC service which will supply the new operating voltage.

602. Turn the On/Off (l/O) key to the "ON" (I) position. The UPS should operate normally. A "High AC" output or "Low AC" output alarm may sound. This is normal. The alarm will stop when you recalibrate the UPS. To silence the alarm, press [CONTROL] [5] [ENTER] [ENTER]; the alarm will not sound, but the alarm will appear on the scrolling display until the unit is calibrated.

603. Connect the handheld Remote Control Panel to the RS232 interface port on the back of the FERRUPS unit. You will use the Remote Control Panel to enter the commands and parameter changes shown in the following steps.

604. From the "=>" prompt, enter the Factory password by pressing [PROGRAM] [1] [8] [4] [7] [3] (ENTER].

605. Apply a load to the FERRUPS unit. The load must be 50% or more of the UPS KW rating.

606. If you changed the input voltage, you must calibrate parameters 43 and 1 by doing the following:

a. Display parameter 43 (Nom VIn) by pressing [DISPLAY] [4] [3] [ENTER]. Your old nominal input voltage should appear. To change this value. press [PROGRAM]? enter the new nominal AC input voltage, and press [ENTER]. The Remote Control Panel should now display your new nominal AC input voltage.

b. Measure the input voltage with a true RMS voltmeter at "Nin" and "Lin" on the input terminal.

c. Next, display the input voltage by pressing [DISPLAY] [I] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value to your measurement by pressing [PROGRAM], entering your AC input voltage measurement, and pressing [ENTER].

607. If you changed the output voltage, you must change parameters 44, 2, and 4 by doing the following:

a. Display parameter 44 (Nom VOut) by pressing [DISPLAY] [4] [4] [ENTER]. Your old nominal output voltage should appear. To change this value, press [PROGRAM], enter the new nominal AC ou t voltage, and press [ENTER]. The Remote Control Panel should now display your new nominal AC out voltage.

b. Measure the AC output voltage. For plug-in **models,** measure at the output receptacles. For **hardwired models,** measure between output terminals "N" and "Ll".

c. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement. Press [PROGRAM], enter your output AC voltage measurement, and press [ENTER].

Note: Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you entered in parameter 44.

d. Measure the AC current by clamping the current probe around the two wires from "L" on the output terminal.

e. Next, display parameter 4 (I Out) on the control panel by pressing [DISPLAY] [4] [ENTER]. If your measurement does not match the value displayed for parameter 4, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC current, and pressing [ENTER].

608. Clear the Factory password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

609. Clear the remote communication mode by pressing [CLEAR] and [.] **at the same time.** This will clear the and allow you to use it for CheckUPS software or terminal communication.

610. Remove all AC and external DC power.

Section 700: Putting the Cover on the UPS

701. Using the slide rails on each side of the unit, slide the cover on the UPS,

702. At the front of the UPS, tighten the screw in the lower right comer of the front panel. Cover the screw with the round sticker you removed. (See Figure 1 on page 2.)

703. Put the screw back in the top of the UPS and tighten the screw. (See Figure 1 on page 2.)

704. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

705. Startup the UPS, connect all load equipment, and return the UPS to normal operation

Best Power
NINTERRUPTIBLE
OWER SYSTEMS

TIP 716
68
May 21.1997

Changing the Operating Voltage on FERRUPS FE and QFE 1.15 and 1.4KVA Models

This Technical Information Publication describes how to change the operating voltage in FE and QFE 1.15 and 1.4 KVA models. This publication is intended for use by a qualified service person familiar with the FERRUPS" FE series unit. If you encounter problems at any time during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only) or t-608-565-2 100, or call your nearest Best Power office.

Tools Needed – Use Insulated Tools:

Remote Control Panel	Wire Cutter	Tie Wraps
Safety Equipment Required by Local Codes	#1 and #2 Phillips Screwdrivers	Shrink Tubing
Fluke 80i-410 Current Probe or Equivalent	True. RMS AC Voltmeter	Needlenose Pliers
5/16-inch and 7/16-inch Wrenches or Nutdrivers		

CAUTION!

This procedure must be performed by a qualified service person FERRUPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!** Make certain the UPS will comply with all applicable electrical codes when you have finished changing the voltage.

Turn off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Your FERRIJPS" in the *FERRUPS* User *Manual* (Section 308). Make sure that the FERRUPS batteries and AC input are off or disconnected before you perform voltage changes.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

FERRIJPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:

A) Remove rings, watches, and other jewelry before servicing the FERRUPS unit.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover off, electric shock is possible; follow all local safety codes.

Note: If your unit was originally ordered with 120 Input/120 Output, you cannot change the voltage. Check your unit's ID label behind the front panel of the UPS.

You most change the backfeed relay when changing from 120 VAC to 208/240 VAC (or vice versa). See Figure 11 on page 10 to determine which backfeed relay you need for your application.

N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover from the UPS

CAUTION!

Make sure the On/Off (I/O) key on the front of the UPS is turned to OFF (0), and make sure all AC and DC power to the unit is off.

101. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

102. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1.)

103. Next, find the sticker in the lower right comer of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 tums to loosen (but not remove) it. Save the sticker. (See Figure 1.)

104. Slide the cover forward until it is completely off the UPS.

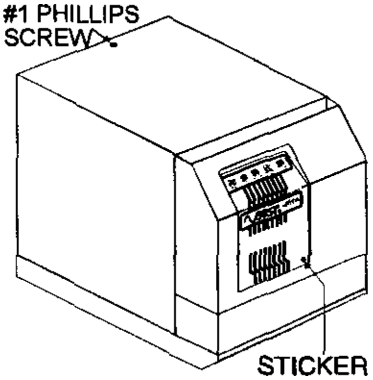
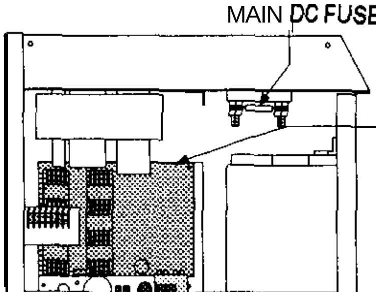


Figure 1

CAUTION! **Before you perform a voltage change, you must disconnect the batteries by following steps 105 through 107. If you do not disconnect the batteries, parts may be damaged as you perform the voltage change.**

105. If your unit has an external battery cabinet, you must tum off the DC disconnect switch or unplug the connector between the UPS and the battery cabinet.

106. Inside the UPS, fmd the main DC fuse shown in Figure 2.



RIGHT SIDE VIEW
(COVER REMOVED)

Figure 2

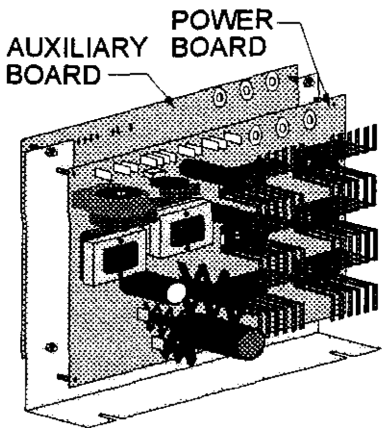
CAUTION!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

107. Use a 1/2-inch wrench or nutdriver to loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the battery cable.

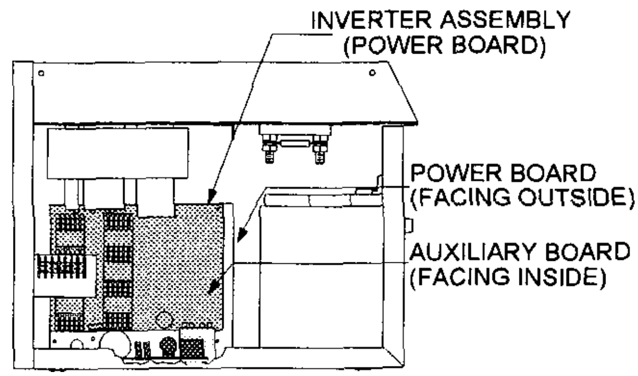
Section ZOO: Changing the Operating Voltage on QFE (50 Hz) Models

201. Find the auxiliary board in the FERRUPS unit. The auxiliary board and the power board are part of the same assembly. (See Figure 3.) The power board faces the outside of the unit. and the auxiliary board faces the inside of the unit. (See Figure 4.)



POWER BOARD ASSEMBLY

Figure 3



RIGHT SIDE VIEW (COVER REMOVED)

Figure 4

202. Refer to Figure 5 and Table 1 on the next page to change the input voltage of the UPS. Remove the transformer leads from E6, E7, and E8 on the auxiliary board. Find the AC Input voltage and the new Transformer Lead Numbers from Table 1 and place the transformer leads on the appropriate auxiliary board terminals for the new voltage.

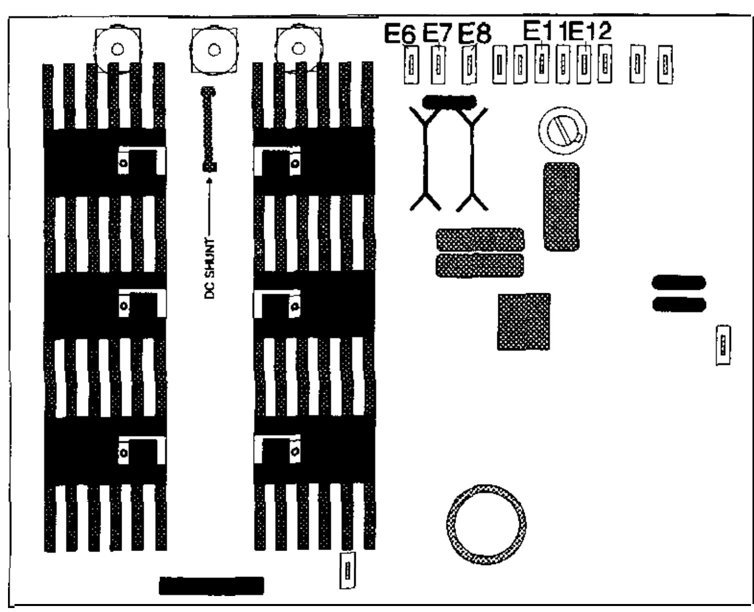


Figure 5 Auxiliary Board

Table 1: Input Voltage Connections; Auxiliary Board

AC Input	Transformer Lead Numbers	AUXILIARY Board Connection
220 VAC	7	E6
	5	E7
	6	E8
230 VAC	6	E6
	5	E7
	7	E8
240 VAC	5	E6
	6	E7
	7	E8

For example: *If the original input voltage was 220 VAC and the new voltage is 240 VAC, transformer lead #5 goes to auxiliary E6, transformer lead #6 goes to auxiliary E7, and transformer lead # 7 goes to auxiliary E8.*

203. Insulate the leads you removed with shrink tubing and position them so that they cannot contact any live terminals or ground. Fasten these leads in place with a tie wrap.

204. Refer to Table 2 to change the output voltage. Remove the transformer leads from E9 on the power board (see Figure 6 *on* the *next* page) and El 1 and El2 on the auxiliary board (see Figure 5 *on* page 3). Find the AC Output voltage and the new Transformer Lead Numbers in Table 2 and connect the transformer leads to the appropriate terminals.

Table 2: Output Voltage Connections; Power Board and Auxiliary Board

AC Output	Transformer Lead Numbers	Board Connection
220 VAC	11	E9 POWER Board
	12	El 1 AUXILIARY Board
	13	El2 AUXILIARY Board
230 VAC	12	E9 POWER Board
	11	El 1 AUXILIARY Board
	13	El2 AUXILIARY Board
240VAC	13	E9 POWER Board
	11	El 1 AUXILIARY Board
	12	El 2 AUXILIARY Board

For example: *If the* original *output voltage was 220 VAC and the new voltage is 240 VAC, transformer lead #11 goes to auxiliary E11, transformer lead #12 goes to auxiliary E12, and transformer lead # 13 goes to power E.9*

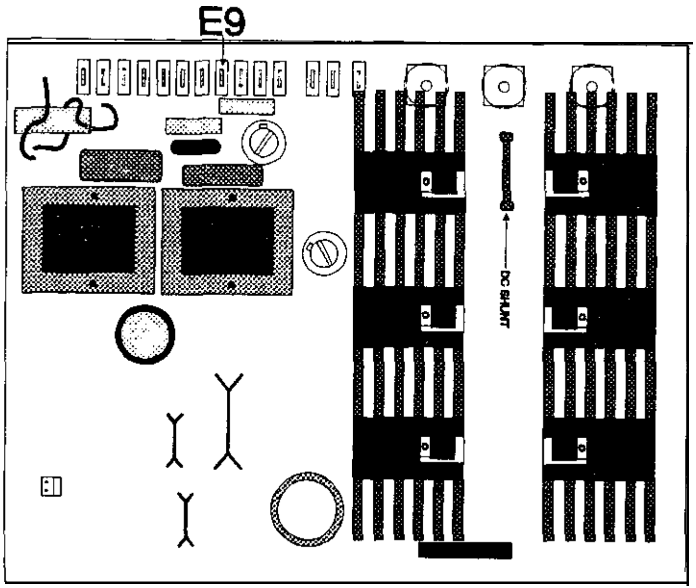


Figure 6 **Power Board**

205. Insulate the leads you removed with shrink tubing and position them so that they cannot contact any live terminals or ground. Fasten these leads in place with a tie wrap.

206. Check that the input and output voltage terminal connections are correct.

Note: Good connections are essential. Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

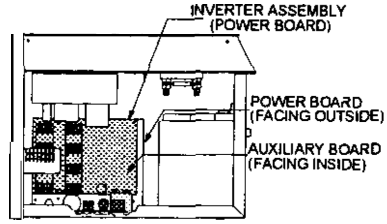
Section 300: Changing the Operating Voltage from 120 to 208 or 240 VAC on FE (60 Hz)

Section 301: Replacing the Power Board and Changing the Voltages

If you are changing the voltage from 120 to 208 or 240 VAC, you must replace the power and auxiliary boards. Look for the part number on a white patch on the power and auxiliary boards. You must replace power board PCP-0095 and auxiliary board PCP-0097 with power board PCP-0082 and auxiliary board PCP-0083 (kit number PWA-0018).

301-1. Find the power board-auxiliary board assembly at the bottom of the unit on the right side. (See Figure 7.)

301-2. **Label with a "P" and the connection points** the wires at J1, J2, E4, E5, E6, E8, E9, E10, E12, E15, E16, E17, E18, E19, and E20 on the power board. Label with an "A" and the connection points the wires at J1, E3, E4, E5, E6, E7, E8, E10, E11, E12, E14, E15, El6 on the auxiliary board. Disconnect the wires, cables, and ribbon cables.



RIGHT SIDE VIEW
(COVER REMOVED)

Figure 7

Note: To remove the cables from E3, E4 and E5 on the auxiliary board and E16, El7 and El8 from the power board, you need a 5/16-inch nutdriver.

301-3. Remove the two 7/16-inch nuts that hold the assembly in the unit.

301-4. Remove the assembly from the unit

301-5. Place the new assembly in the unit and attach the two 7/16-inch nuts that hold the assembly in place.

301-6. Reconnect the wires to their board connections. (See Figures 8 and 9 and Tables 3 and 4 on the following pages for reference.)

301-7. Remove all labels from the wires you reattached

Table 3: Power Board Connections

POWER Board Connection	Wire Description
J1	Ribbon cable to J1 on the AUXILIARY board and J3 on the logic board.
J2	Wires to the On/Off switch
E4	Connected in later step.
E5	Wire to the tank capacitor.
E6	Transformer lead #10.
E8	No connection.
E9	Connected in Inter step.
E10	Wire to the terminal block..
E12	Connected in later step.
E15	Wire to the DC fuse.
E16	Transformer lead #4A.
E17	Negative battery cable.
E18	Transformer lead #1A.
E19	Connected in later step.
E20	Connected in later step.

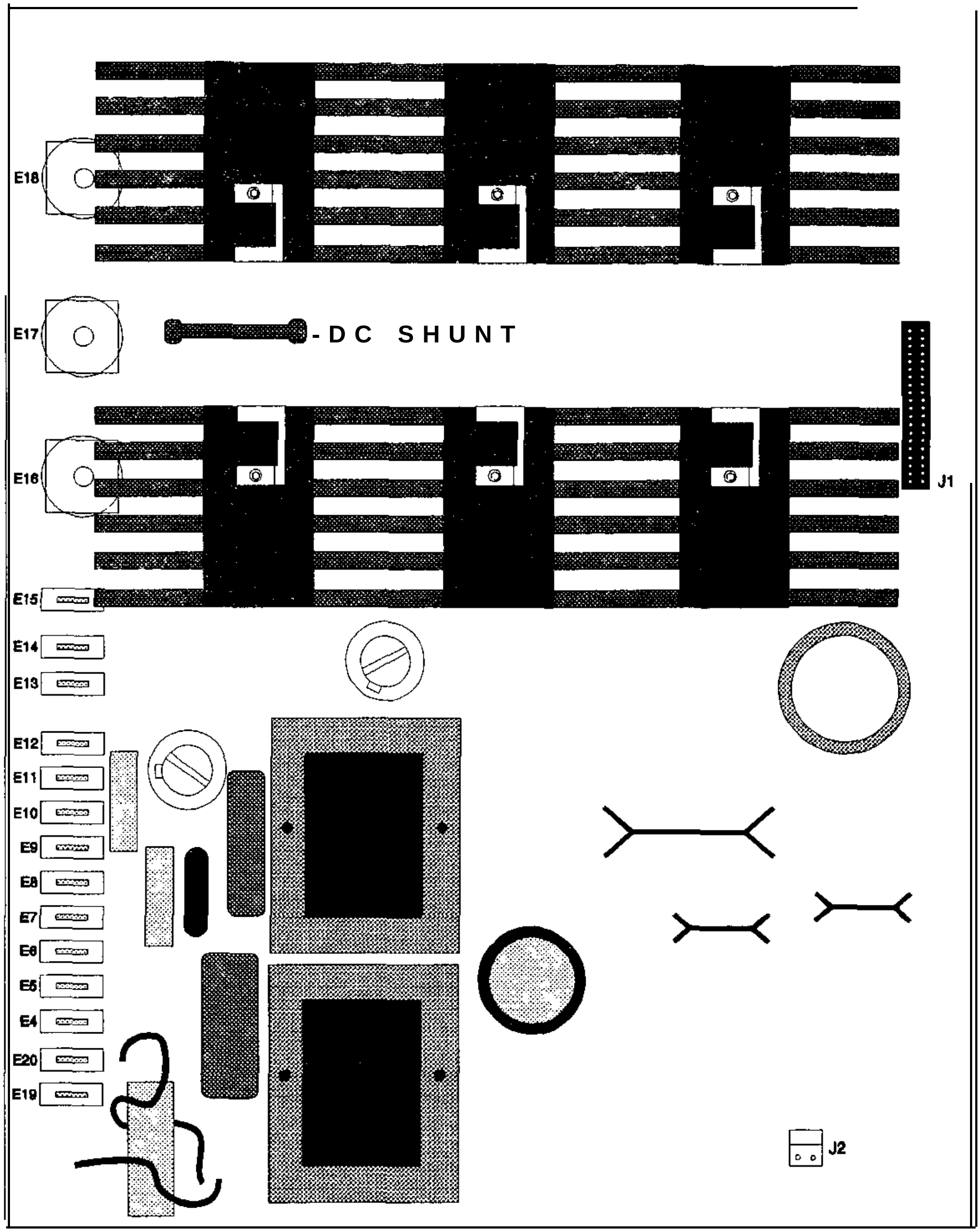


Figure 8 **Power Board**

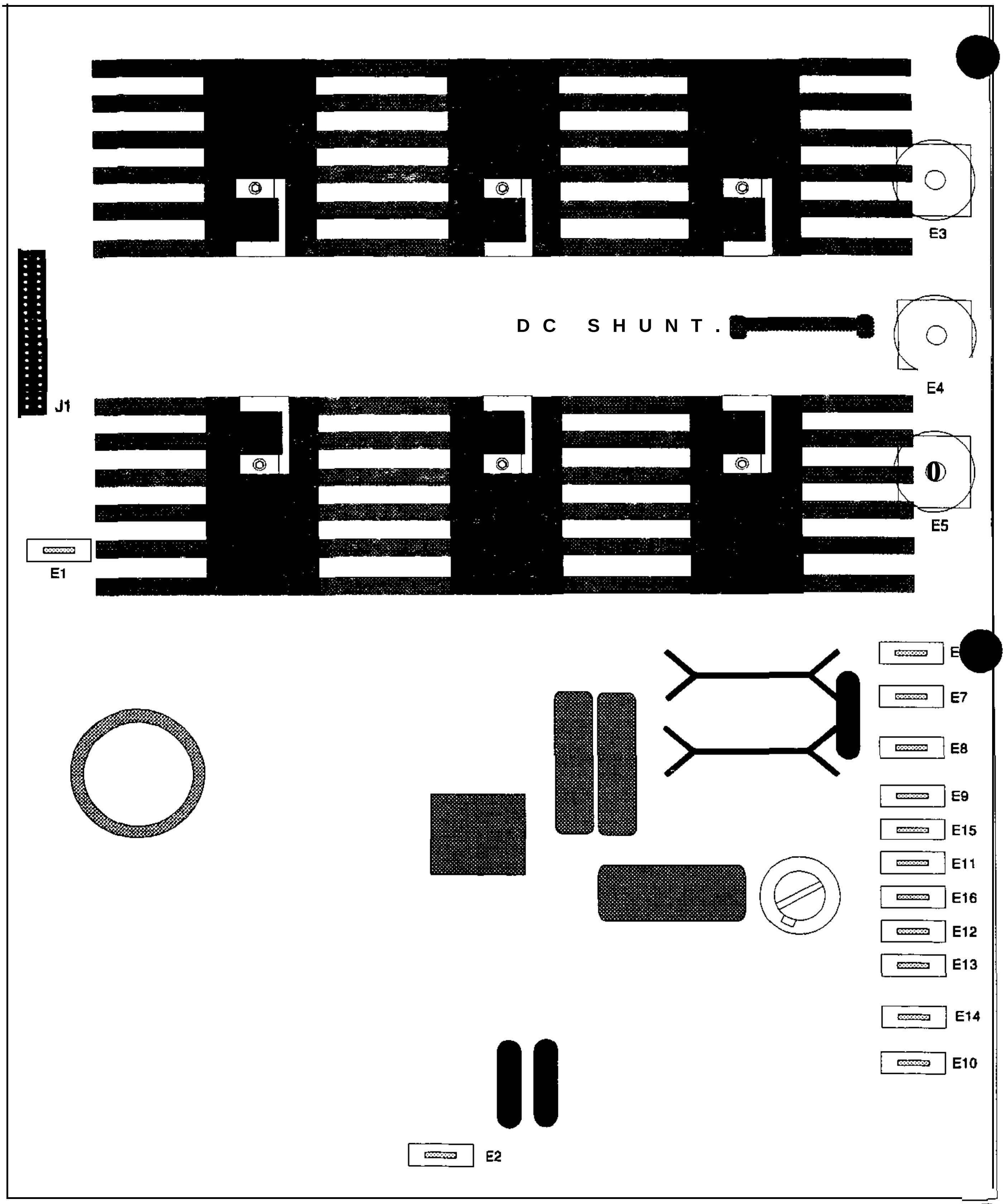


Figure 9 Auxiliary Board

Table 4: Auxiliary Board Connections

AUXILIARY Board Connection	Wire Description
J1	Ribbon cable to POWER board J1 and logic board J3.
E3	Transformer lead #1.
E4	Negative battery cable.
E5	Transformer lead #4.
E6	**Connected in later step.**
E7	**Connected in later step.**
E8	**Connected in later step.**
E10	Wire to backfeed relay terminal #4.
E11	**Connected in later step.**
E12	**Connected in later step.**
E14	Wire to backfeed relay terminal #6.
E15	Connected in later step.
El6	Connected in later step.

Section 302: Replacing the Backfeed Relay

If you are changing the input voltage from 120 to 208 or 240 (or vice versa), you must replace the backfeed relay.

302-I. Find the backfeed relay behind the batteries on the bottom on the left side of the unit. (See Figure 10.)

302-2. Label the wires connected to the relay with the terminal numbers they are connected to. (See Figure 11.) Disconnect the wires from the relay.

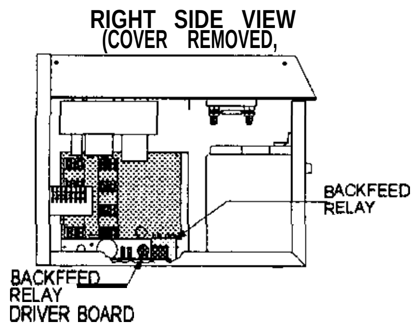


Figure 10

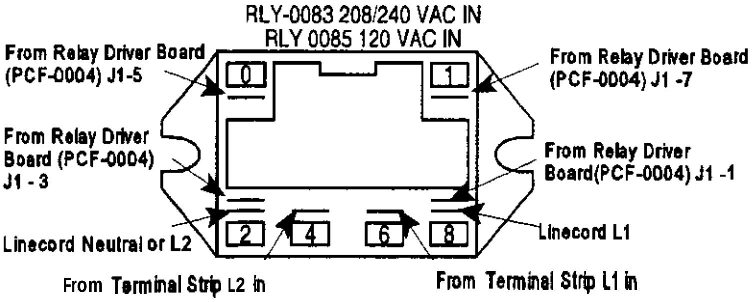


Figure 11

302-3. Remove the two mounting screws and remove the relay from the unit.

302-4. Install the new relay and reconnect the wires as shown in Figure 11. Remove the labels you put on the wires.

302-5. Locate the backfeed relay driver board next to the relay. (See Figure 10 above.) Move the jumper at J2 to the ≥ 200V position after changing the AC input to 208 or 240. (See Figure 12 on the next page.)

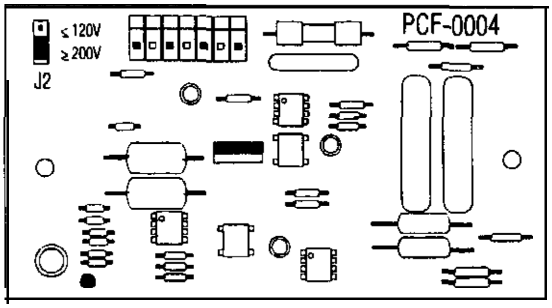


Figure 12

Section 303: Changing the Voltages

303-1. To **change the input** voltage, follow the steps in the box below. (See Figures 8 on page 7, **Figure** 9 on page 8 and Table 5.)

Changing the input voltage from 120 to 208 or 240 VAC	
a.	Find E12 on the power board and E6 on the auxiliary board.
b.	*To change the input voltage to 208,* reconnect transformer lead #9 to El2 on the Power board. Find transformer lead #6 tied back in a bundle at the main transformer Attach lead #6 to E6 on the auxiliary board. Insulate leads #5, #7, and #8 and tie them back to the main bundle at the main transformer
c.	*To change the input voltage to 240,* reconnect transformer lead #9 to El2 on the power board and transformer lead #5 to E6 on the auxiliary board. Insulate leads #7 and #8 and tie them back to the main bundle at the main transformer
d.	If you are changing the output voltage, go to step 303-2. If not, continue with step 303-3.

303-2. Use the appropriate chart to change the output voltage. (See Figures 8 on page 7 and 9 on page 8 and Table 6 for reference.)

Changing the output voltage from 120 to 208 or 240 VAC	
a.	Jumper the grounding wire from E8 on the power board and transformer lead #11 from E9 on the power board *together.* *Insulate these wires* and *tie them* back to the bundle at the main transformer.
b.	*If you are changing your UPS to* 208 *VAC out,* find transformer lead #12 tied to the bundle at the main transformer. Attach lead #12 to E9 on the power board. *If you are changing your UPS to 240 VAC out,* find transformer lead #13 tied to the bundle at the main transformer. Attach lead # 13 to E9 on the power board.
c.	Reattach the red wire from E4 on the power board to El9 on the power board.
d.	Install a jumper wire from E4 to E20 on the power board. If you do not have **a jumper wire,** call Best Power Worldwide Service.
e.	Go to step 303-3.

Changing the output voltage from 120 to 120/208 or 120/240 VAC mixed output voltages	
a.	*If you ore changing to a 120/208 mixed output,* find transformer lead #12 tied back to the bundle at the main transformer. Connect lead #12 to E8 on the **auxiliary** board. *If you ore changing to a 120/240 mixed output,* find transformer lead #1 3 tied back to the bundle at the main transformer. Connect lead # 13 to ES on the auxiliary board.
b.	Go to step 303-3.

303-3. Check that the input and output voltage terminal connections are correct. Use Tables 5 and 6 to verify your connections. Remove the temporary labels you put on the wires.

Note: Good connections are essential. Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

Table 5: Changing Input Voltages

Voltage	Transformer Lead #	Lead Connection
120 VAC	5 and 8	E6 on the AUXILIARY board.
	6	E7 on the AUXILIARY board.
	7 and 9	E12 on the POWER board.
208 VAC	6	E6 on the AUXILIARY board.
	5	E7 on the AUXILIARY board.
	9	E12 on the POWER board.
240 VAC	5	E6 on the AUXILIARY board.
	6	E7 on the AUXILIARY board.
	9	E12 on the POWER board.

Table 6: Changing Output Voltages

Voltage	Board Connection	Wire Description
120 VAC	AUXILIARY board E8	120: Not connected. **120/208:** Transformer lead #12. **120/240:** Transformer lead #13.
	AUXILIARY board El2	Not connected.
	AUXILIARY board El6	Not connected.
	POWER board E4	Black wire to the output terminal block.
	POWER board E8	Wire to ground.
	POWER board E9	Transformer lead #1 1.
	POWER board El0	White (neutral) wire to the output terminal block
	POWER board E19	120: Not connected.. **120/208:** Transformer lead #13. 1201240: Transformer lead #12.
	POWER board E20	120: Not connected. **120/208 or 120/240:** Red wire to the output terminal block.

Voltage	Board Connection	Wire Description
208 VAC	AUXILIARY board E8	Transformer lead #13.
	AUXILIARY board E12	Wire to ground.
	AUXILIARY board E16	Transformer lead #11.
	POWER board E4	Jumper wire to POWER board E20.
	POWER board E8	Not Connected.
	POWER board E9	Transformer lead #12.
	POWER board E10	Red wire to the output terminal block.
	POWER board E19	Black wire to the output terminal block.
	POWER board E20	Jumper wire to POWER board E4.
240 VAC	AUXILIARY board E8	Transformer lead #12.
	AUXILIARY board E12	Wire to ground.
	AUXILIARY board E16	Transformer lead #11.
	POWER board E4	Jumper wire to POWER board E20.
	POWER board E8	Not Connected.
	POWER board E9	Transformer lead #13.
	POWER board E10	Red wire to the output terminal block.
	POWER board E19	Black wire to the output terminal block.
	POWER board E20	Jumper wire to POWER board E4.

303-4. Check to make sure that you have the correct line cords and receptacles for the new input and output voltages of your unit. Replace any line cords or receptacles that do not match the voltage requirement. Call BEST's Worldwide Service if you need assistance.

Section 400: Changing the Operating Voltage from 208 or 240 to 120 VAC on FE (60 Hz)

401. Find the auxiliary board in the FERRUPS unit. The auxiliary board and the power board are part of the same assembly. (See Figure 13.) The power board faces the outside of the unit and the auxiliary board faces the inside of the unit. (See Figure 14.)

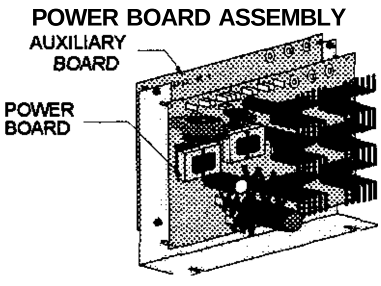


Figure 13

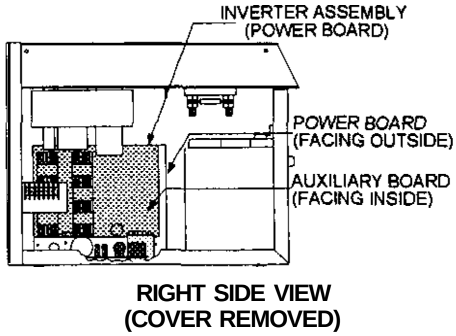


Figure 14

402. **To change** the **input** voltage, follow the steps in the box that applies to your voltage (see Figures 15 and 16 on page 14 and Table 7 on page 13):

Changing the input voltage from 208 or 240 to 120 VAC	
a.	Find transformer leads #5, #7, and #8. (If your UPS is at 240 VAC, lead #5 will already be attached to E6 on the auxiliary board.)
b.	If you are changing from 208 VAC, disconnect lead #6 from E6 on the auxiliary board. Insulate lead #6 and tie it back to the bundle at the main transformer.
c.	Attach transformer leads #5 and #8 to E6 on the auxiliary board and transformer leads #7 and #9 to El 2 on the power board.
d.	If you are changing the output voltage, go to step 403. If not, continue with step 404.

Changing the input voltage from 208 to 240 VAC (or vice versa)	
a.	Find E6 and E7 on the **auxiliary** board.
b.	To *change rhe voltage from 208 to 240, remove transformer* lead #5 from "E7" on the auxiliary board and transformer lead #6 from "E6" on the **auxiliary** board. Attach transformer lead #6 to "E7" on the **auxiliary** board and transformer lead #5 to "E6" on the **auxiliary** board. *To change the voltage from 240 to 208, remove* transformer lead #6 from "E7" on the auxiliary board and transformer lead #5 from "E6" on the auxiliary board. Attach transformer lead #5 to "E7" on the auxiliary board and transformer lead #6 to "E6" on the auxiliary board.
c.	If you are changing the output voltage, go to step 403. If not, continue with step 404.

Table 7: Changing Input Voltages

Voltage	Transformer Lead #	Lead Connection
120 VAC	5 and 8	E6 on the AUXILIARY board.
	6	E7 on the AUXILIARY board.
	7 and 9	El2 on the POWER board.
208 VAC	6	E6 on the AUXILIARY board.
	5	E7 on the AUXILIARY board.
	9	El 2 on the POWER board.
240 VAC	5	E6 on the AUXILIARY board.
	6	E7 on the AUXILIARY board.
	9	El2 on the POWER board.

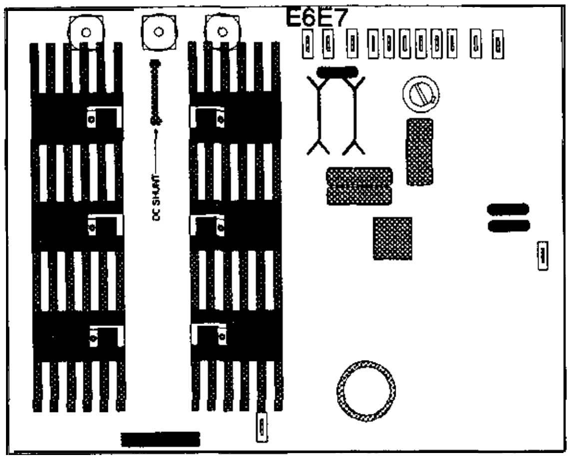


Figure 15 Auxiliary Board

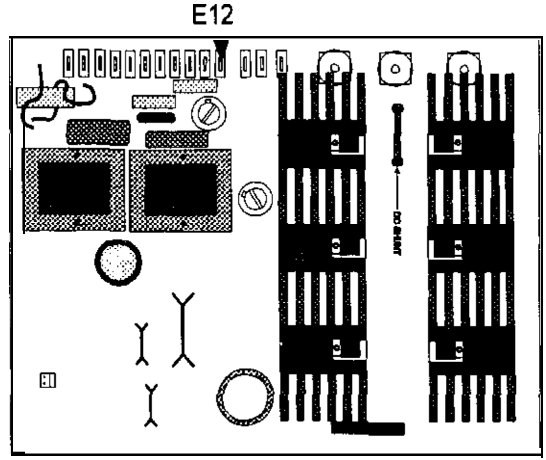


Figure 16 Power Board

403. Use the appropriate chart to change the output voltage (see Figures 17 and 18 on page 16 and Table 8 on page 15.):

Changing the output voltage from 208 or 240 to 120, 120/208, or 120/240 mixed voltage
Disconnect transformer lead #12 (208 VAC) or lead #13 (240 VAC) from E9 on the power board.
). If you are converting to a mired voltage: Disconnect the red jumper wire from E4 on the power board. Disconnect the receptacle wire from El 9 on the power board and attach it to E4 on the power board. other end of this wire should be attached to "L1" on the output terminal. 1 Attach the red wire from E20 on the power board to "L2" on the output terminal block. Attach transformer lead #12 for 120/208 or transformer lead #13 for 120/240 to El 9 on the power board. Insulate the unused lead and tie it back to the bundle at the main transformer.
If you are converting to straight 120 **VAC,** insulate the lead you disconnected and tie it back to the bundle at the transformer.
Find transformer lead #1 l tied back to the bundle at the main transformer. The ground wire should be attached to lead #11. Separate the wires and connect lead #1 1 to E9 on the power board and the grounding wire to E8 on the power board.
l. Go to step 404.

Changing the output voltage from 208 to 240 VAC or vice versa	
a.	*To change the voltage from 208 to 240, remove* transformer lead #12 from E9 on the **power board.** Insulate the lead and tie it back to the bundle at the main transformer. Find transformer lead #13 in this bundle and attach lead #13 to E9 on the **power board.** *To change the voltage from 240 to 208,* remove transformer lead # 13 from E9 on the **power** board. Insulate the lead and tie it back to the. bundle at the main transformer. Find transformer lead #12 in this bundle and attach lead #12 to E9 on the power board.
b.	**Go to** step 404.

able 8: Changing Output Voltages

Voltage	Board Connection	Wire Description
120 VAC	AUXILIARY board E8	**120:** Not connected. **120/208:** Transformer lead # 12. **120/240:** Transformer lead #13.
	AUXILIARY board El 2	Not connected.
	AUXILIARY board El6	Not connected.
	POWER board E4	Black wire to the output terminal block.
	POWER board E8	Wire to ground.
	POWER board E9	Transformer lead #1 1.
	POWER board E10	White (neutral) wire to the output terminal block
	POWER board El 9	**120:** Not connected. **120/208:** Transformer lead #1 3. **120/240:** Transformer lead # 12.
	POWER board E20	**120:** Not connected. **120/208 or 1201240:** Red wire to the output terminal block.
208 VAC	AUXILIARY board E8	Transformer lead #1 3.
	AUXILIARY board E I 2	Wire to ground.
	AUXILIARY board El6	Transformer lead #11.
	POWER board E4	Jumper wire to POWER board E20.
	POWER board E8	Not Connected.
	POWER board E9	Transformer lead #1 2.
	POWER board El0	Red wire to the output terminal block.
	POWER board El9	Black wire to the output terminal block.
	POWER board E20	Jumper wire to POWER board E4.
240 VAC	AUXILIARY board E8	Transformer lead #12.
	AUXUI ARY board E12	Wire to ground.
	AUXILIARY board E 16	Transformer lead #1 1.
	POWER board E4	Jumper wire to POWER board E20.
	POWER board E8	Not Connected.
	POWER board E9	Transformer lead #1 3.
	POWER board E10	Red wire to the output terminal block.
	POWER board E I 9	Black wire to the output terminal block.
	POWER board E20	Jumper wire to POWER board E4.

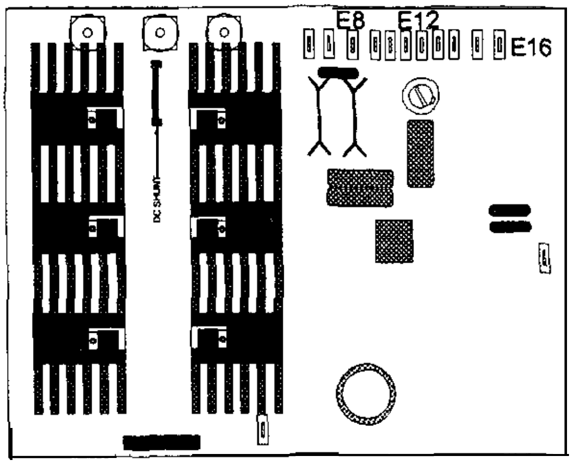


Figure 17 **Auxiliary Board**

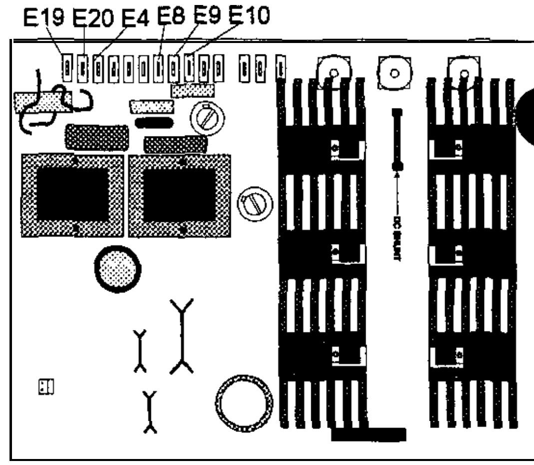


Figure 18 **Power Board**

404. Check that the input **and** output voltage terminal connections arc correct. Use Table 7 on page 13 **and** Table **8** on page 15 to verify your connections.

Note: Good connections are essential. Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

405. When you changing the input voltage, you must replace the backfeed relay.

a. Find the backfeed relay behind the batteries on the bottom on the left side of the unit. (See Figure 19.)

b. Label the wires connected to the relay with the terminal numbers they are connected to. (See Figure 20.) Disconnect the wires from the relay.

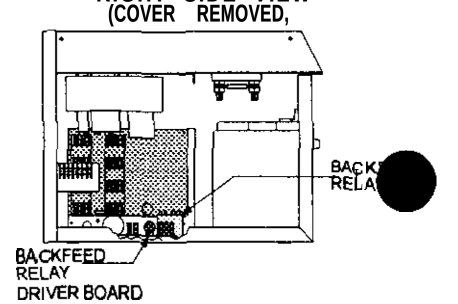


Figure 19

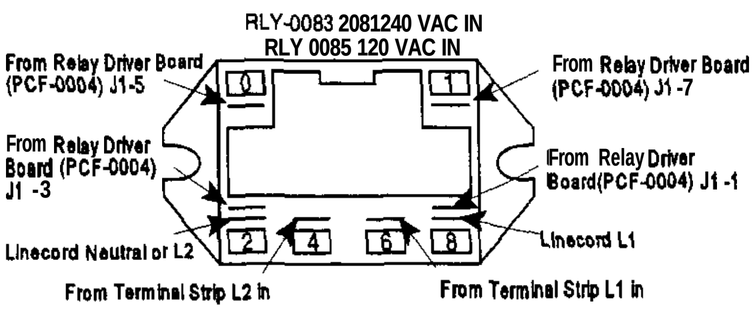


Figure 20

c. Remove the two mounting screws **and remove the** relay from the unit

d. Install the new relay and reconnect the wires as shown in Figure 11. Remove the labels you put on the wires.

e. **Locate the backfeed relay** driver board next to the relay. (See Figure 10 above.) Move the jumper at J2 to the ≤ 120 V after changing the voltage to 120 VAC or to the ≥ 200V position after changing the AC input to 208 or 240. (See Figure 21 on the next page.)

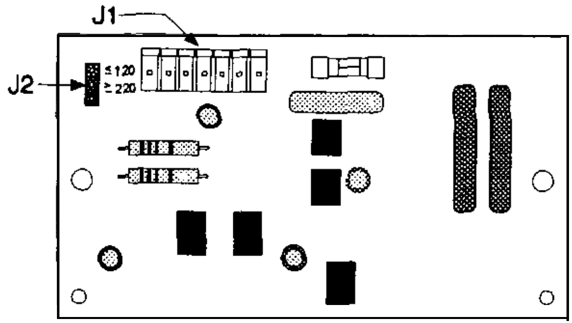


Figure 21

Section 500: Reconnecting DC Power to the UPS

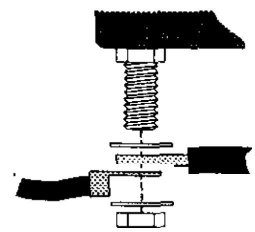


Figure 22

501. Remove the tape from the disconnected end of the DC fuse; then, move the fuse back into place. Once the fuse is in position, use a 1/2-inch wrench or nutdriver to tighten the nuts that hold the cables to the DC fuse.

Important: Make sure the fuse connector is next to the battery cable connector on the bolt, there should not be a washer in between. (See Figure 22.)

502. If your UPS has external batteries, reconnect it to the batteries or turn on the DC switch.

Section 600: Calibrating the FERRUPS Unit after the Voltage Change

Complete the voltage change procedure by calibrating the FERRUPS unit. You will need to recalibrate several parameters to match your new voltage configuration. To do this you will need a handheld Remote Control Panel or a terminal. The steps below are written for a remote control panel. Refer to TIP 407 if you are using the Remote Control Panel or to TIP 503 if you are using the communications port and a terminal.

601. With the On/Off (I/O) key in the "OFF" (0) position, connect **the** UPS to **the AC service which will supply the new operating voltage.**

602. Turn the On/Off (I/O) key to the "ON" (I) position. The UPS should operate normally. A "High AC" output or "Low AC" output alarm may sound. This is normal. The alarm will stop when you recalibrate the UPS. To silence the alarm, press [CONTROL] [5] [ENTER] [ENTER]; the alarm will not sound, but the alarm will appear on the scrolling display until the unit is calibrated.

603. Connect the handheld Remote Control Panel to the RS232 interface port on the back of the FERRUPS. You will use the Remote Control Panel to enter tbe commands and parameter changes shown in the following steps.

604. First, enter [CLEAR] [I] [2] [3] [DISPLAY] [CONTROL] [PROGRAM] [ENTER]. Your control panel should display "FERRUPS BY BEST." Your control panel is now communicating with your FERRUPS.

605. Next, enter the Factory password by pressing [PROGRAM] [I] [8] [4] [7] [3] [ENTER]

606. Apply a load to the FERRUPS unit. The load must be 50% or more of the UPS KW rating.

607. If you changed the input voltage, you must calibrate parameters 43 and 1 by doing the following:

a. Display parameter 43 (Nom Vln) by pressing [DISPLAY] [4] [3] [ENTER], Your old nominal input voltage should appear. To change this value, press [PROGRAM], enter the new nominal input voltage, and press [ENTER]. The Remote Control Panel should now display your new input AC voltage.

b. Measure the input voltage with a true RMS voltmeter.

For 120 **VAC** input models, measure at **"Nin"** and **"Lin"on** the input terminal.
For **208** or 240 **VAC** input models, measure at **"$L2_{IN}$"** and **"$L1_{IN}$"** on the input **terminal**.

c. Next, display the. input voltage by pressing [DISPLAY] [1] [ENTER]. If your **measurement** does not match the value displayed for parameter 1, change the parameter value to your measurement by pressing [PROGRAM], entering your input AC voltage measurement, **and** pressing [ENTER].

608. **If you** changed the output voltage, you must calibrate parameters 44, 2, and 4 by doing the following:

a. Display parameter 44 (Nom VOut) by pressing [DISPLAY] [4] [4] [ENTER]. Yom old nominal output voltage should appear. To change this value, press [PROGRAM], enter the new output AC voltage, and press [ENTER]. The Remote Control Panel should now display your new output AC voltage.

b. Measure the AC output voltage.

For **plug-in** models, measure at the output receptacles.

For **hardwired models,** measure between the appropriate output terminals for your model as shown in Figure 23 and Table 9.

Table 9 Terminal Block Points to Measure Output Voltage

Nominal OUTPUT Voltage		Measure OUTPUT Voltage between terminals:
60 Hz	120VAC	N_{OUT} to L_{OUT} or $L2_{OUT}$
	208VAC	L_{OUT} to $L1_{OUT}$
	240VAC	L_{OUT} to $L2_{OUT}$
50 Hz	220VAC	L_{OUT} to N_{OUT}
	230VAC	L_{OUT} to $N2_{OUT}$
	240VAC	L_{OUT} to $N3_{OUT}$

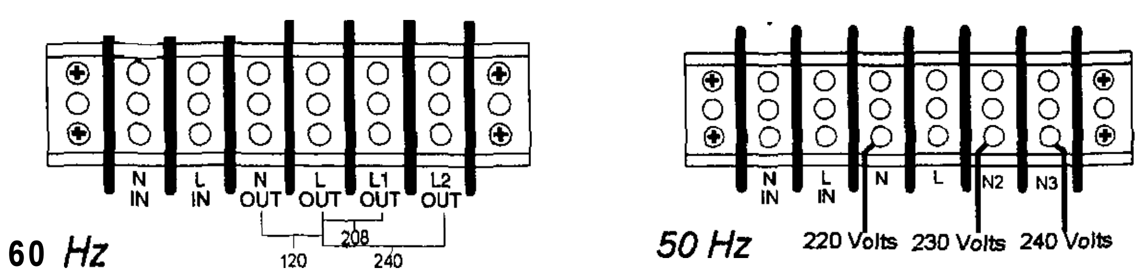


Figure 23

c. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER], If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC voltage measurement, and pressing [ENTER].

Note: Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you entered in parameter 44.

d. Measure the AC current by clamping the current probe around the two wires from "L" of "LOAD OUT" on the output terminal.

e. Next, display parameter 4 (I Out) on the control panel by pressing [DISPLAY] [4] [ENTER]. If your measurement does not match the value displayed for parameter 4, change the parameter value to your measurement by pressing [PROGRAM], then entering your output AC current, and pressing [ENTER].

609. Clear the Factory password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

610. Remove all AC and external DC power.

Section 700: Putting the Cover on the UPS

701. Using the slide rails on each side of the unit, slide the cover on the UPS.

702. At the front of the UPS, tighten the screw in the lower right comer of the front panel. Cover the screw with the round sticker you removed. (See Figure 1 on page 2.)

703. Put the screw back in the top of the UPS and tighten the screw. (See Figure 1 on page 2.)

704. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

705. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Best Power
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TIP 721
35
November 16, 1994

Replacing the Power Factor Module Circuit Board in FE/QFE 500,700, and 850 VA Models

This Technical Information Publication explains how to replace the power factor module circuit board in FE/QFE 500,700, and 850 VA models. A qualified technician who is familiar with the FERRUPS unit must replace this circuit board. If you have problems during this procedure, please contact BEST's Technical Support Center at 1-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers	Labeling Material	Needlenose Pliers
1/2-inch Open end Wrench or Nutdriver	Electrical Tape	Fluke 87 Multimeter
Safety Equipment Required by Local Codes		

WARNING

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous **voltages may** be present even if AC line **or DC** voltage **is** removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the PFM circuit board.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical. circuitry.

UPS batteries are high current sources. Shorting **battery** terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the **cover removed, electric shock is possible; follow all local safety codes.**

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1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. **See Figure 1.**

104. Next, find the sticker in the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

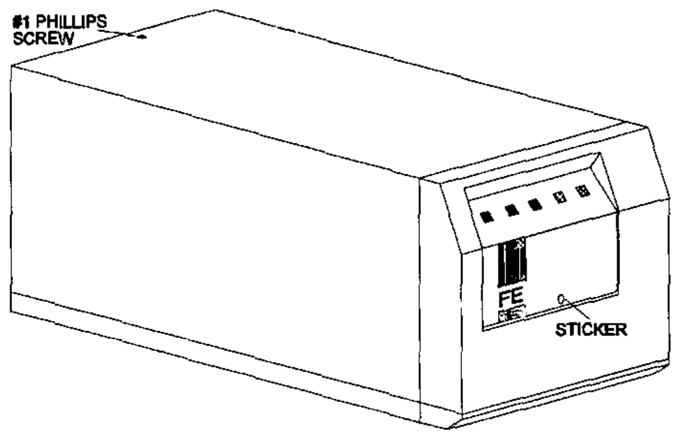

Figure 1

105. Slide the cover forward until it is completely off the UPS.

Section 200: Removing the PFM Circuit Board

Caution: **Before you remove the PFM circuit board, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, the new PFM circuit board could be damaged as you install it iu the unit.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page.

> WARNING
>
> **As you follow the nest step, he careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

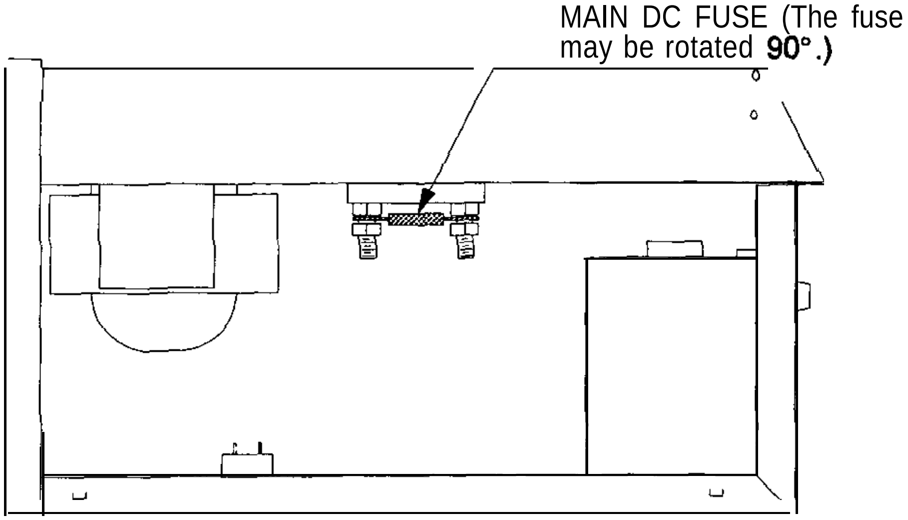

Figure 2

203. Using a 1/2-inch wrench or a 1/2-inch nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected. Tape the fuse end so it cannot contact the battery cable.

204. Next, find the PFM circuit board shown in Figure 3 below. Notice that the PFM circuit board is covered with insulating material.

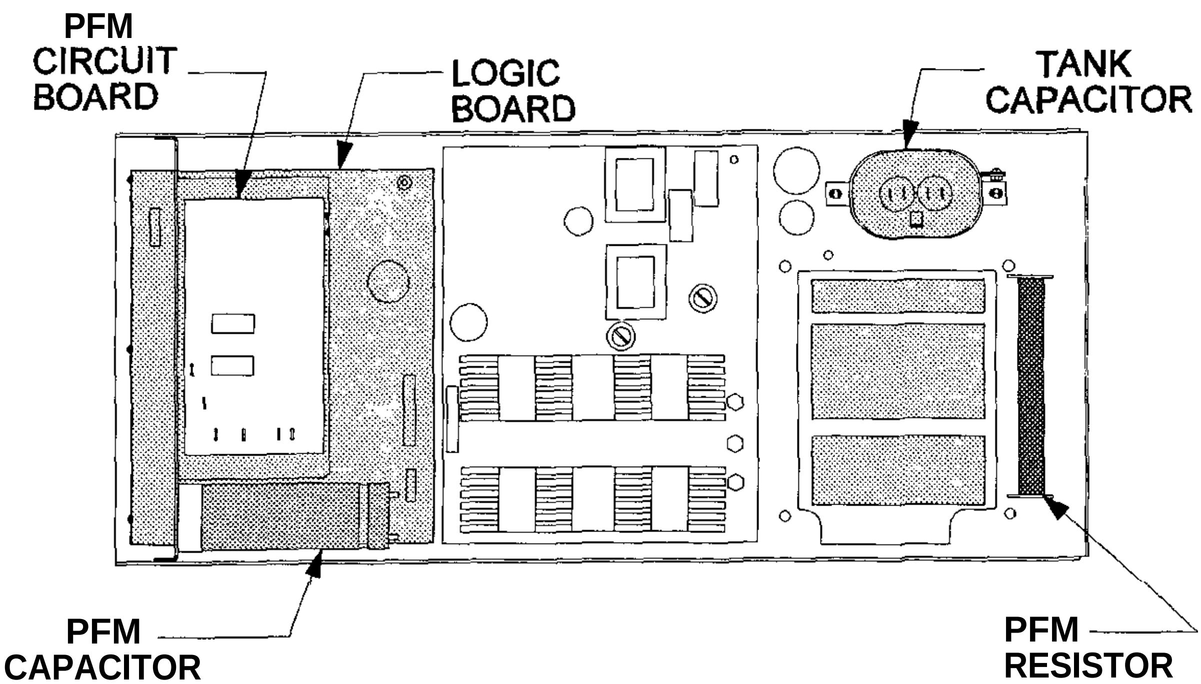

Figure 3

205. The insulating material that covers the PFM circuit board has a flap that goes under the board. Pull out the flap so you can uncover the circuit board. Do not attempt to remove the insulating material from the unit.

206. Now, find the wires connected to the following points on the PFM circuit board. **Using masking tape or other labeling material, label each wire so you can connect it to the new board correctly.** Then, disconnect the wires from the PFM circuit board.

PFM Circuit Board Connection	Wire Description
E1	Wire to the side of the PFM resistor closest to the tank capacitor.
E2	Wire to the positive (+) PFM capacitor terminal.
E3	Wire to the tank capacitor.
E4	Wire to E9 on the power board.
ES	Wire to the negative (-) PFM capacitor terminal.
E6	Wire to the remaining side of the PFM resistor.

207. The PFM circuit board is held in place by four plastic standoffs. Press the tab on each standoff and lift the circuit board over the tab. Remove the circuit board from the unit.

Section 300: Replacing the PFM Circuit Board

301. Put the new PFM circuit board in place. Insert the standoffs through the circuit board and press gently until they snap into place.

302. Reconnect the following wires. Use the labels you put on the wires in step 206 to match them to the correct connection points on the PFM circuit board. **Make sure the connection point on the circuit board goes into the CENTER (not the side) of each wire's connector.**

PFM Circuit Board Connection	Wire Description
E1	Wire to the side of the PFM resistor closest to the tank capacitor.
E2	Wire to the positive (+) PFM capacitor terminal.
E3	Wire to the tank capacitor.
E4	Wire to E9 on the power board.
E5	Wiie to the negative (-) PFM capacitor terminal.
E6	Wire to the remaining side of the PFM resistor.

303. Remove the temporary labels from the wires.

304. Bend the insulated material over the new PFM circuit board and insert the flap under the circuit board.

305. At the DC fuse, remove the tape from the disconnected end of the fuse; then, move the fuse back into place. Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer in between. (See Figure 4.) Once the fuse is in place, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

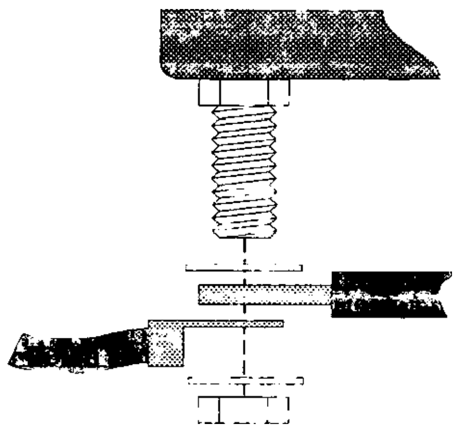

Figure 4

306. If the UPS has external batteries, reapply DC power to the UPS.

307. Apply AC power to the UPS.

308. Monitor the DC voltage across the PFM capacitor as you turn the UPS on. The voltage across the capacitor should increase in stages and reach a "steady state" level in about three to five seconds. If the voltage stays near zero for more than five seconds, turn the UPS off and check the connections.

If the voltage reaches the steady state level, remove all AC and external DC power and go on to Section 400.

Section 400: Putting the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back in the top of the UPS and tighten the screw

404. Reapply AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation

Replacing the Power Factor Module Circuit Board in FE/QFE 1.15 and 1.4 KVA Models

This Technical Information Publication explains how to replace the power factor module circuit board in FE/QFE 1.15 and 1.4 KVA models. A qualified technician who is familiar with the FERRUPS unit must replace this circuit board. If you have trouble during this procedure, please contact BEST's Technical Support Center at 1-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers	1/2-inch Open end Wrench	1/2-inch Nutdriver
Labeling Material	Needlenose Pliers	Electrical Tape
Safety Equipment Required by Local Codes	True RMS AC Voltmeter	

WARNING

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. TEST **BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS batteries and AC input are off or disconnected before you replace the PFM circuit board.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment **damage, and** injury. A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the **cover removed, electric shock is possible; follow all local safety codes.**

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. See **Figure 1.**

104. Next, find the sticker in the lower right comer of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

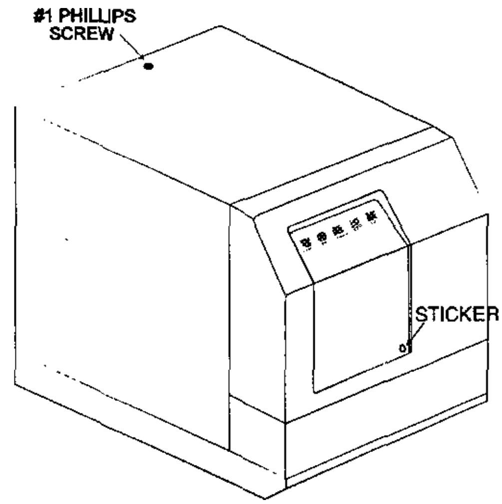

Figure 1

105. Slide the cover forward until it is completely off the UPS,

Section 200: Removing the PFM Circuit Board

Caution: **Before you remove the PFM circuit hoard, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, the new PFM circuit hoard could be damaged as you install it in the unit.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page.

> **WARNING**
>
> **As you follow the next step, he careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

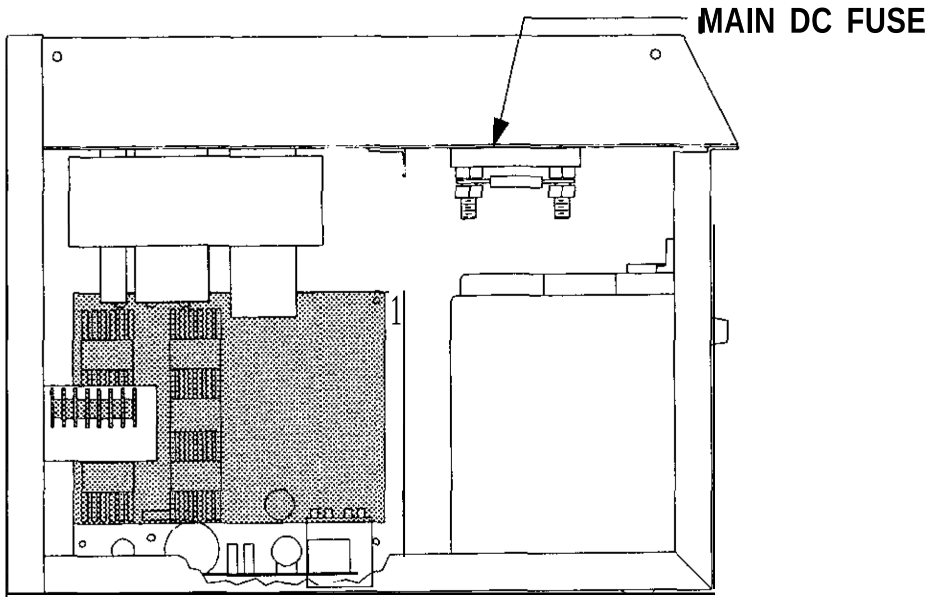

Figure 2

203. Using a 1/2-inch wrench or a 1/2-inch nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected. Tape the fuse end so it cannot contact the battery cable.

204. Next, find the PFM circuit board in Figure 3 or Figure 4. In some models, the PFM circuit board is above the logic board as shown in Figure 3; if this is true, the PFM circuit board is covered with insulating material. In other models, the PFM circuit board is next to the logic board as shown in Figure 4 (next page); if this is true, the circuit board is not covered with insulating material.

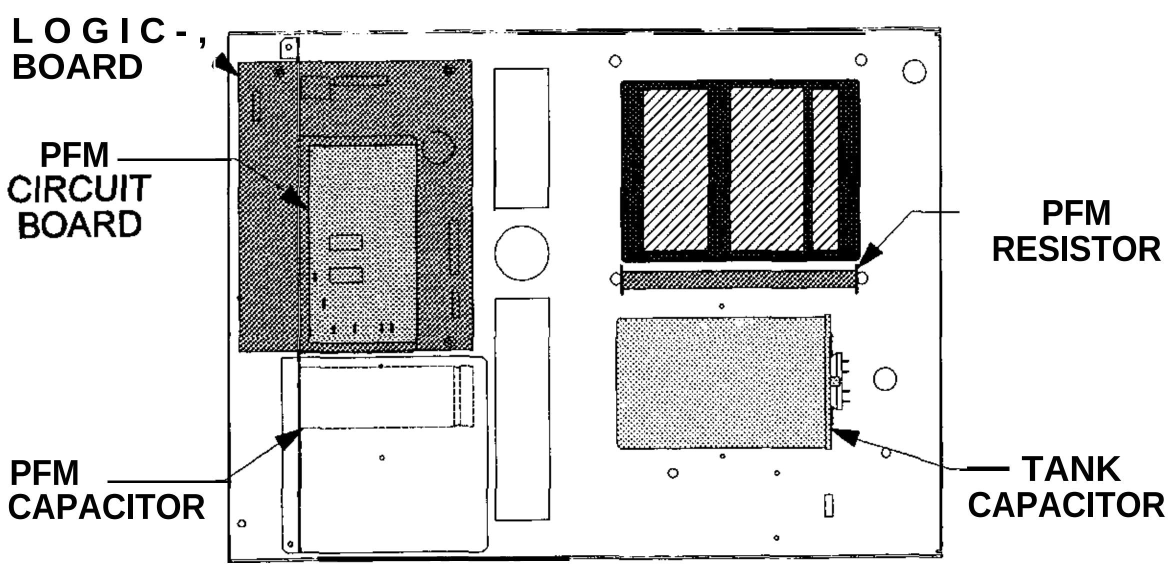

Figure 3

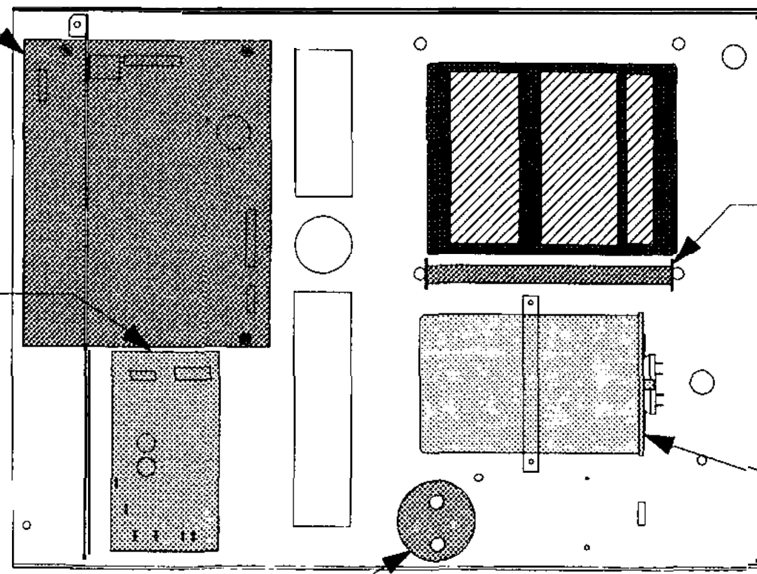

Figure 4

205. If the PFM circuit board is covered with insulating material, the material has a flap that goes under the board. Pull out the flap so you can uncover the circuit board. Do not attempt to remove the insulating material from the unit.

206. Now, find the wires connected to the following points on the PFM circuit board. **Using masking tape or other labeling material, label each wire so you can connect it to the new board correctly.** Then, disconnect the wires from the PFM circuit board.

PFM Circuit Board Connection	Wire Description
E1	Wire to the closest side of the PFM resistor.
E2	Wire to the closest PFM capacitor terminal.
E3	Wire to middle terminal block terminal.
E4	Wire to end terminal block terminal.
E5	Wiie to the far PFM capacitor terminal.
E6	Wiie to the far end of the PFM resistor.

207. The PFM circuit board is held in place by four plastic standoffs. Press the tab on each standoff and lift the circuit board over the tab. Remove the circuit board from the unit.

Section 300: Replacing the PFM Circuit Board

301. Put the new PFM circuit board in place. Insert the standoffs through the circuit board and press gently until they snap into place.

302. Reconnect the following wires. Use the labels you put on the wires in step 206 to match them to the correct connection points on the PFM circuit board. **Make sure the connection point on the circuit board goes into the CENTER (not the side) of each wire's connector.**

PFM Circuit Board Connection	Wire Description
E1	Wire to the closest side of the PFM resistor.
E2	Wire to the closest PFM capacitor terminal.
E3	Wire to middle terminal block terminal.
E4	Wire to end terminal block terminal.
E5	Wire to the far PFM capacitor terminal.
E6	Wire to the far end of the PFM resistor.

303. Remove the temporary labels from the wires.

304. If the old PFM circuit board was covered with insulating material, bend the material over the new PFM circuit board and insert the flap under the circuit board.

305. At the DC fuse, remove the tape from the disconnected end of the fuse; then, move the fuse back into place. **Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer** in between. (See Figure 5.) Once the fuse is in position, use a l/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

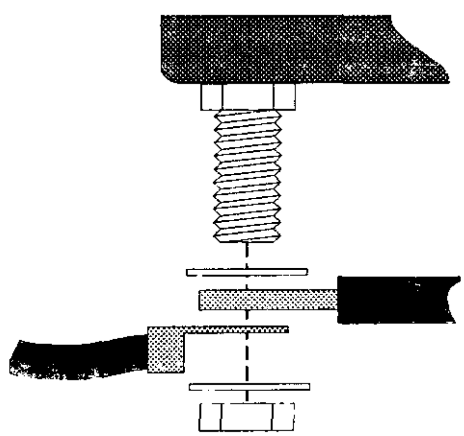

Figure 5

306. If the UPS has external batteries, reapply DC power to the UPS

307. Reapply AC power to the UPS

308. Monitor the voltage across the PFM capacitor as you turn the UPS on. The voltage should increase in stages and reach a "steady state" level in about three to five seconds. If the voltage stays near zero for more than five seconds, turn the UPS off and check your connections.

If the voltage does reach a steady state, turn the UPS off, remove all AC and external DC power and go on to Section 400.

Section 400: Putting the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the lower right comer of the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back in the top of the UPS and tighten the screw.

404. Reapply AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation

Best Power
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POWER SYSTEMS

TIP 730
35
November 13.1996

Replacing the Power Board in FE/QFE 500,700, and 850 VA Models

This Technical Information Publication explains how to replace the power board in *FE/QFE* 500,700, and 850 VA models. A qualified technician who is familiar with the FERRUPS unit must replace the power board. If you encounter any problems during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only). 1-608-565-2100, or call your local Best Power office.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers
1/2, 3/8, and 5/16-inch Nutdrivers
Fluke 80i-4 10 DC/AC Current Probe or Equivalent
Safety Equipment Required by Local Codes
Side Cutters
Labeling Material
Electrical Tape
1/2-inch Open End Wrench
True RMS AC Voltmeter
Remote Control Panel

CAUTION!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages maybe present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the power board.

This unit contains electrostatic-sensitive devices If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode. Always wear protective clothing and eye protection and use insulated tools when working near batteries.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:
A) Remove rings, watches, and other jewelry before servicing the FERRUPS unit.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.

LPT-07306

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

CAUTION

Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1.)

104. Next, find the sticker in the front panel with the BEST logo. Remove the sticker and loosen (but not remove) the #2 Phillips screw behind the sticker 5 or 6 turns. Save the sticker.

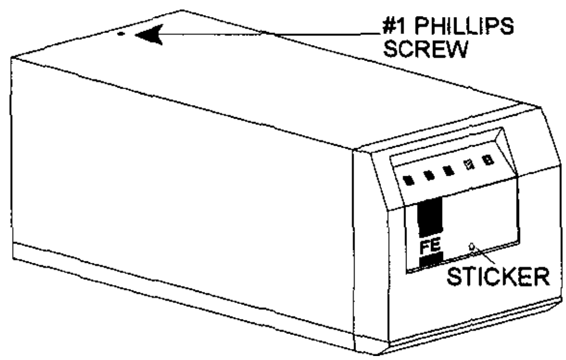

Figure 1

105. Slide the cover forward until it is completely off the UPS.

A **CAUTION:** **If there are batteries inside the UPS, you must disconnect the batteries by following step 106. If you do not disconnect the batteries, parts could be damaged as you replace the power board.**

106. If the UPS has internal batteries, disconnect the negative (-) battery cable from the batteries. Insulate the disconnected cable by taping it with electrical tape.

Section 200: Removing the Power Board

201. Inside the UPS, fmd the main DC fuse shown in Figure 2 **on the next** page.

A CAUTION!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

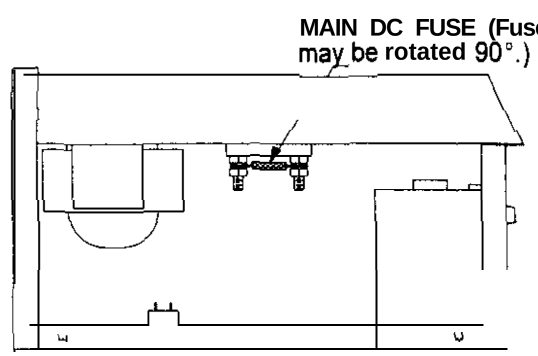

Figure 2

203. Using a 1/2-inch wrench or nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it *is* disconnected from the battery. Tape the fuse end so it cannot contact the battery cable.

204. Now, fmd the power board in Figure 3 below. The drawing shows a top view of the UPS with the cover removed.

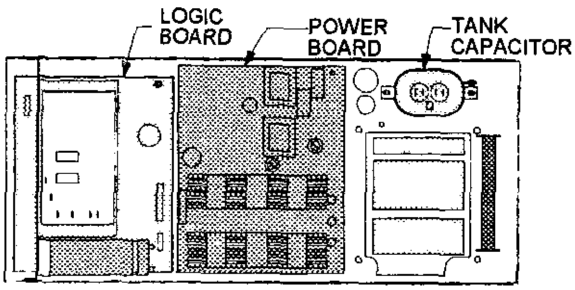

Figure 3

a

205. Use Figure 4 to find the wires connected to these points on the power board. Using masking tape or other labeling material, label each wire so you can reconnect it correctly later. Then, disconnect the wires from the power board. **For your model and voltage, some of the points listed below may not be connected.**

To disconnect E16, E17, and E18, you will need a 3/8-inch nutdriver and a 5/16-inch nutdriver.

In some models, the ribbon cable at J1 (from the logic board) is sealed with RTV-like silicone. *Carefully cut* through this silicone before you remove the cable from the power board.

Disconnect the following: J1, J2, J3, E4, E5, E6, E7, ES, E9, EIO, Ell, E12, E13, E14, E15, E16, E17, E18, E19, **and E20.**

Important: Although this TIP includes tables that show the power **board** connections for different voltages, the connections vary if your unit has a special configuration **or special** options. Labeling the wires is the best way to make sore you can reconnect them correctly.

206. The power board is held in place by four white plastic standoffs. Press the tab on each standoff and lift the power board over the tab. Remove the power board from the unit.

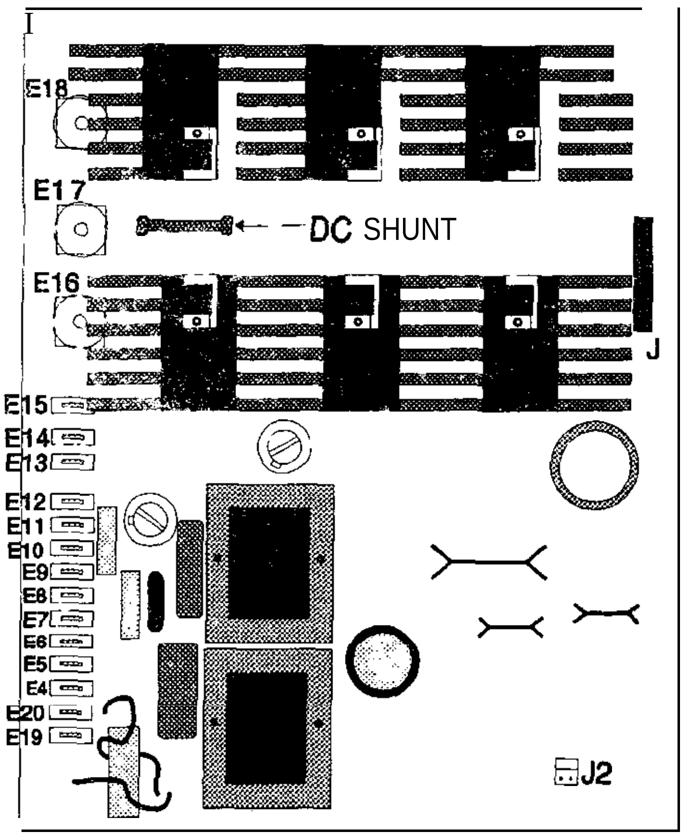

Figure 4

Section 300: Replacing the Power Board

301. Put the new power board in place. Insert the standoffs through the power board and press gently until they snap into place.

302. Reconnect the following wires. Use the labels you put on the wires in step 204 to match them to the correct connection points on the power board. The tables below can serve as a guide to reconnecting the wires. See Figure 4 on page 3 to find the connection points.

60 Hz 120-volt Only Models: Power Board Connections	
Power Board Connection	**Wire Description**
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
J3 **(units with optional chargers inside)**	Wire from the optional charger.
E4	Wire from the closest output receptacle (if applicable).
E5	Wire from one side of the fan.
E6	Transformer wire 10.
E7	Wire from one side of the fan.
E8	Wire to cabinet ground.
E9	Transformer wire 11.
E10	Wire from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	Transformer wire 5.
E15	Wire from the DC fuse.
E16	Transformer wire 4.
E17	Negative battery cable.
E18	Transformer wire 1.

60 Hz 208 and 240 VAC Input Models: Power Board Connections	
Power Board Connection	**Wire Description**
J1	**Ribbon cable from the logic board.**
J2	Wires from the On/Off switch.
J3 **(units with optional chargers inside)**	Wire from the optional charger.
E4	Depends on output voltage: 120 only: wire from receptacle. 208 or 240 only: Jumper wire to E20 (already connected). 120/208 or 1201240: Wire from receptacle.
E5	Wire from one side of the fan
E6	Transformer wire 10.
E7	Wire from one side of the fan.
E8	Depends on output voltage: With single output voltage: No connection. With 120/208 or 1201240: Wire to cabinet ground.
E9	Depends on output voltage: 120 only: Transformer wire I 1. 208 only: Transformer wire 12. 240 only: Transformer wire 13. 120/208 or 120/240: Transformer wire 1 1.
E10	Wiie from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	Depends **on input** voltage: 208 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E15	Wire from the DC fuse.
E16	Transformer wire 4.
E17	Negative battery cable.
E18	Transformer wire 1.
E19	Depends on output voltage: 120 only: No connection. 208 or 240 only: Wire from output receptacle (ii applicable). 120/208: Transformer wire 12. 120/240: Transformer wire 13.
E20	Depends on output voltage: 120 only: No connection. 208 or 240: Jumper wire to E4 (already connected). 120/208 or 1201240: Wire from output receptacle L2 (if applicable).

50 Hz 220,230, or 240 VAC Models: Power Board Connections	
Power **Board Connection**	**Wire Description**
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
J3 **(units with optional chargers inside)**	Wire from the optional charger.
E4	Jumper wire to E20 (already connected).
E5	Wire from one side of the fan.
E6	Transformer wire 10.
E7	Wise from one side. of the fan.
E8	Wire to cabinet ground.
E9	Depends on output **voltage:** 220 VAC: Transformer wire 11. 230 VAC: Transformer wire 12. 240 VAC: Transformer wire 13.
E10	Wiic from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	Depends on input voltage: 220 VAC: Transformer wire 7. 230 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E15	Wire from the DC fuse.
E16	Transformer wire 4.
E17	Negative battery cable.
E18	Transformer wire 1
E19	Wiic from the output receptacle (if applicable).
E20	Jumper wire to E4 (already connected).

303. Remove the temporary labels from the wires.

304. Remove the tape from the disconnected end of the DC fuse; then, move the fuse back into place. **Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer in between. Once** the fuse is in position, use a 1/2-inch wench or nutdriver to tighten the nuts that hold the cables to the DC fuse.

305. If the unit has external batteries, turn on the DC switch or reconnect the UPS to the batteries

Section 400: Calibrating the System

The parts you received are calibrated before they are shipped, but after replacing the power board, you should check calibration settings. Best Power requires you to use the Fluke 87 true RMS multimeter or its equivalent, (The procedure below is based on the measurements of a Fluke 87 true RMS multimeter.) You must use a true RMS meter for all AC measurements. For the DC current measurement, you must use a Fluke 80i-4 10 DC/AC Current Probe or its equivalent. If you do not have this current probe or its equivalent, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), l-608-565-2100, or your local Best Power office.

To perform the calibration commands, use a remote control panel and follow the steps below. (See TIP 407 for more information on connecting the control panel.) You can also send calibration commands from a terminal or computer, see the *Service Manual* or TIP 503 for specific instructions. *If* you have questions or problems during this procedure, call Best Power Worldwide Service at I-800-356-5737 (US. and Canada only). l-608-565-2100, or your local Best Power office.

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltage or battery current incorrectly could cause a battery alarm.

401. Reapply AC voltage and startup the UPS.

402. Using the remote control panel, enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

403. Apply the load to the UPS. The load applied must be 50% or more of the UPS KW rating.

404. Now, measure AC input voltage at the input terminals “A” and “B” of “LINE IN.” (See Figure 5.)

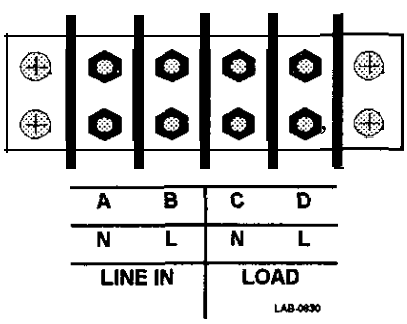

Figure 5

405. Next, display parameter 1 (V In) on the control panel by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter I, change the parameter value to your measurement by pressing [PROGRAM], entering your input AC voltage measurement, and pressing [ENTER].

406. To determine where to measure output voltage, you must display the nominal output voltage (parameter 44). To do this, press [DISPLAY] [4] [4] [ENTER]. Note the nominal output voltage.

Note: If your unit provides a mixed output voltage (1201208 or 120/240), the unit monitors the 120 VAC from the the unit.

407. Now, measure AC output voltage. For **plug-in models,** measure at the output receptacles. For **hardwired models,** measure between output terminals “C” and “D” of “LOAD OUT.” (See Figure 5.)

408. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value. displayed for parameter 2, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC voltage measurement, and pressing [ENTER]. Make **sure the measured value you enter into parameter 2 is acceptable for the nominal va you displayed in parameter 44.**

409. Next, measure the AC output current with the Fluke 80i-410 DC/AC Current Probe (or equivalent); if you do not have this probe, call Best Power Worldwide Service at l-800-356-5737, or call your local Best Power office. Set the meter for AC mV and attach the Fluke 80i-4 10 current probe; then, clamp the probe to the wires coming from "D"/"L" of "LOAD OUT" on the output terminal. (See Figure 5.)

410. Now, display parameter 4 (I Out) by pressing [DISPLAY] [4] [ENTER]. If your measurement does not match the display, change the parameter value to your measurement by pressing [PROGRAM], entering your AC current measurement, and pressing [ENTER].

411. You most make the next two measurements while the UPS is running on inverter (battery). Remove AC input power and let the unit run on inverter for approximately one minute.

412. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by pressing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7, change the parameter value to your measurement by pressing [PROGRAM], entering your battery voltage measurement, and pressing [ENTER].

413. To measure DC current, you must use a Fluke 80i-410 DC/AC Current Probe. Set the meter for DC mV and attach the Fluke 80i-410 current probe: then, clamp the probe to the positive DC cable and read the measurement. DC current will equal one amp per mV DC measured.

414. Display parameter 6 (I Batt) by pressing [DISPLAY] [6] [ENTER]. If your measurement does not match t value displayed for parameter 6, change the parameter value to your measurement by pressing [PROGRAM], entering your battery current measurement, and pressing [ENTER].

415. Clear the Service password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

416. Remove all AC and external DC power.

Section 500: Putting the Cover on the UPS

501. Using the slide rails on each side of the unit, **slide the** cover on the UPS.

502. At the front of the UPS, tighten the screw in the front panel. Cover the screw with the round sticker you removed.

503. Put the screw back in the top of the UPS and tighten the screw.

504. Reapply AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

505. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Replacing the Power Board Assembly in FE/QFE 1.15 and 1.4 KVA Models

This Technical Information Publication explains how to replace the power board assembly (made up of the power board, a mounting bracket, and the auxiliary board) in FUQFE 1.15 and 1.4 KVA models. A qualified technician who is familiar with the FERRUPS unit must replace the assembly. If you encounter any problems during this procedure, call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only), l-608-565-2100, or call your local Best Power office.

Tools Needed - Use Insulated Tools:

1/2-inch Open End Wrench	Side Cutters	1/2-inch Nutdriver
# 1 and#2 Phillips Screwdrivers	Labeling Material	True RMS AC Voltmeter
Fluke 80i-410 DC/AC Current Probe or Equivalent	Tie-wraps	Electrical Tape
Safety Equipment Rewired by Local Codes		

CAUTION!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the *FERRUPS User Manual*. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the power board assembly.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode. Always wear protective clothing and eye protection and use insulated tools when working near batteries.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:

A) **Remove rings, watches, and other jewelry before servicing the FERRUPS unit.**
B) **Always** wear protective clothing and eye protection and use insulated tools **when working near batteries.**
C) **Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.**

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PO. Box 280 • Necedah. Wisconsin 54646 U.S.A.. 608-565-7200
Toll-Free: 800-356-5794 • Service Toll-Free: 800356.5737 (U.S.A. & Canada)
FAX: 608-565-2221 • Service FAX: 608-565-2509

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the # 1 Phillips screw on the top of the UPS. (See Figure 1.)

104 Next, find the sticker in the lower right corner of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the. sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105, Slide the cover forward until it is completely off the UPS.

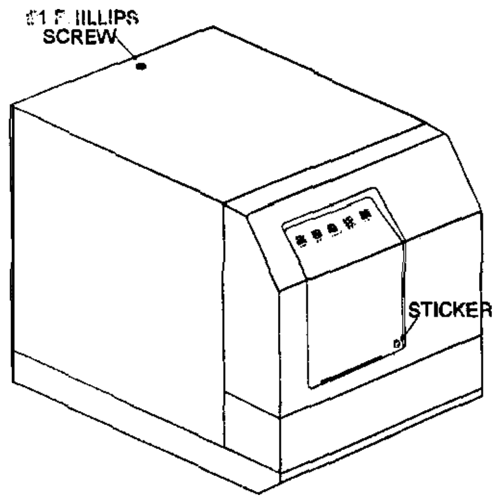


Figure 1

Section 200: Removing the Power Board Assembly

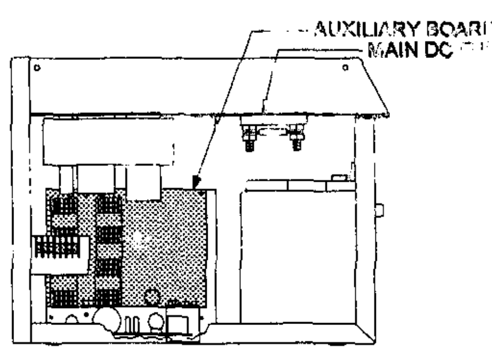
Caution: Before you remove tbe power board assembly, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, the new assembly could be damaged as you install it in the unit.

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, fmd the main DC fuse shown in Figure 2

CAUTION!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.



203 Using a 1/2-inch wench or a 1/2-inch nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected Tape the fuse end so it cannot contact the battery cable.

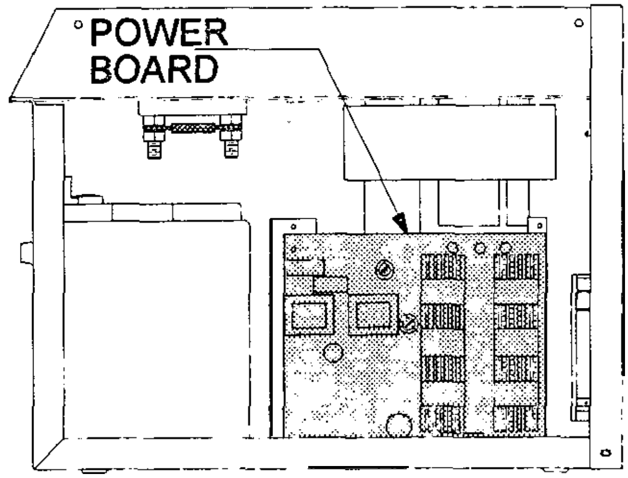


Figure 3

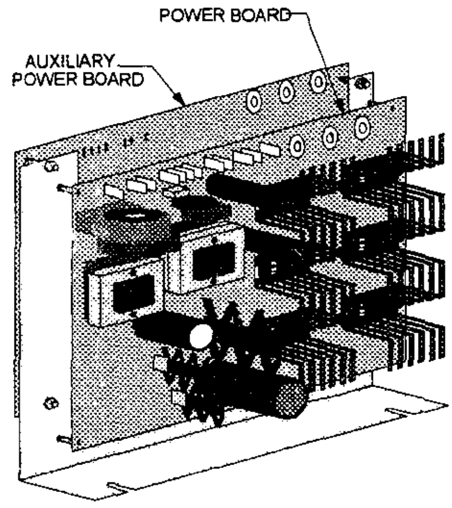


Figure 4

204. Figures 2 and 3 show the two sides of the power board assembly. Figure 2 shows the auxiliary board on one side of the assembly (towards the inside of the unit), and Figure 3 shows the power board on the other side of the assembly (towards the outside of the unit). Figure 4 shows the assembly outside of the unit.

205. Go to the power board (the board that is closest to the outside of the unit). At this board, label the wires to the following points with a "P" and the connection point (such as "E19"). Then, disconnect the wires from the power board. To your model and voltage, some points may not be connected. To disconnect the cables from E16, E17, and E18, you will need a wrench and a nutdriver.

J1, J2, E4, E5, E6, E8, E9, E10, E12, E15, E16, E17, E18, E19, and E20

Important: Although this TIP includes tables that show power board connections for different voltages, the connections vary if your unit has a special configuration or special options. Labeling the wires is the best way to make sure you can reconnect them correctly.

In some models, the nbbon cable at J 1 (from the logic board) is sealed with RTV-like silicone. Carefully cut through this silicone before you remove the cable from the power board.

206. If there is a jumper wire from E4 to E20 on the power board, cut the tie-wraps on the wire.

207. The auxiliary board is on the other side of the assembly bracket. To disconnect the wires from the auxiliary board, you must detach the bracket from the bottom of the chassis.

Remove the two nuts that fasten the assembly bracket to the bottom of the FERRUPS chassis. Then, gently pull the entire assembly out the side of the unit until you can access the auxiliary board ties. If necessary, remove wires from the clips on the bottom of the chassis.

208. Now, fmd the following wires on the auxiliary board, label each wire with an "A" and the auxiliary board connection point (such as "E10") so you can reconnect them correctly later. Then, disconnect the wires. For your model and voltage, some points may not be connected. To disconnect the cables from E3, E4, and E5, you will need a wrench and a nutdriver.

J1, E3, E4, E5, E6, E7, E8, E10, El 1, E12, E14, E15, and El6

Important: Although this TIP includes tables that show auxiliary board connections for different voltages, the connections vary if your unit has a special configuration or special options. Labeling the wires is the best way to make sure you can reconnect them correctly.

In some models, the ribbon cable at J 1 (from the logic board) is sealed with RTV-like silicone. *Carefully* cut through this silicone before you remove the cable from the power board.

209. Find the short ribbon cable that goes through the grommet in the assembly bracket. On the auxiliary board side of the assembly, gently pull the cable out through the grommet. Remove the other wire that went through the grommet between the auxiliary **board** and the power board.

210. Some wires will still be connected between the power board and the auxiliary board. Remove the tie-wraps that hold these wires to other wires inside the unit. Then, remove the bracket (with both boards attached) from the unit.

Section 300: Replacing the Power Board Assembly

301. Put the new assembly in position, but do not fasten it to the FERRUPS chassis yet.

302. Gently pull the short ribbon cable through the grommet to the power-board side of the assembly.

303. Now find the wires you labeled “A” in step 208 and reconnect them to the auxiliary **board. You should have labeled these wires with their correct connection points. The tables on the next two pages can serve as a guide** to reconnecting the wires for your unit’s voltage. See Figure 5 on page 6 to fmd the connection points on the auxiliary **board.**

These tables do not include wires that are already connected between the auxiliary board and the power board.

60 Hz, 120 VAC Only Models: Auxiliary Board Connections 1

AUXILIARY Board Connection	Wire Description
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
E3	Transformer wire 1.
E4	Negative battery cable.
ES	Transformer wire 4.
E6	Transformer wire 5.
El0	Wire to backfeed relay terminal 4.
El4	Wire to backfeed relay terminal 6.

60 Hz, 120/208/240 VA@ Models: Auxiliary Board Connections	
AUXILIARY Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
E3	Transformer wire 1
E4	Negative battery cable.
E5	Transformer wire 4.
E6	Depends on input voltage: 120 VAC: Transformer wires 5 and 8. 208 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E7	Depends on input voltage: 120 VAC: Transformer wire 6. 208 VAC: Transformer wire 5. 240 VAC: Transformer wire 6.
E8	Depends on output voltage: 120 VAC only: No connection. 208 VAC or 120/208 VAC: Transformer wire 13. 240 VAC or 120/240 VAC: Transformer wire 12.
E10	Wire to backfeed relay terminal 4
E11	Depends on input voltage: 120 VAC: No connection. 208 or 240 VAC: Transformer wire 7.
E12	Depends on output voltage: 208 or 240 VAC only: Wire to cabinet ground. 120 only, 120/208 or 120/240 VAC: No connection.
E14	Wire to backfeed relay terminal 6.
E15	Depends on input voltage. 120 VAC: No connection. 208 or 240 VAC: Transformer wire 8.
E16	Depends on output voltage: 208 or 240 VAC only: Transformer wire 11. 120, 120/208 or 120/240 VAC: No connection.

[illegible] Auxiliary Board Connections

AUXILIAR / Board Connection	Wire Description
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
E3	Transformer wire 1.
E4	Negative battery cable.
E5	Transformer wire 4.
E6	Depends on input voltage: 220 VAC: Transformer wire 7. 230 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E1	Depends on input voltage: 220 or 230 VAC: Transformer wire 5. 240 VAC: Transformer wire 6.
E8	Depends on input voltage: 220 VAC: Transformer wire 6. 230 or 240 VAC: Transformer wire 7.
E10	Wire to backfeed relay terminal 4.
E11	Depends on output voltage: 220 VAC: Transformer wire 12. 230 and 240 VAC: Transformer wire 11.
E12	Depends on input voltage: 220 and 230 VAC: Transformer wire 13. 240 VAC: Transformer wire 12.
E14	Wii to backfeed relay terminal 6.

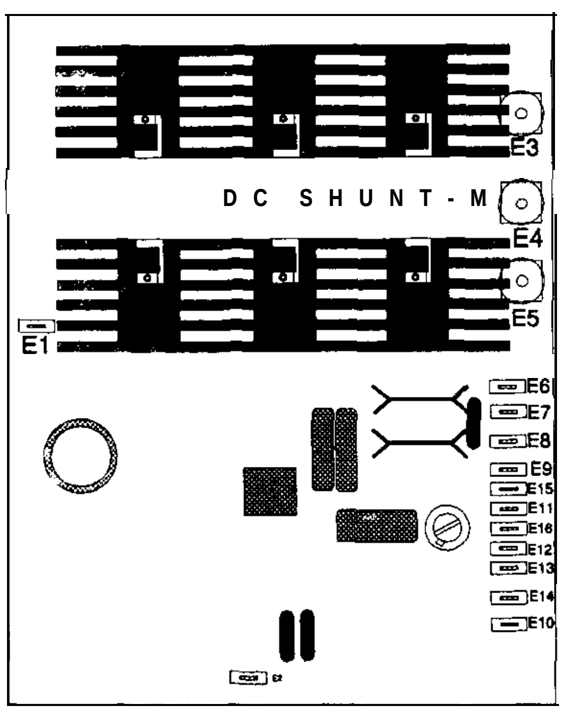


Figure 5 **Auxiliary Board**

3[illegible]. Remove the temporary [illegible] from the wires. If you removed wires from the clips in the bottom of the FERRUPS chassis, put the wires back in the clips. Replace tie-wraps as necessary.

305. Put the assembly bracket (with both boards attached) in place and use the two nuts to reattach it to the bottom of the FERRUPS chassis.

306. Now fmd the wires you labeled "P" in step 205 and reconnect them to the power board. You should have labeled these wires with their correct connection points. The tables below can serve as a guide to reconnecting the wires for your unit's voltage. See Figure 6 on page 9 to find the connection points on the power board. (The tables below do not include wires that are already connected between tbe power board and the auxiliary board.)

60 Hz, **120 VAC** Only **Models:** POWER **Board** Connections	
POWER Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the auxiliary board.
J2	Two wires to the On/Off switch.
E4	Wire to the terminal block terminal closest to the backfeed relay driver board.
E5	Wire to the tank capacitor.
E6	Transformer wire IO.
E8	Wire to cabinet ground.
E9	Transformer wire 1 1.
E10	Wire to the middle terminal block terminal.
E12	Transformer wire 9.
E15	Wire to the DC fuse.
E16	Transformer wire 4A.
E17	Negative battery cable.
E18	Transformer wire 1 A.

60 Hz, 208 or 240 VAC Input Models: POWER Board Connections	
POWER Board Connection	Wire Description
J1	Ribbon Cable to J1 on the auxiliary board.
J2	Two wires to the On/Off switch.
E4	Depends on output voltage: 208 or 240 VAC only: Jumper wire to E20 (already connected). 120, 120/208, or 120/240 VAC: Wire to the terminal block.
E5	Wire to the tank capacitor.
E6	Transformer wire 10.
E8	Depends on output voltage: 120, 120/208, or 120/240 VAC: Wire to cabinet ground. 208 or 240 VAC: No connection.
E9	Depends on output voltage: 208 VAC only: Transformer wire 12. 240 VAC only: Transformer wire 13. 120, 120/208, or 120/240 VAC: Transformer wire 11.
E10	Wire to the terminal block.
E12	Depends on input voltage: 120 VAC: Transformer wires 7 and 9. All other input voltages: Transformer wire 9.
E15	Wire to the DC fuse.
E16	Transformer wire 4A.
E17	Negative battery cable.
E18	Transformer wire 1A.
E19	Depends on output voltage: 208 or 240 VAC: Wire to the terminal block. 120 VAC: No connection. 120/208 VAC: Transformer wire 12. 120/240 VAC: Transformer wire 13.
E20	Depends on output voltage.: 208 or 240 VAC: Jumper wire to E4. 120 VAC: No connection. 120/208 or 120/240 VAC: Wire to the terminal block.

50 Hz 220.230. or 240 VAC Input Models: POWER Board Connections	
POWER Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
J2	Two wires to the On/Off switch.
E5	Wiie to the tank capacitor.
E6	Transformer wire 10.
E8	Wire to cabinet ground.
E9	Depends on output voltage: 220 VAC: Transformer wire 11. 230 VAC Transformer wire 12. 240 VAC: Transformer wire 13.
E10	Wire to the middle terminal block terminal
E12	Transformer wire 9.
E15	Wire to the DC fuse.
E16	Transformer wire 4A
E17	Negative battery cable.
E18	Transformer wire 1A.
E19	Wire from the terminal block terminal closest to the backfeed relay driver board.

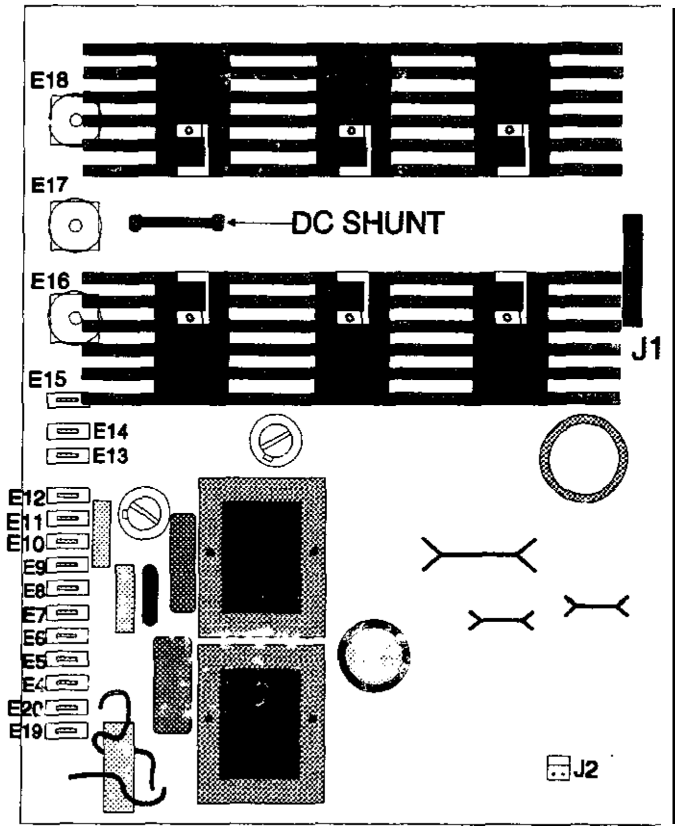


Figure 6 Power Board

307. Remove the temporary labels you put on the wires to the circuit boards.

308. Remove the tape from the disconnected end of the DC fuse; then, move the fuse back into place. Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer in between. Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

309. If the UPS has external batteries, reconnect the UPS to the batteries or tom on the DC switch.

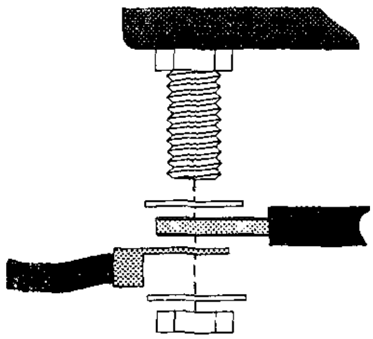


Figure 7

Section 400: Calibrating the System

The parts you received are calibrated before they are shipped, but after replacing the power board assembly, you should check calibration settings. Best Power requires you to use the Fluke 87 true RMS multimeter or its equivalent. (The procedure below is based on the measurements of a Fluke 87 true RMS multimeter.) You must use a true RMS meter for all AC measurements. For the DC current measurement, you must use a Fluke 80i-410 DC/AC Current Probe or its equivalent. If you do not have this current probe or its equivalent, call Best Power Worldwide Service at 1-800-356-5737.

To perform the calibration commands below, use an optional control panel and follow the steps below. (See TIP 407 for more information on connecting the control panel.) You can also send calibration commands from a terminal or computer; see the Service Manual or TIP 503 for specific instructions. If you have any questions or problems during this procedure, contact BEST's Technical Support Center at 1-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your local Best Power office.

Important: In the steps below, measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltage or battery current incorrectly could cause a battery alarm.

401. Reapply AC voltage and startup the UPS.

402. Using the remote control panel, enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

403. Apply the load to the UPS. The load applied must be 50% or more of the UPS KW rating.

404. Now, measure AC input voltage. For 120 voltage and 50 Hz models, measure at the input terminal ("A" and "B" of "Line In"). (See Figure 8.)

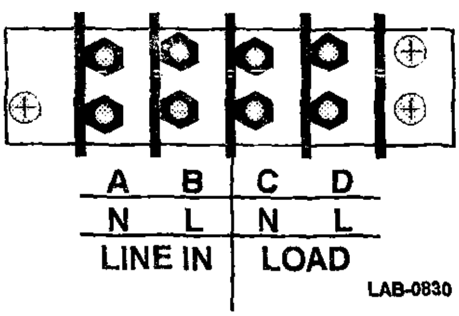
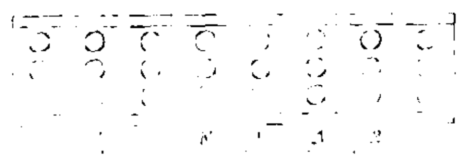


Figure 8

... ge, measure at "Nin" and "Lin" of the input terminal. (See Figure 9 below.)



For 60 Hz models with high input and high output voltage, measure at "L2in" and "L1in" of the input terminal. (See Figure 10 below.)

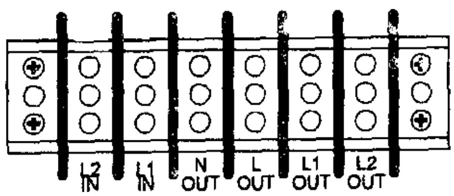


Figure 10

405. Next, display parameter 1 (V In) on the control panel by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value to your measurement by pressing [PROGRAM], entering your AC input voltage measurement, and pressing [ENTER].

406. **To determine where to measure output voltage, you must display the nominal output voltage (parameter 44).** To do this, press [DISPLAY] [4] [4] [ENTER]. Note the nominal output voltage.

Note: **If your unit provides a mixed output voltage (120/208** or **120/240), the** unit monitors the 120 VAC from the the unit. Note the output voltage being monitored.

407. Now, **measure AC** output voltage.

Plug-in **Models:** Measure at the output receptacles.

Hardwired models: In the table below, find the nominal output voltage you displayed in parameter 44. Then, at the output terminal block, measure at the output terminals shown for that nominal voltage. (See Figure 11, 12, or 13 and the table below.)

For **this nominal output voltage...**	**...measure here:**
120 VAC (60Hz)*	Between Output Terminals "L" and "N"
208 or 240 VAC (60Hz)*	Between Output Terminals "L1" and "L2"
220,230, or 240 VAC (SO Hz)	Between Output Terminals "L" and "N"

*Note: **If your unit's output** is **120/208** or **120/240, the unit** monitors tbe output voltage shown in parameter 44. Use the nominal voltage **shown** in parameter 44 to decide which voltage to measure. Then, use your measurement to calibrate parameter 2 in step 408.

408. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement by pressing [PROGRAM], entering your AC output voltage measurement, and pressing [ENTER]. **Make sure the measured value you eater into parameter 2 is acceptable for the nominal value you displayed in parameter 44.**

409. **Next,** measure the AC output current with the Fluke 8Oi-4 10 DC/AC Current Probe; if you do not have this probe, call Best Power Worldwide Service at l-800-356-5737 or call your local Best Power office. Set the meter for AC mV and attach the Fluke 8Oi-4 10 current probe; then, clamp the probe to the wires coming from "D/L" of "LOAD OUT" on the output terminal (See Figure 8) or to the appropriate output "L" wires (See Figure 9 or 10).

410. Now, display parameter 4 (I Out) by pressing [DISPLAY] [4] [ENTER]. If your measurement does not match the display: change the parameter value to your measurement by pressing [PROGRAM], entering your AC output current measurement, and pressing [ENTER].

411. You must make the next two measurements while the UPS is running on inverter (battery). Remove AC input power and *let the unit run* on inverter *for approximately one minute.*

412, Measure the battery string voltage with the digital multimeter. Then, **display** parameter 7 (V Batt) on the control panel by pressing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7, change the parameter value to your measurement by pressing [PROGRAM], entering your battery voltage measurement, and pressing [ENTER].

413 To measure DC current, you must use a Fluke 80i-410 **CC/AC** Current Probe. Set the meter for DC mV and attach the Fluke 80i-410 cm-rent probe; then, clamp the probe to the positive DC cable and read the measurement. DC current will equal one amp per mV DC measured.

414 *Display parameter 6* (I *Batt) by pressing [DISPLAY] [6] [ENTER]. If your measurement* does not match the value displayed for parameter 6, change the parameter value to your measurement by pressing [PROGRAM], entering your battery current measurement. and pressing [ENTER].

415 Clear the Service password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display

416 Remove all AC and external DC power.

Section 500: Putting the Cover on the UPS

501. Using the slide rails **on each** side of the unit, slide the cover on the UPS.

502. At the front of the UPS. tighten the screw in the lower right **comer** of the front panel. Cover the screw with the round sticker you removed.

503. Put the screw back in the top of the UPS and tighten the *screw.*

504. Reapply **AC** power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with *internal batteries* should already have *DC* power applied.)

505. Startup the UPS, connect a 1 load equipment, and return the UPS to normal operation.

TIP 732
35
November 18, 1996

Replacing the Logic Board in FERRUPS FE and QFE 500 VA-E .4 KVA Models

This Technical Information Publication describes how to replace the logic board in FERRUPS® FE and QFE 500VA, 700VA, 850VA, 1.15KVA, and 1.4 KVA models. A qualified service person who is familiar with the FERRUPS unit most replace the logic board. If you encounter problems during this procedure, call Best Power Worldwide Service at 1-608-565-2100, l-800-356-5737 (U.S. and Canada only), or call your local Best Power office.

Tools **Needed** - Use Insulated **Tools:**

#1 and #2 Phillips Screwdrivers	1/2-inch Open End Wrench or Nutdriver	Labeling Material
Remote Control Panel	Safety Equipment Required by Local Codes	Tie-Wraps
True RMS AC Voltmeter	Fluke 80i-410 Current Probe or Equivalent	Electrical Tape

WARNING

This procedure must be performed by a qualified service person ONLY! UPS units are designed to provide power unde a variety of operating conditions Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the *FERRUPS User Manual*. Make sure that the UPS batteries and AC input are off or disconnected before you replace the logic board.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow al local safety codes.

PT-0732C

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Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **CAUTION!**
> Make sure the On/Off switch on the back of the UPS is OFF, and follow the steps below to make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1 or Figure 2.)

104. Next, find the sticker in the from panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105. Slide the cover forward until it is completely off the UPS

500 VA, 700 VA, and 850 VA

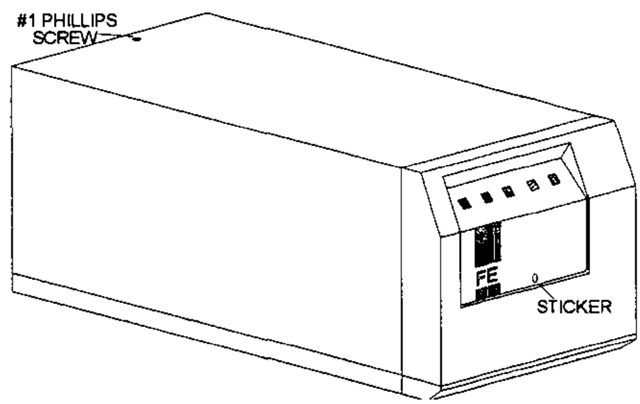


Figure 1

1.15 WA and 1.4 WA

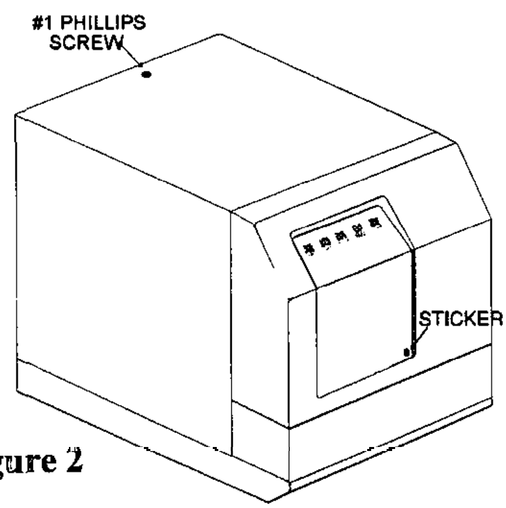


Figure 2

Section 200: Removing the Logic Board

A Caution: Before you remove the logic board, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, the new logic board could be damaged as you install it in the unit.

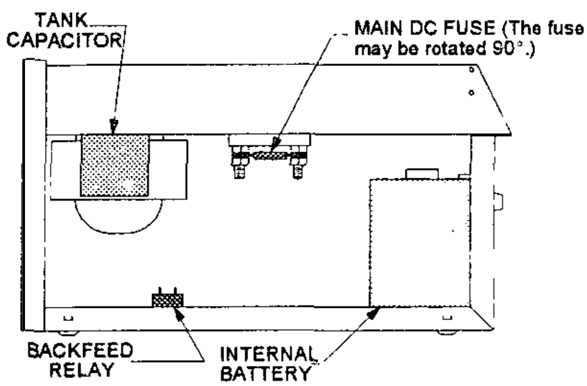
201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse. For 500,700, and 850 VA models, see Figure 3 on the next page. For 1.15 and 1.4 KVA models, see Figure 4 on the next page.

⚠ CAUTION!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

500, 700, and 850 VA



Note: In some 500-850VA models, the fuse is rotated 90”.

Figure 3

1.15 and 1.4 KVA

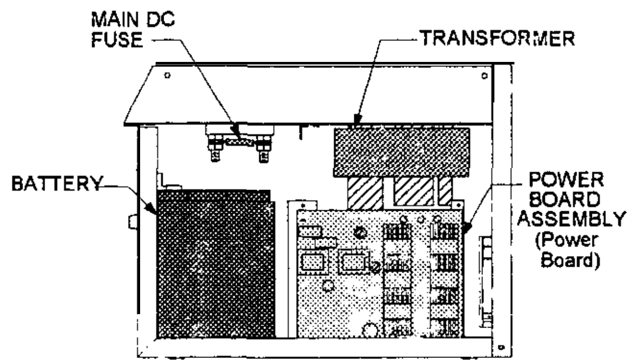


Figure 4

203. Use a 1/2-inch wench or nutdriver to loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the battery cable.

204. Now, fmd the logic board toward the front of the UPS. For 500,700, and 850 VA models, see Figure 5 below; notice that the logic board is under the PFM assembly.

500,700, and 850 VA Top View

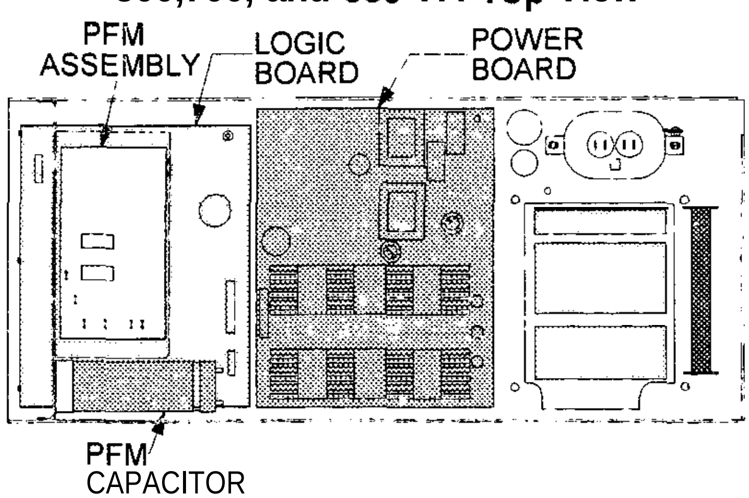


Figure 5

For 1.15 and 1.4 KVA models, see Figure 6 or Figure 7. On some models, the logic board is under the PFM assembly; see Figure 6. On other models, the logic board is next to the PFM assembly; see Figure 7.

1.15 and 1.4 KVA Top View

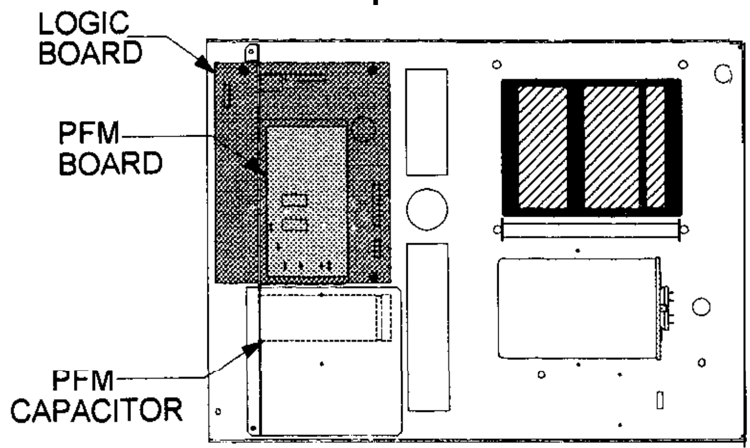


Figure 6

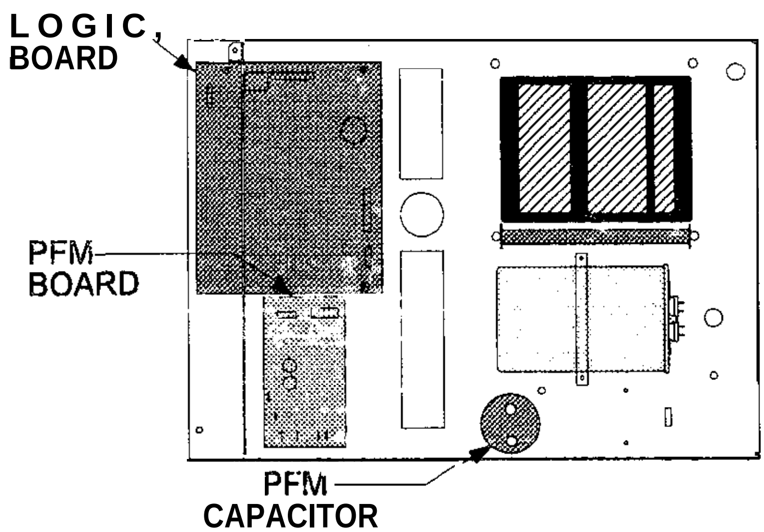


Figure 7

205. If the logic board is **not** under the PFM assembly, go to step 206. If the logic board **is** under the PFM assembly, you must move the PFM assembly out of the way. To do this, you must **first** remove the screws that hold the PFM bracket in place. Follow the instructions on the next page for your model.

> **CAUTION!**
>
> **As you move the PFM assembly, do not let it contact components on any circuit board. Do not contact the terminals on the PFM capacitor, and do not allow these terminals to contact the chassis or another component. Some voltage may be present across the capacitor terminals.**

500,700, and 850 VA: The PFM assembly's bracket is held in place by two screws in each side of the unit (four total). **Hold the PFM assembly in place as you remove the screws.** Then, place a piece of insulating material on top of the power board (see Figure 5), and gently turn the assembly upside-down and lay it on top of the insulating material. Make sure **you do not contact the capacitor terminals.**

1.15 and 1.4 KVA: The PFM assembly bracket is held to the top of the chassis by two screws at the front of the unit Hold the PFM assembly in place as you remove the screws. Then, gently lift the PFM assembly up slightly, turn it upside-down, and lay it on too of the transformer, PFM resistor, and tank capacitor, making certain nothing can contact the PFM capacitor terminals.

206. On the logic board, find J3, J4 J9, J11, and J16, shown in the Table 1 below and Figure 8. Using masking tape or other labeling material, label each wire with its logic board connection point; this will help you connect the wires to the new logic board correctly. The ambient temperature probe is mounted on the board at "J4." This probe must be detached from the old board and placed on the new board; this probe does not come with the new board. For 1.15 and 1.4 KVA models, you must also label the wire connected to J1 on the logic board.

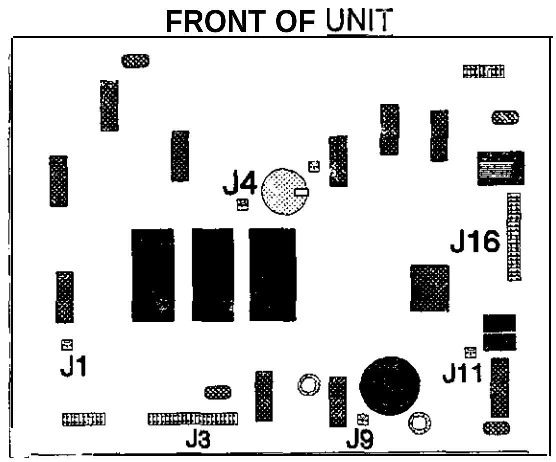


Figure 8

Once you have labeled the wires, remove the following connectors. Remove tie-wraps whenever necessary.

Note: In some models, the ribbon cable at J1 (from the logic board) is sealed with RTV-like silicone. *Carefully* cut through this silicone before you remove the cable from the power board.

All Models:	
Logic Board Connection	**Description**
J3 (POWER)	Ribbon cable from the power board.
J4 (AMB)	Ambient temperature probe.
J9 (B. SWITCH)	Wires to the Alarm Silence switch.
J11 (PFCT)	PFM temperature probe.
J16 (CONSOLE)	Ribbon cable to the RS232 port.
1.15 and 1.4 KVA Only:	
Logic Board Connection	**Description**
J1 (XFT)	Transformer temperature probe.

207. Remove the four Phillips screws that hold the logic board in place and remove the board from the unit. Leave the standoffs in place for the new logic board.

Section 300: Replacing the Logic Board

301. Put the new logic board in the unit and use the four Phillips screws to secure it through the standoffs.

302. Reconnect the wires to the following connectors. (See Figure 8.)

All Models:	
Logic Board Connection	**Description**
J3 (POWER)	Ribbon cable from the power board.
J4 (AMB)	Ambient temperature probe.
J9 (B. SWITCH)	Wires to the Alarm Silence switch.
J11 (PFCT)	PFM temperature probe.
J16 (CONSOLE)	Ribbon cable to the RS232 port.
1.15 and 1.4 KVA Only:	
Logic Board Connection	**Description**
J1 (XFT)	Transformer temperature probe.

303. Remove the temporary labels you put on the connectors. Replace any tie-wraps you removed

304. If you did **not** move the PFM assembly, **go** to step **305.** If you **did** move the PFM assembly, carefully move the assembly back in place, being careful not to contact the PFM capacitor terminals or the other circuit boards in the unit.

CAUTION!

As you **move the PFM assembly, do not let it contact components on any circuit board. Do not contact the terminals on the YFM capacitor, and do not allow the terminals to contact the chassis or another component. Some voltage may be present across tbe capacitor terminals.**

500,700, and 850 VA Models: Hold the PFM assembly in place and use the four Phillips screws to attach the bracket to the sides of the unit.

1.15 and 1.4 KVA Models: Hold the PFM assembly in place and use the two Phillips screws to attach the bracket to the top of the chassis.

305. Remove the tape from the end of the DC fuse you disconnected; then, move the fuse back into place, **Make sore the fuse connector is next to the battery cable connector on the bolt; do not put a washer in between** these connectors. (See Figure 9.) Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

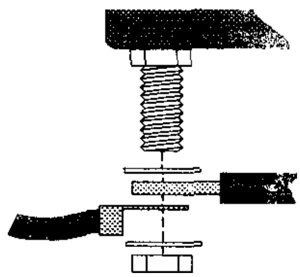


Figure 9

306. If your UPS has an external battery cabii turn the DC Disconnect switch on or reconnect the UPS to the battery **cabinet.**

Section 400: Calibrating the System. and Setting Unit Parameters

The parts you received are calibrated before they are shipped, but after replacing the logic **board, you should** check the calibration settings. You must also check the parameters for the unit's serial number, model size, and battery amp-hour.

Tbe calibration settings are based on the measurements of a Fluke 87 true RMS multimeter. BEST requires a Fluke 87 true RMS multimeter or its equivalent. For the DC current measurement, you must use a Fluke 80i-4 10 DC/AC Current Probe or equivalent. If you do not have this probe, or equivalent, call Best Power Worldwide Service at l-608-565-2100 or l-800-356-5737 (U.S. and Canada only) or call your local Best Power office.

To perform the calibration commands below, use a remote control panel. (See TIP 407 to connect the control panel.) You can also enter calibration commands from a terminal or computer; see the Service Manual or TIP 503 for specific instructions. If you have any questions or problems during this procedure, please call Best Power Worldwide Service at l-608-565-2100 or I-800-356-5737 (U.S. and Canada only) or call your local Best Power office.

Important: In the steps below. measure voltages at the locations specified. Measuring input or output voltages incorrectly could cause alarms for High AC Input, Low AC Input, High AC Output, or Low AC Output. Measuring battery voltage or battery current incorrectly could cause a battery alarm.

401. Reapply AC voltage and startup the UPS

402. Using the remote control panel, enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

403. Apply the load to the UPS. The load applied must be 50% or more of the UPS KW rating.

404. First, you must check your unit's serial number. To do this, display parameter 40 (Serial Number) by pressing [DISPLAY] [4] [0] [ENTER]. Compare the display to the serial number on your unit's ID label (on the back of the unit or the front of the chassis). If the parameter 40 display is correct, go on to step 405. If it is not correct, follow these steps to enter the correct serial number:

a. Press [CLEAR] to return to the normal display,

b. Before you can enter the new serial number, you must enter the Factory password. To do this, press [PROGRAM], then [1] [8] [4] [7] [3], then [ENTER].

c. Now, display parameter 40 again by pressing [DISPLAY] [4] [0] [ENTER].

d. Press [PROGRAM].

e. Since the serial number includes letters as well as numbers, you must go into the message editor to enter the new serial number. To do this, press [DISPLAY] and (PROGRAM] a! the same time. The display will show "Message. Editor," then a period.

f. Enter the correct serial number:

Whenever you need to type a letter, press [ ] and [3] together; then, press [DISPLAY] to scroll through the alphabet until you reach the letter you need. Once you reach the correct letter, press [PROGRAM] to go to the next character.

Whenever you need to type a number, press [ ] and [2] together; then, press [DISPLAY] to scrol! through the numbers until you reach the one you need. Once you reach the correct number, press [PROGRAM] to go to the next character.

When you have entered the complete serial number, press [ENTER]. The new serial number will scrol! across the display. Press [ENTER] again to go back to the parameter display.

To do this in the message editor...	...do this.
Enter the message editor.	Press [DISPLAY] and [PROGRAM] together.
Type a letter.	Press [ ] and [3] together, then press [DISPLAY] until you reach the correct letter.
Type a number.	Press [ ] and [2] together, then press [DISPLAY] until you reach the correct number.
Save a character and go to the next character.	Press [PROGRAM].
Save the serial number and exit the message editor.	Press [ENTER], check the scrolling display, and press [ENTER] again.

405. Next, you most set the unit's model size. To do this, display parameter 4 1 (Model Index). Compare the display to the model number shown on your unit's ID label. If the display shows the correct model number, go on to step 406. If not, press [PROGRAM] and enter the setting for your model's size:

1 = FE500VA 2 = FE700VA 3 = FE850VA 4 = FE1.15KVA 5 = FE1.4KVA

The prefix for the 50Hz models will be designated "QFE" in the model index

406. Now, you must enter the ampere-how rating for your unit's batteries. To determine the ampere-hour rating, look for a battery part number (BAT-*XXXX*) on a label on your batteries. If your batteries do have a part number, use Table 4 on the next page to determine the ampere-hour rating. If they do not have part number, call BEST at l-608-565-2100 or l-800-356-5737 (U.S. and Canada only) or call your local BEST office for more information.

Now, display parameter 69 (Batt AH). If the ampere-hour rating shown matches the ampere-hour rating of your batteries, go on to step 407. If **not,** press [PROGRAM]; enter the correct ampere-hour rating, and press [ENTER].

Table 4: Battery Amp-Hour Ratings for FERRUPS Batteries

Battery Part Number	Battery Ampere-Hour Rating
RAT-0007	55 AH
BAT-0046	75 AH
BAT-0047	75 AH
BAT-0048	100 AH
BAT-0049	100 AH
BAT-0050	200 AH
BAT-005 1	200 AH
BAT-0053	31 AH
BAT-0058	17AH
BAT-0065	31 AH
BAT-0103	75 AH
BAT-0122	100 AH

407. Now, measure AC input voltage. For 500,700, and 850 VA models, measure between El2 **and** El3 on the power board.

For 1.15 and 1.4 KVA units, find the backfeed relay on the bottom of the chassis in front of the terminal block. Measure AC input voltage between backfeed relay terminals 2 and 8. (The terminals are numbered.) Make sure you measure input voltage at the correct location.

408. Next, display parameter 1 (V In) on the control panel by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter to the value of your measurement by pressing [PROGRAM], entering your input AC voltage measurement, and pressing [ENTER].

409. To determine where to measure output voltage, you must display the nominal output voltage (parameter 44). To do this, press [DISPLAY] [4] [4] [ENTER]. Note the nominal output voltage.

410. Now, measure AC output voltage.

For Plug-in Models, measure at the output receptacles.

For **Hard-wired** Models, in the table below find the nominal output voltage you displayed in parameter 44. Then, at the installation terminal block, measure at the output terminals shown for that nominal output voltage.

For **this nominal output voltage..**	**...measure here:**
120 VAC (60 Hz)"	Between Output Terminals L and N
208 or 240 VAC (60 Hz)*	Between Output Terminals L1 and L2
220,230, or 240 VAC (50 Hz)	Between Output Terminals L and N

*Note: If your unit's output is 120/208 or 120/240, the unit monitors one of the available output voltages -the one shown in parameter 44. Use the nominal voltage shown in parameter 44 to decide which voltage to measure. Then, use your measurement to calibrate parameter 2 in step 4.11.

411. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC voltage measurement and pressing **[ENTER]. Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you displayed in parameter 44.**

412. You must make the next two measurements while the UPS is running on inverter (battery). Remove AC input power and lot the unit run on inverter for approximately one minute before you go on.

413. Measure the battery string voltage with the digital multimeter. Then, display parameter 7 (V Batt) on the control panel by pressing [DISPLAY] [7] [ENTER]. If your measurement does not match the value displayed for parameter 7, change the parameter to the value of your measurement by pressing [PROGRAM], entering your battery voltage measurement, and pressing [ENTER].

414. To measure DC current, you must use 2 Fluke 80i-410 DC/AC Current Probe or equivalent. If you do not have this probe or its equivalent, call Best Power Worldwide Service or call your local Best Power office. Set the meter for DC mV and **clamp** it on the positive (+) battery cable. Then, read the measurement. DC current will ***equal one*** amp per mV DC measured.

415. Display parameter 6 (I Batt) by pressing [DISPLAY] [6] [ENTER]. If your measurement does not match the value displayed for parameter 6, change the parameter value to your measurement by pressing [PROGRAM], entering your battery current measurement, and pressing [ENTER].

416. Clear the Service Password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

417. Turn the FERRUPS On/Off switch off; then, remove all AC and external DC voltage.

Section 500: Putting the Cover on the UPS

501. Using the slide rails on each side of the unit, slide the cover on the UPS.

502. At the front of the UPS, tighten the screw in the front panel with the BEST logo. Cover the screw with the round sticker you removed.

503. Put the screw back into the top of the UPS and tighten the screw.

504. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

505. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Best Power

UNINTERRUPTIBLE POWER SYSTEMS

TIP 771
35
November 17, 1994

Replacing the Fan in Standard FE and QFE 500, **700,** and **850** VA Models **Without** Extended Runtime

This Technical Information Publication explains how to replace the fan in FE and QFE 500, 700, and 850 VA models **without** extended runtime. A qualified technician who is familiar with the FERRUPS unit must replace the fan. If you encounter problems during this procedure, please contact BEST's Technical Support Center at l-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers
Electrical Tape
1/2-inch Nutdriver or Open End Wrench
Safety Equipment Required by Local Codes

WARNING!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety ofoperating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describii "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the fan.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working neat batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes,

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N9246 Highway 80 South, P.O. Box 280, Necedah, WI 54646 U.S.A. / Web Site: www.bestpower.com
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. **See Figure 1.**

104. Next, find the sticker in the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105. Slide the cover forward until it is completely off the UPS.

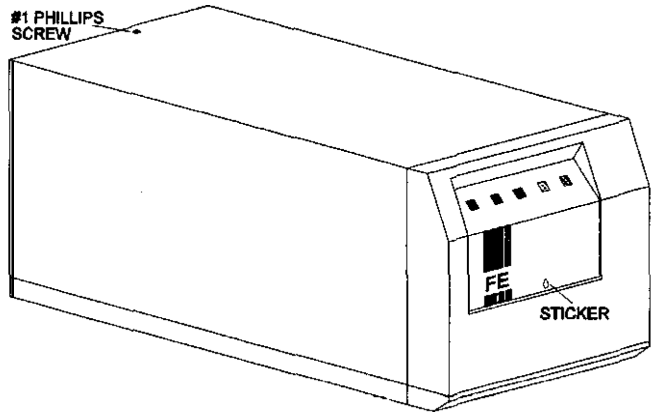

Figure 1

Section 200: Removing the Fan

Caution: **Before you remove the fan, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, voltage will be present inside the unit.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page.

> **WARNING**
>
> **As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

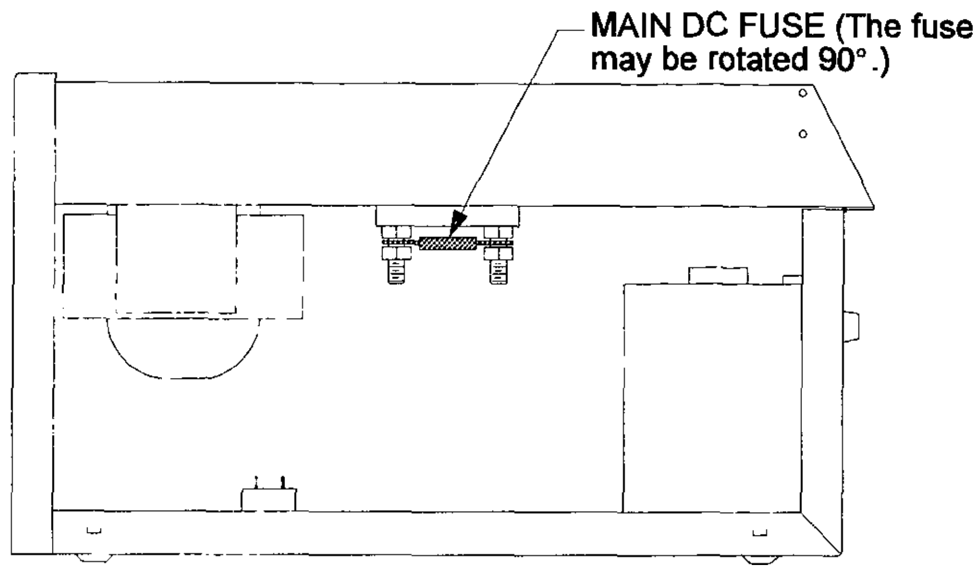

Figure 2

203. Using the 1/2-inch wrench or nutdriver, loosen both nuts at the DC fuse. Then, turn one end of the fuse out so it is disconnected from the bolt. Tape the fuse end with electrical tape.

204. Two wires from the fan go to E5 and E7 on the power board. Disconnect these wires from the power board and pull them down through the grommet.

205. As **you hold the fan,** remove the four Phillips screws that hold the fan bracket under the top of the FERRUPS chassis. Remove the fan from the unit.

Section 300: Replacing the Fan

301. Put the new fan in place with the wires on the side closest to the transformer. Then, use the four Phillips screws to attach the new fan to the FERRUPS chassis.

302. Find the fan wire closest to the DC fuse, and pull it up through the grommet to the power board. Connect this wire to E5 on the power board.

303. Pull the other fan wire through the grommet and to the power board. Connect this wire to E7 on the power board.

304. Move the DC **fuse** back into place. **Make sure the fuse connector is next to the other cable connector on the bolt; there should not be a washer in between.** (See Figure 3 on the next page.) Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

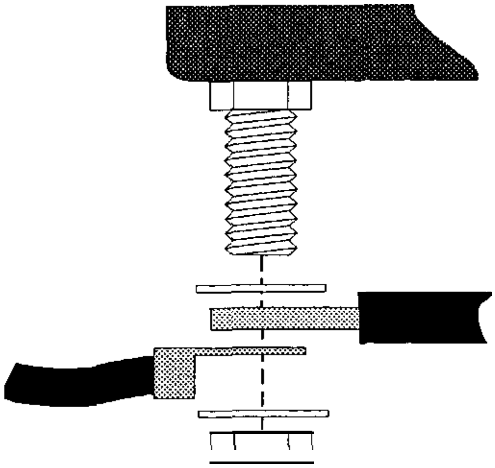

Figure 3

Section 400: Putting the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the lower right comer of the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back into the top of the UPS and tighten the screw.

404. Reapply all AC power to the UPS. If the UPS has external batteries,, turn the DC Disconnect switch on or reconnect the UPS to the battery cabinet. (Units with an internal battery should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

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POWER SYSTEMS

TIP 772
35
November l?. 1994

Replacing the Fan in FE and QFE 1.15 and 1.4 KVA Models

This Technical Information Publication explains how to replace the fan in FE and QFE 1.15 and 1.4 KVA models. A qualified technician who is familiar with the FERRUPS unit must replace the fan. If you encounter problems during this procedure, please contact BEST's Technical Support Center at I-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers	Electrical Tape Tie-Wraps
1/2-in. Nutdriver or Open End Wrench	Safety Equipment Required by Local Codes

WARNING!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS' in the FERRUPS User Manual. Make sure that the UPS batteries and AC input are off or disconnectec before you replace the fan.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit, can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working neat batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible: follow all local safety codes.

LPT-0772A

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. **See Figure 1.**

104. Next, find the sticker in the lower right comer of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

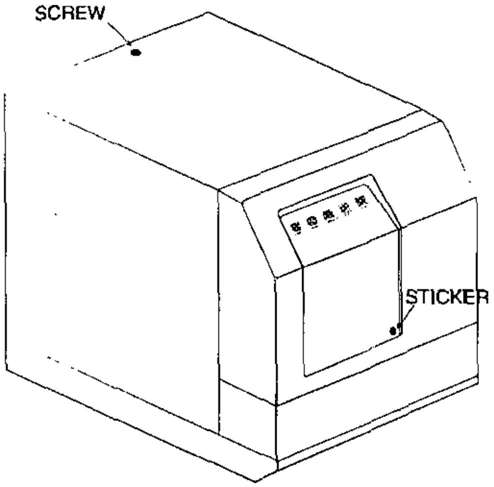

Figure 1

105. Slide the cover forward until it is completely off the UPS.

Section 200: Removing the Fan

Caution: **Before you remove the fan, you must disconnect the batteries by following steps 201 through 203. If you do not disconnect the batteries, voltage could be present at the inverter assembly near the fan.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page

> **WARNING**
>
> **As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

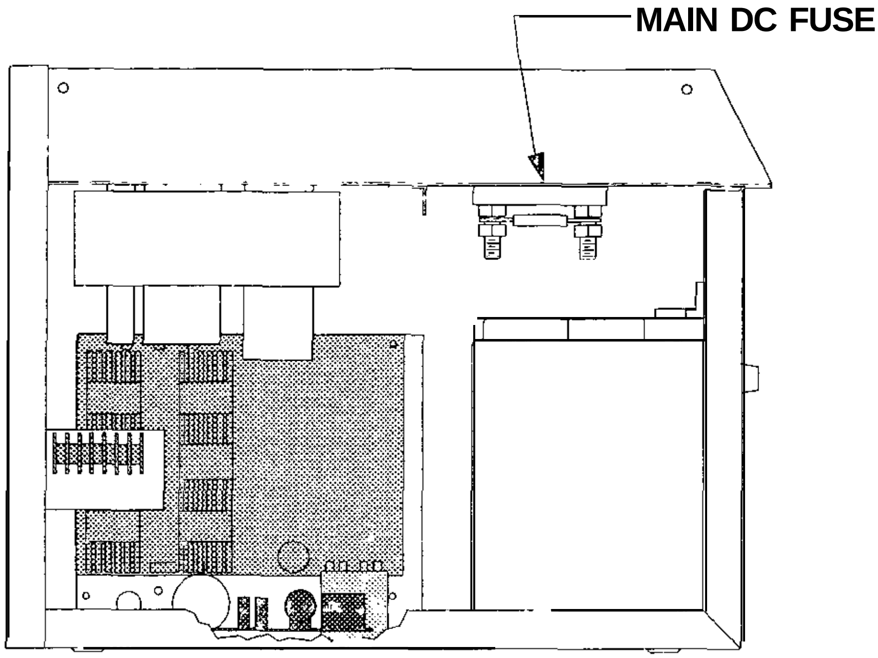

Figure 2

203. Using a 1/2-in. wrench or nutdriver, loosen both nuts at the DC fuse. Then, turn one end of the fuse out so it is disconnected from the battery Tape the fuse end so it cannot contact the battery cable.

204. Cut the tie wrap that holds the ambient temperature probe to the clip on the bottom of the fan.

205. Two wires go from the fan to the terminal block behind the backfeed relay. Disconnect these wires from the fan.

206. Now, look at the back of the unit. Notice that four screws hold a grill over the fan. These screws go through the back of the unit and hold the fan in place. As **you hold the fan,** remove the four Phillips screws in the back of the unit to remove the fan and the grill. Then, remove the fan, **being careful not to contact components on the inverter assembly's circuit boards.**

Section 300: Replacing the Fan

301. Put the new fan in place. Then, put the grill on the back of the unit, and use the four Phillips screws to attach the new fan and the grill to the back of the UPS.

302. Reconnect the wires you disconnected from the fan.

303. Tie-wrap the ambient temperature probe to the clip in one bottom corner of the fan.

304. Move the DC fuse back into place. **Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer in between.** (See Figure 3.) Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

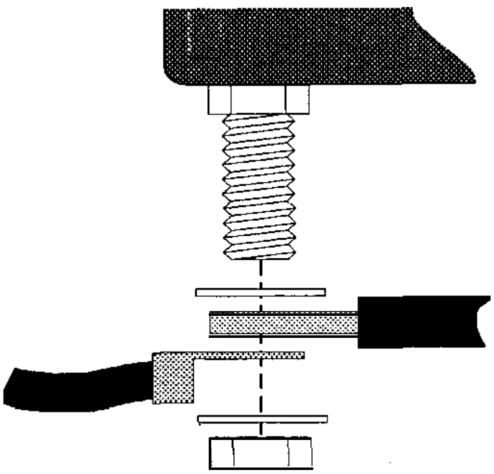

Figure 3

Section 400: Putting the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the lower right corner of the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back into the top of the UPS and tighten the screw.

404. Reapply all AC power to the UPS. If the UPS has external batteries, turn the DC Disconnect switch on or reconnect the UPS to the battery cabinet. (Units with an internal battery should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation

Replacing the DC Fuse in FE and QFE 500,700, and 850 VA and 1.15 and 1.4 KVA Models

This Technical Information Publication explains how to replace the DC fuse in FE and QFE 500, 700, and 850 VA and 1.15 and 1.4 KVA models, A qualified technician who is familiar with the FERRUPS unit must replace the DC fuse. If you encounter problems during this procedure, please contact BEST's Technical Support Center at l-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers
1/2-in. Nutdriver
1/2-in. Open End Wrench
Safety Equipment Required by Local Codes
Electrical Tape

WARNING!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety ofoperating conditions. Dangerous voltages may be present even if AC tine or DC **voltage** is removed. **TEST BEFOBE TOUCHING!**

Turn off the UPS according to the procedure descniing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual, Make sure that the UPS' batteries and AC input are off or disconnected before you replace the DC fuse.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. **A** short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working neat batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.

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Toll-Free: 800-356-5794 . Service Toll-Free: 800-356-5737 (U.S.A. & Canada)
FAX: 608-565-2221 . Service FAX: 608-565-2509

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top **of the UPS. See Figure 1 or Figure 2.**

104. Next, find the sticker in the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105. Slide the cover forward until it is completely off the UPS.

500,700, and 850 VA

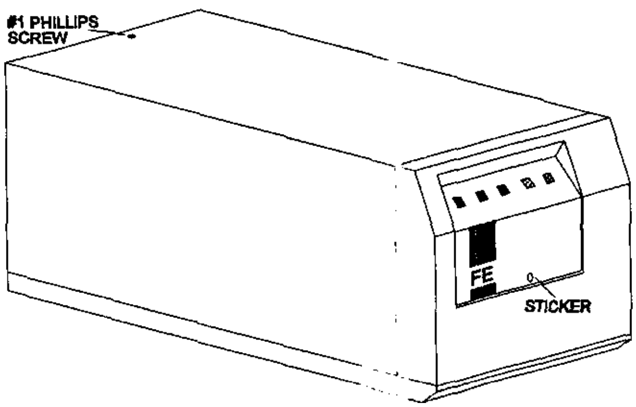


Figure 1

1.15 and 1.4 **KVA**

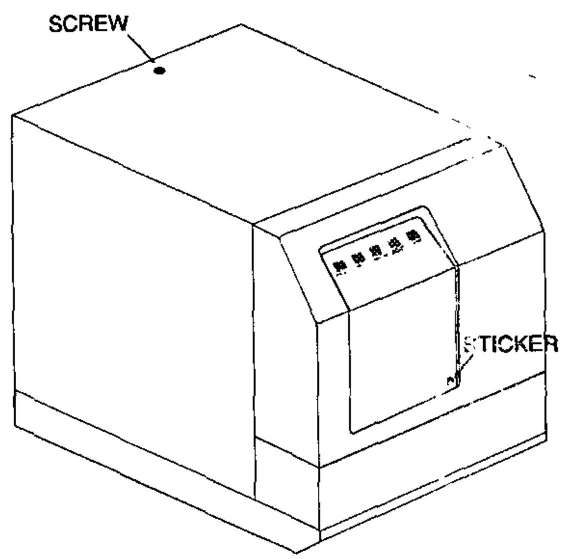


Figure 2

Section 200: Removing the DC Fus

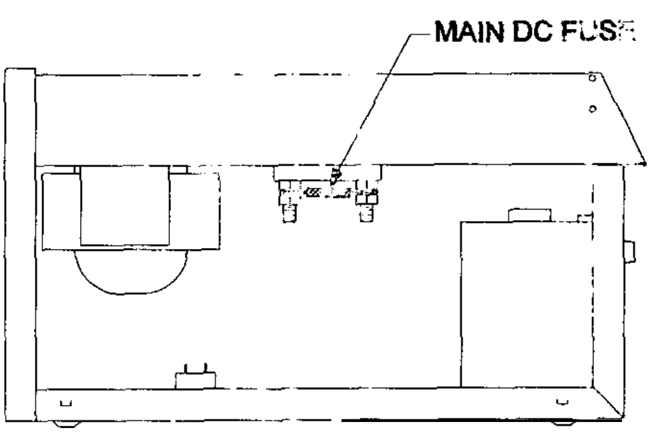
201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse. See Figure 2 on the next page for 500, TOO, and 850VA models; for 1.15 and 1.4 KVA models, see Figure 3.

⚠ WARNING

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

500,700, and 850 VA Models



Note: On some 500-850VA models, the fuse is [illegible]

Figure 2

1.15 and 1.4 KVA Models

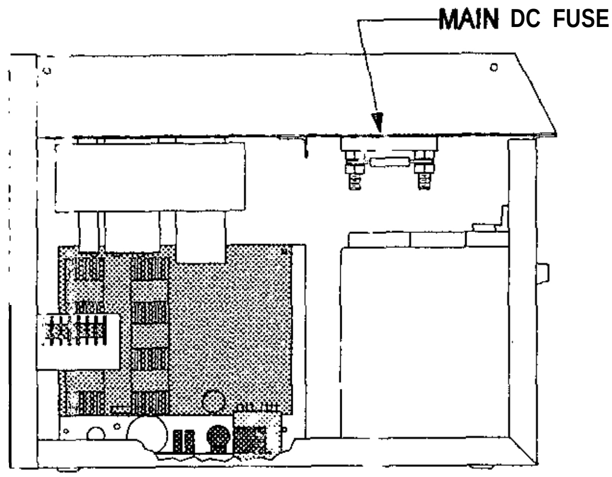


Figure 3

203. [illegible] the nuts that hold the DC fuse in place and slide the fuse off the bolts. Do not [illegible] nuts or the cables.

Section 300: Replacing the DC Fuse

301. Slide the new fuse in place. **Make sure the fuse connectors are next to the other cable connectors; do not put a washer in between the fuse and cable connectors.** See Figure 4 below.

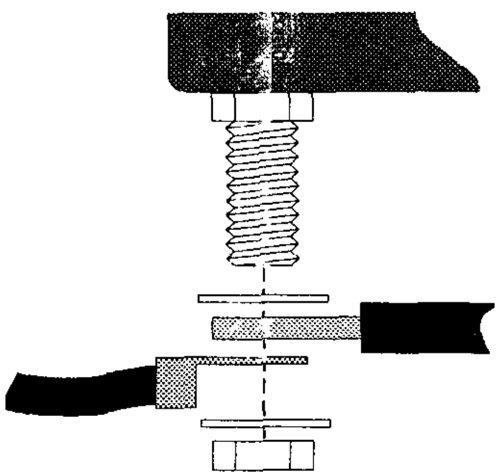


Figure 4

Section 400: Putting the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back into the top of the *UPS* and tighten *the screw*

404. Reapply all AC power to the UPS. If the UPS has external batteries, turn the DC Disconnect switch on or reconnect the UPS to the battery cabinet. (Units with an internal battery should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Replacing the Standard Internal Battery in FERRUPS®
FE and QFE 500 – 850 VA Models

This Technical Information Publication (TIP) explains how to replace the standard internal battery in FE and QFE 500-850 VA models. A qualified service person familiar with the FERRUPS unit must replace the standard internal batteries. If you encounter any problems duringthis procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), **I-608-565-2** 100, or call your local Best Power office.

Tools Needed — Use Insulated Tools:

7/16-inch Open End Wrench or Nutdriver
Safety Equipment Required by Local Codes
Masking Tape and Pen to Label Wires
Phillips Screwdriver
Torque Wrench Calibrated to In/lbs or N/m
Electrical Tape

CAUTION!

This procedure must be performed by a qualified service person. FERRUPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the *FERRUPS User Manual*. Make sure that the FERRUPS batteries and AC input are off or disconnected before you replace the standard internal battery.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe **damage to theelectricalcircuitry.**

FERRUPS batteries are higb current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:
A) Remove rings, watches, and other jewelry before servicing the FERRUPS unit.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover off, electric shock is possible; follow all local safety codes.

Contents Table

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FAX: 608-565-2221 • Service FAX: 608-565-2509

Section 100: Removing the Cover from the UPS

101. Shut down all load equipment plugged into (or hardwired to) the UPS.

> **CAUTION!**
>
> **Make sure the On**/Off **(I/O)** switch on the back of the UPS is **turned to Off (0), and make sure all AC and DC power to the unit is off.**

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

133. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1.)

104. Next, fmd the sticker in the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105. Slide the cover forward until it is completely off the UPS.

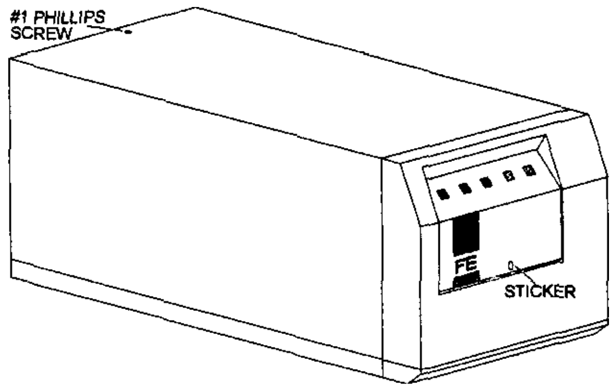

Figure 1

Section 200: Removing the Standard Internal Battery

201. Using a 7/16-inch wrench or nutdriver, remove the battery brackets holding the battery to the front of the unit the battery. (See Figure 2.)

202. Label each cable with its battery connection (+ or -) to guide you when you install the new battery.

203. Disconnect the battery. Remove the negative (-) cable first. Tape the cable end with electrical tape to prevent contact with the battery or components in the unit. Then, disconnect the positive (+) cable.

Remove nuts holding the battery brackets

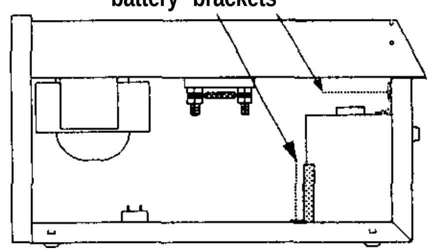

Figure 2

> **CAUTION!**
>
> **Use proper safety and lifting procedures when removing the battery from the unit.**

204. Remove the battery from the unit.

Section 300: Replacing the Standard Internal Battery

301. Place the battery in the unit. Using torque wrench calibrated to 32 in/lbs (3.6 Newton-meters) and the labels which you attached earlier, reconnect the positive (+) cable to the battery first, then the negative (–) cable.

302. Reattach the battery brackets to the unit.

303. Dispose of the old battery properly. For information on proper battery disposal, call Best Power Worldwide Service at I-800-356-5737 or your local Best Power office.

Section 400: Placing the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back in the top of the UPS and tighten the screw.

404. Reapply AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Replacing the Standard Internal Battery in FERRUPS® FE and QFE 1.15 – 1.4 kVA Models

This Technical Information Publication (TIP) explains how to replace the standard internal battery in FE and QFE 1.150-1.4 kVA models. A qualified service person familiar with the FERRUPS unit must replace the standard internal batteries. If you encounter any problems during this procedure, please call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), 1-608-565-Z 100, or call your local Best Power office

Tools Needed — Use Insulated Tools:

7/16-inch Open End Wrench or Nutdriver	Phillips Screwdriver
Safety Equipment Required by Local Codes	Torque Wrench Calibrated to In/lbs or N/m
Masking Tape and Pen to Label Wines	Electrical Tape

CAUTION!

his procedure must be performed by a qualified service person. FERRUPS units are designed to provide power under a variet f operating conditions. Dangerous voltages may be present even if AC line **or** DC voltage is removed. **TEST BEFORE 'OUCHING!**

n off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Yom FERRUPS" in th *ERRUPS User Manual*. Make sure that the FERRUPS batteries and AC input are off or disconnected before you replace th tandard internal battery.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause seven damage to the electrical circuitry.

ERRUPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury , short circuit can cause a battery to explode.

lest **Power recommends the following for qualified service personnel servicing the FERRUPS unit:**

) **Remove rings, watches, and other jewelry before servicing the FERRUPS unit.**
) **Always wear protective clothing and eye protection and use insulated tools when working near batteries.**
) **Whenever you are servicing an energized unit with the cover off, electric shock is possible; follow all local safet codes.**

Contents Table

T-0776A

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PO. Box 280 • Necedah, Wisconsin 54646 U.S.A. • 608-565-7200
Toll-Free: 800-356-5794 • Service Toll-Free: 800-356-5737 (U.S.A. & Canada)
FAX: 608-565-2221. Service FAX: 608-565-2509

Section 100: Removing the Cover from the UPS

101. Shut down all load equipment plugged into (or hardwired to) the UPS.

> **CAUTION!**
>
> Make sure the On/Off (I/O) switch on the back of the UPS is turned to Off (0), and make sure all AC and DC power to the unit is off.

102. Turn off the UPS, If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. (See Figure 1.)

104. Next, find the sticker in the lower right comer of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker.

105. Slide the cover forward until it is completely off the UPS.

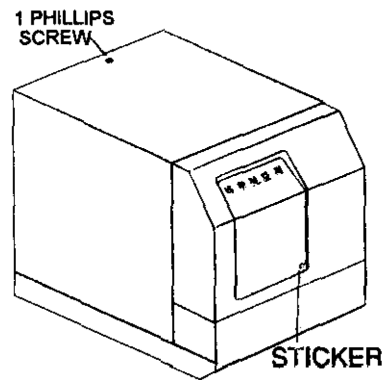

Figure 1

Section 200: Removing the Standard Internal Battery

201. Using an S-mm wrench or nutdriver, remove the battery brackets holding the battery in place. (See Figure 2.)

202. Label each cable with its battery connection (+ or -) to guide you when you install the new batteries.

203. Disconnect the battery. Remove the negative (–) cable first. Tape the cable end with electrical tape to prevent contact with the battery or components in the unit. Then, disconnect the positive (+) cable.

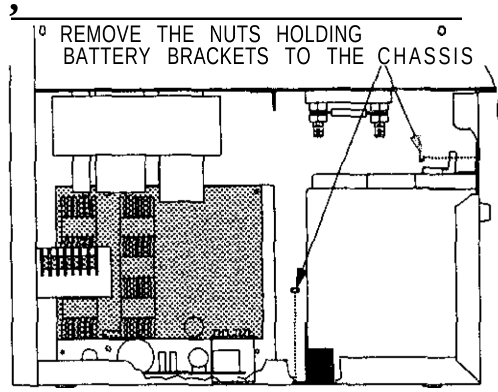

Figure 2

> **CAUTION!**
>
> Use proper safety and lifting procedures when removing **the battery from the unit.**

204. Remove the battery from the unit

Section 300: Replacing the Standard Internal Battery

301. Place the battery in the unit. Using a torque wrench calibrated to 32 in/lbs (3.6 Newton-meters) and the labels which you attached earlier, reconnect the positive (+) cable to the battery first, then the negative (–) cable.

302. Reattach the battery brackets to tba unit. (See Figure 2 above.)

303. Dispose of the old battery properly. For information on proper battery disposal, call Best Power Worldwide Service at 1-800-356-5737 or your local Best Power office.

Section 400: Placing the Cover on the UPS

401. Using the slide rails on each side of the unit, slide the cover on the UPS.

402. At the front of the UPS, tighten the screw in the lower right comer of the front panel with the BEST logo. Cover the screw with the round sticker you removed.

403. Put the screw back in the top of the UPS and tighten the screw.

404. Reapply AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Best Power
UNINTERRUPTIBLE
POWER SYSTEMS

TIP 777
35
November 17, 1994

Replacing the Temperature Probes in FE/QFE 500,700, and 850 VA Models

This Technical Information Publication describes how to identify a failed temperature probe and replace the ambient and PFM temperature probes in FE and QFE 500, 700, and **850** VA models. **If the heatsink temperature probe has failed, BEST does not recommend that you try to replace the probe; instead, replace the entire power hoard. (See TIP 730 for instructions.)** A qualified technician who is familiar with the FERRUPS unit must replace the temperature probes. If you encounter any problems during this procedure, please contact BEST's Technical Support Center at l-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers	Side Cutters	Paper and Pencil or Pen	Needlenose Pliers
Hand-held Remote Control Panel	Tie-Wraps	1/2-inch Open End Wrench	
Safety Equipment Required by Local Codes			

WARNING!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under **a variety** of **operating conditions.** Dangerous voltages **may be** present **even** if AC **line** or **DC** voltage is removed. **TEST BEFORE TOUCHING!**

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources: Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

BEST recommends the fallowing for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.

LPT-0777A

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Locating the Failed Temperature Probe

If you know which temperature probe has failed, skip this section and go on to Section 200. If the unit is sounding a "Probe Missing" alarm, you may not know which temperature probe has failed. To decide which probe has failed, you must program each temperature alarm parameter to "0." (Follow the steps below.) This disables the "Probe Missing" alarm for the related temperature probe. When the alarm stops, you have found the failed probe.

To follow the steps below, you need an optional control panel. You can also use a terminal or computer connected to the FERRUPS RS232 port and substitute terminal commands for the control panel key commands, See TIP 503 or your Service Manual for more information on FERRUPS commands and programming parameters.

101. Using the remote control panel, enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

102. Parameter 80 (AT Alarm) is the Ambient Temperature alarm setpoint

a. Display this parameter by pressing [DISPLAY] [8] [0] [ENTER]

b. Write down the parameter number and its setting.

c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the alarm stops, the ambient temperature probe caused the alarm; go to Section 200.

If not, the ambient temperature probe is not the cause. Program parameter 80 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "60."

103. Parameter 82 (HT Alarm) is the Heatsink Temperature alarm setpoint.

a. Display this parameter by pressing [DISPLAY] [8] [2] [ENTER].

b. Write down the parameter number and its setting

c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the alarm stops, the heatsink temperature probe caused the alarm **BEST does not recommend that you replace the probe alone; instead, see TIP 730 to replace the entire power board. Make sore you change parameter 82 back to its original setting.**

If the alarm did not stop when you changed the setting of parameter 82, the heatsink temperature probe is not the cause. Program parameter 82 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "95."

104. Parameter 86 (PF Alarm) is the PFM Temperature alarm setpoint.

a. Display this parameter by pressing [DISPLAY] [8] [6] [ENTER].

b. Write down the parameter number and its setting.

c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the Probe Missing alarm stops, the PFM temperature probe caused the alarm; go to Section 200.

If not, the PFM temperature probe is not the cause. Program parameter 86 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "85."

105. If none of the temperature probes seem to have caused the problem, you must replace the logic board. See TIP 732.

If the alarm stops when you change this parameter...	...this temperature probe has failed.	Go to...
Parameter 80	Ambient Temperature Probe	Section 200 of this TIP.
Parameter 82	Heatsink Temperature Probe	TIP 730 (to replace the power board).
Parameter 86	PFM Temperature Probe	Section 200 of this TIP.

Section 200: Removing the Cover and Disconnecting the Battery

201. Shut down all load equipment connected to the UPS and shut down the UPS.

WARNING

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. **Make** sure that the UPS' batteries and AC input are off or disconnected before you replace the temperature probe. Make **sure the** On/Off switch on the **back** of the UPS is OFF, and make sure all AC and DC power to the unit is off.

202. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

203. Remove the #1 Phillips screw on the top of the UPS. See Figure 1.

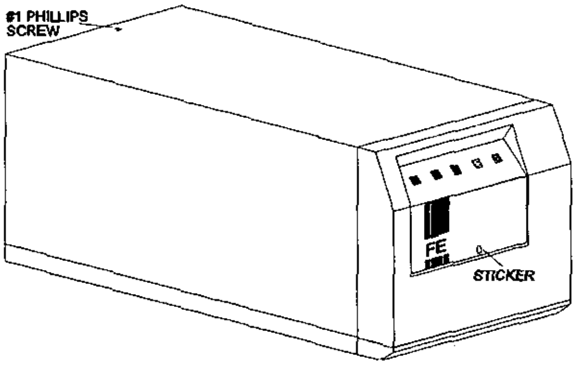

Figure 1

204. Next, find the sticker in the front panel with the BEST logo. Remove and save the sticker and loosen the screw behind the sticker by turning it counter-clockwise for only 5 to 8 turns. Now slide the cover forward until it is completely off the UPS.

Caution: Before you remove the temperature probe, you must disconnect the batteries by following steps 205 through 207 below. If you do not disconnect the batteries, voltage may be present inside the UPS.

205. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

206. Inside the UPS, find the main DC fuse shown in Figure 2 below.

WARNING!
As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

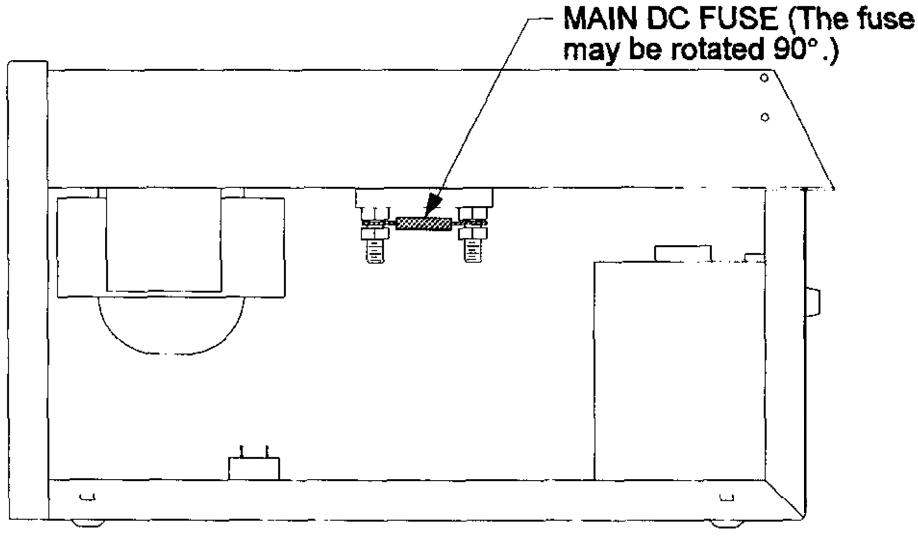

Figure 2

207. Using a 1/2-inch wrench or a 1/2-inch nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected. Tape the fuse end so it cannot contact other cable ends or the bolt.

208. Now, go to Section 300 to replace the ambient temperature probe or Section 400 to replace the PFM temperature probe.

Section 300: Replacing the Ambient Temperature Probe

301. The ambient temperature probe is mounted directly on **J4** on the logic board. To remove either probe, you must first move the PFM assembly out of the way. Figure 3 below shows the logic board, the PFM board, and the PFM capacitor.

> **WARNING**
>
> **As you move the PFM assembiy, do not iet it contact components on any circuit board. Do not contact the terminals on the PFM capacitor, and do not allow these terminals to contact the chassis or another component. Some voltage may be present across the capacitor terminals.**

The PFM assembly's bracket is held in place by two screws in each side of the unit (four total). **Hold the PFM assembly in place** as you remove the screws. Then, place a piece of insulating material on top of the power board (shown in Figure 3). Gently turn the PFM assembly upside-down and lay it on top of the insulated material. **Make** sure you **do not contact the capacitor terminals.**

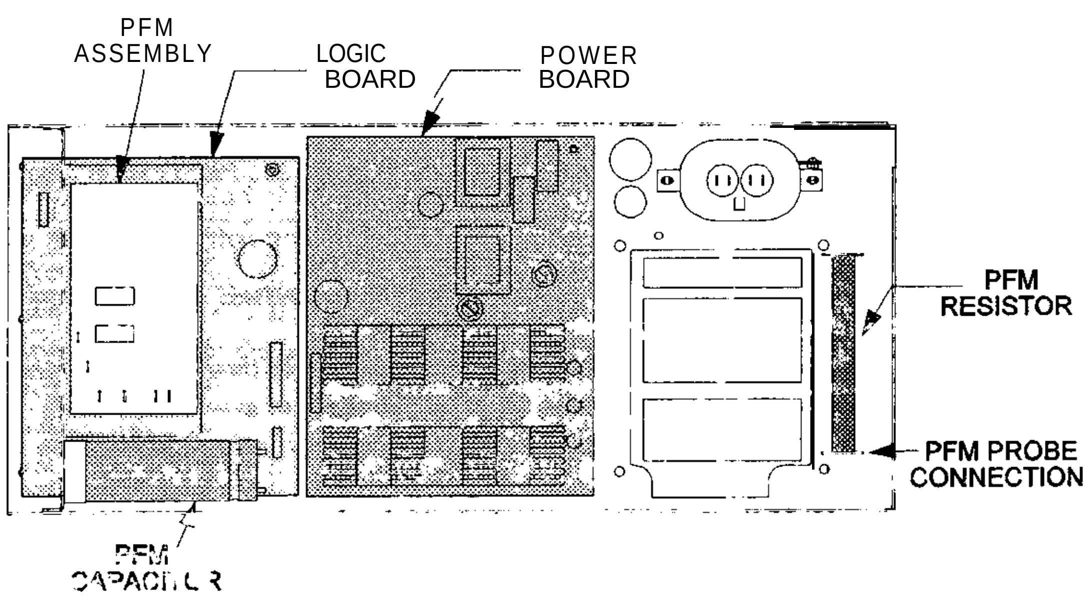

Figure 3

302. Now, find J4 on the logic board; Figure 4 on the next page can help you locate this connection point. Pull back slightly on the clip on one side of the connector, and lift the ambient temperature probe off the connector.

303. Notice. that one side of the new temperature probe has a lip on the bottom. This fits under the clip on J4. Place the new probe on J4 so the lip on the probe fits under the clip.

304. Put the PFM assembly back in place and use the four Phillips screws to attach the bracket to the sides of the unit. Remove the insulating material you placed over the power board.

LOGIC BOARD

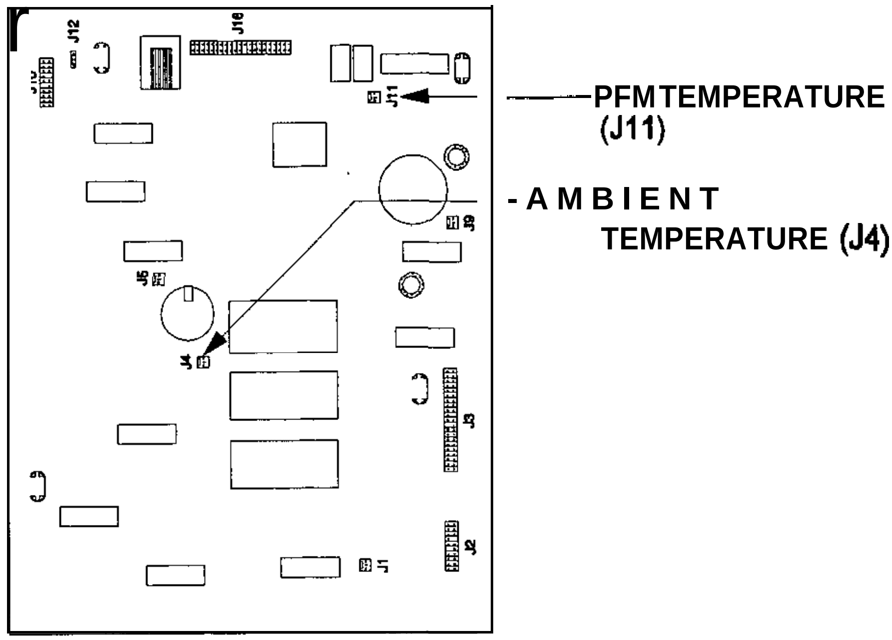

Figure 4

Section 400: Replacing the PFM Temperature Probe

401. The PFM temperature probe is bolted to one side of the PFM resistor. (See Figure 5 below.) Remove the Phillips screw that holds the probe to the PFM resistor, and remove the probe's ring connector from the screw. Put the washer, the nut, and the other wire from the logic board back on the screw for now,

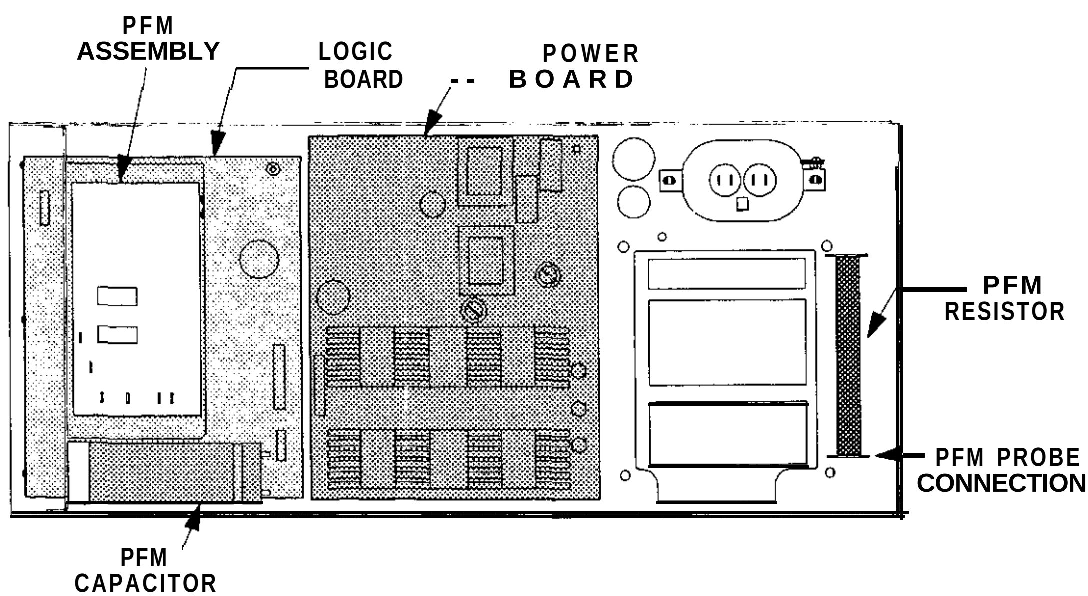

Figure 5

Being careful not to contact the PFM capacitor, remove the PFM temperature probe wires from the white clips on the side of the unit. Remove tie-wraps if necessary.

403. The PFM temperature probe is also connected to J1 1 on the logic board. (See Figure 4.) To remove the probe, you must first move the PFM circuit board (shown in Figure 5) out of the way. To do this, use needlenose pliers to press in the tab on each standoff that holds the PFM board in place. Lift the PFM circuit board and its insulating material off each standoff.

Move the PFM circuit board out of the way. Pull back **slightly** on the clip on one side of the connector, and lift the PFM temperature probe off the connector. Then, pull the old temperature probe wires out of the unit.

405. Connect the plug end of the new temperature probe wire to J1 1 on the logic board.

406. Make sure the insulating material is still around the PFM circuit board; then, position the insulating material and the circuit board over the standoffs, and press each comer until the circuit board snaps onto the standoffs.

407. Attach the ring connector on the other end of the temperature probe wires to the end of the PFM resistor. Tighten the Phillips screw. **Do not put the washer between the PFM temperature probe and the other wire from the logic board.**

408. Insert the wires back into the white clips on the side of the unit. If you removed tie-wraps, replace them.

Section 500: Reconnecting the Battery and Putting the Cover on the UPS

501. Remove the tape from the end of the DC fuse you disconnected; then, move the fuse back into place. **Make sure the fuse connector is next to the cable connector(s) on the bolt; do not put a washer between these connectors.** See Figure 6. Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

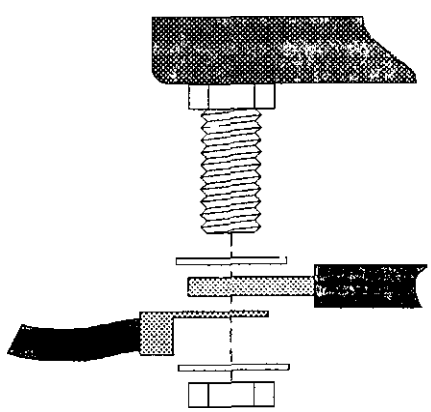

Figure 6

502. Remove all AC and external DC voltage from the UPS.

503. Slide the cover on the UPS using the slide rails on each side of the unit

504. Tighten the screw in the front panel and replace the sticker you removed in step 204 over the top of this screw.

505. Put the screw back into the top of the UPS and tighten the screw.

506. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

507. Startup the UPS.

508. Display parameters 80, 82, and 86, and make sure you have changed them back to their original settings, See Section 100 for more information on the default settings and displaying the parameters. You should have written down the original settings as you followed the steps in Section 100.

509. Connect all load equipment, and return the UPS to normal operation.

TIP 779
35
November 17, 1994

Replacing the Temperature Probes in FE/QFE 1.15 and 1.4 KVA Models

This Technical Information Publication describes how to identify a failed temperature probe and replace the ambient, transformer, and PFM temperature probes in FE and QFE 1.15 and 1.4 KVA models. **If the heatsink temperature probe has failed, BEST does not recommend that you try to replace the probe; instead, replace the entire inverter assembly. (See TIP 731 for instructions.)** A qualified technician who is familiar with the FERRUPS unit must replace the temperature probes. If you encounter any problems during this procedure, please contact BEST's Technical Support Center at 1-800-356-5737.

Tools Needed - Use Insulated Tools:

#1 and #2 Phillips Screwdrivers	Side Cutters	Remote Control Panel
Paper and Pencil or Pen	Tie-Wraps	1/2-inch Open End Wrench
Safety Equipment Required by Local Codes		

WARNING!

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, acd other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.

LPT-0778A

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P.O. Box 280 • Necedah, Wisconsin 54646 U.S.A. • 608-565-7200
Toll-Free: 800-356-5794 • Service Toll-Free: 800-356-5737 (U.S.A. & Canada)
FAX: 608-565-2221. Service FAX: 608-565-2509

Section 100: Locating the Failed Temperature Probe

If you know for certain which temperature probe has failed, skip this section and go on to Section 200. If your unit is sounding a "Probe Missing" alarm, you may not know which probe has failed. To determine which probe has failed, you must program each temperature alarm parameter to "0." (Follow the steps below.) This disables the "Probe Missing" alarm for the related temperature probe. When the alarm stops, you have found the failed probe.

To follow the steps below, you need an optional control panel. You can also use a terminal or computer connected to the FERRUPS RS232 port and substitute terminal commands for the control panel key commands. See TIP 503 or your Service Manual for more information on FERRUPS commands and programming parameters.

101. Using the remote control panel, enter the Service password by pressing [CLEAR] [PROGRAM] [2] [6] [3] [9] [ENTER].

102. Parameter 80 (AT Alarm) is the Ambient Temperature alarm setpoint.

   a. Display this parameter by pressing [DISPLAY] [8] [0] [ENTER]

   b. Write down the parameter number and its setting

   c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the alarm stops, the ambient temperature probe caused the alarm; go to Section 200.

   If not, the ambient temperature probe is not the cause. Program parameter 80 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "60."

103. Parameter 82 (HT Alarm) is the Heatsink Temperature alarm setpoint.

   a. Display this parameter by pressing [DISPLAY] [8] [2] [ENTER].

   b. Write down the parameter number and its setting

   c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the alarm stops, the heatsink temperature probe caused the alarm, **BEST does not recommend that you replace the probe alone; instead, see TIP 731 to replace the entire inverter assembly. Make sure you change parameter 82 back to its original setting.**

   If the alarm did not stop when you changed the setting of parameter 82, the heatsink temperature probe is not the cause. Program parameter 82 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "95."

104. Parameter 84 (XT Alarm) is the Transformer Temperature alarm setpoint

a. Display this parameter by pressing [DISPLAY] [8] [4] [ENTER]

b. Write down the parameter number and its setting

c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the Probe Missing alarm stops, the transformer temperature probe caused the alarm; go to Section 200.

If not, the transformer temperature probe is not the cause. Program parameter 84 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "75" for the 1.15 KVA and "70" for the 1.4 KVA.

105. Parameter 86 (PF Alarm) is the PFM Temperature alarm setpoint,

a. Display this parameter by pressing [DISPLAY] [8] [6] [ENTER].

b. Write down the parameter number and its setting.

c. Program the setting to "0" by pressing [PROGRAM] [0] [ENTER]. If the Probe Missing alarm stops, the PFM temperature probe caused the alarm; go to Section ZOO.

If not, the PFM temperature probe is not the cause. Program parameter 86 back to its original setting by pressing [PROGRAM] [original value] [ENTER]. At the factory, this parameter is set to "80."

106. If none of the temperature probes seem to have caused the problem, you must replace the logic board. See TIP 732.

If the alarm stops when you change this parameter...	. ..this temperature probe has failed.	Go to...
Parameter 80	Ambient Temperature Probe	Section 200 of this TIP.
Parameter 82	Heatsink Temperature Probe	TIP 730 (to replace the power board).
Parameter 84	Transformer Temperature Probe	Section 200 of this TIP.
Parameter 86	PFM Temperature Probe	Section 200 of this TIP.

Section 200: Removing the Cover and Disconnecting the Battery

201. Shut down all load equipment connected to the UPS and shut down the UPS

WARNING

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. **Make** sure that the UPS' batteries and AC input are off or disconnected before you replace the temperature probe. Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

202. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

203. Remove the #1 Phillips screw on the top of the UPS. See Figure 1.

204. Next, find the sticker in the lower right corner of the front panel with the BEST logo. Remove and save the sticker and loosen the screw behind the sticker by turning it counter-clockwise for only 5 to 8 turns. Now slide the cover forward until it is completely off the UPS.

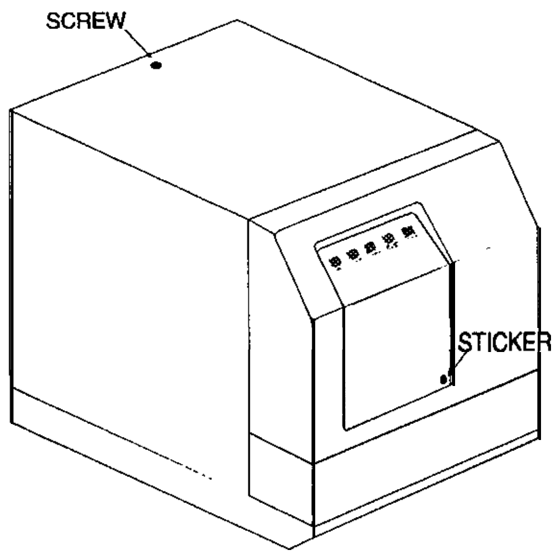

Figure 1

Caution: **Before you remove the temperature probe, you must disconnect the batteries by following steps 205 through 207 below. If you do not disconnect the batteries, the logic board probe may be damaged as you follow this procedure.**

205. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

206. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page.

WARNING!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

207. Using a 1/2-inch wrench or a 1/2-inch nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the battery terminal,

208. Now, go to Section 300 to replace the ambient temperature probe, Section 400 to replace the PFM temperature probe, or Section 500 to replace the transformer temperature probe.

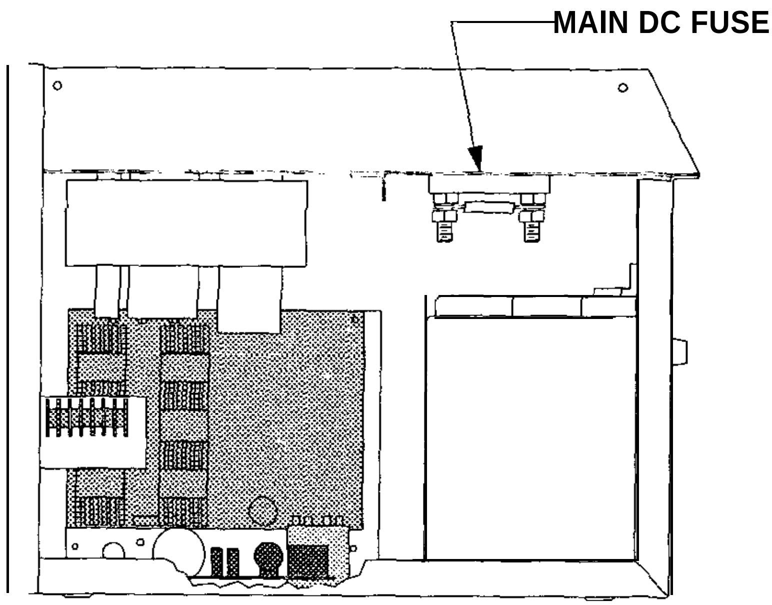

Figure 2

300 Replacing the Ambient Temperature Probe

301. The ambient temperature probe is mounted directly on J4 on the logic board, so you must be able to reach the logic ***board*** to remove the probe. On some models, the PFM ***circuit*** board is over the logic board (see Figure 3); in others, the PFM circuit board is next to the logic board (see Figure 4). If the PFM circuit board is **next to (not over)** the logic board, go on to step 302.

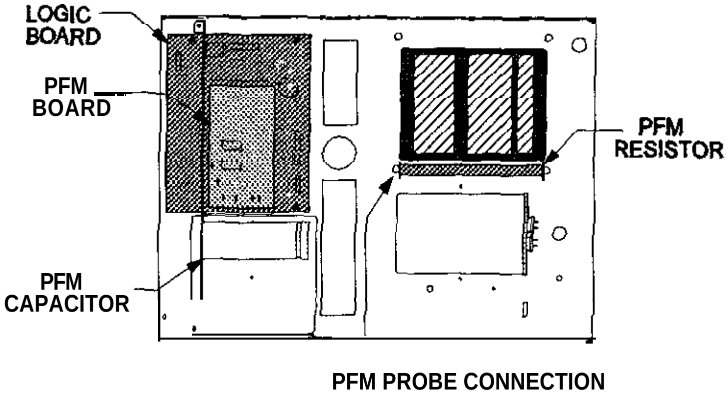

Figure 3

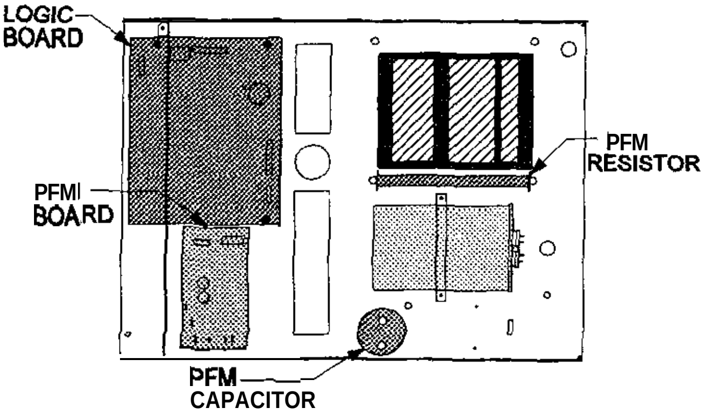

Figure 4

If the PFM circuit board is **over** the logic board, you must move the PFM assembly (the bracket, PFM circuit board, and PFM capacitor) out of the way.

WARNING

As you move the PFM assembly, do not let it contact components on any circuit board. Do not contact the terminals on the PFM capacitor, and do not allow these terminals to contact the chassis or another component. Some voltage may be present across the capacitor terminals.

The PFM assembly's bracket is held to the top of the chassis by two screws at the front of the unit. **Hold the PFM assembly in place** as you remove the screws. Then, gently lift the PFM assembly slightly, turn it upside-down and lay it on top of the transformer, PFM resistor, and tank capacitor, **making certain nothing can contact the PFM capacitor terminals.**

302. Find the fan on the inside of the FERRUPS' back panel. The ambient temperature probe is tie-wrapped to one bottom corner of the fan. Remove the tie-wrap. Next, follow the path of the two thin temperature probe wires up through the grommet and to the logic board. Remove tie-wraps wherever necessary.

303. Find J4 on the logic board; Figure 4 on the next page can help you locate this connection point. Grasp the plug connected to J4 at a point close to the logic board and lift it until it is free from the board.

304. Connect the plug end of the new temperature probe wire to J4 on the logic board

305. Route the wire down through the grommet behind the logic board and down to the clip on the bottom of the chassis (between the backfeed relay and the backfeed relay driver board), Connect the wires to the clip. Then, route the probe itself to the bottom corner of the fan, and tie-wrap the new probe to the fan.

306. If you moved the PFM assembly, put it back in place and use the two Phillips screws to attach the bracket to the top of the chassis.

307. Go to Section 600

400 Replacing the PFM Temperature Probe

401. The PFM temperature probe is bolted to one side of the PFM resistor. (See Figure 3 above.) Remove the Phillips screw that holds the probe to the PFM resistor and remove the probe's ring connector from the screw. Put the washer, the nut, and the other wire back on the screw for now.

402. Remove the tie-wraps that hold the two thin temperature probe wires to other wires and to the clip on the top of the FERRUPS chassis.

403. At the logic board, find J11 (shown in Figure 5 on the next page); grasp the plug connected to J1 1 and lift it until it is free from the board.

404. **Being careful not to contact the PFM capacitor,** remove the PFM temperature probe wires from the white clips on the side of the unit, and pull the wires out of the unit.

405. Connect the plug end of the new temperature probe wire to J1 1 on the logic board.

406. Attach the ring connector on the other end of the wires to the end of the PFM resistor. Tighten the Phillips screw. **Do not put the washer between the PFM temperature probe and the other wire from the PFM circuit board.**

Replace the tie-wraps that hold the temperature probe wires to the other wires and to the clip on the top of the FERRUPS chassis,

408. Go to Section 600.

LOGIC BOARD

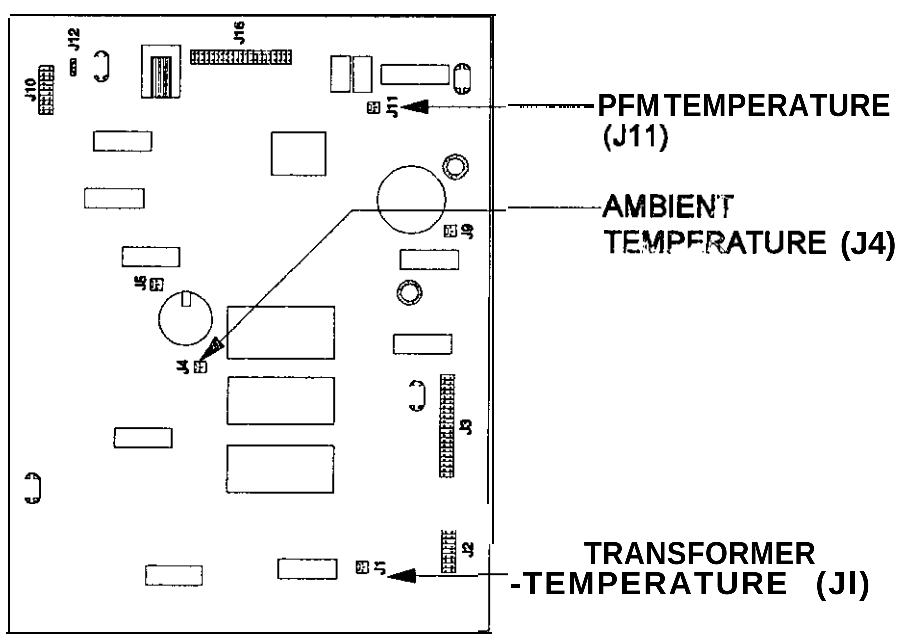

Figure 5

500 Replacing the Transformer Temperature Probe

501. The transformer temperature probe is bolted to one comer of the top of the transformer. Remove the nut from the transformer bolt and remove the temperature probe's ring connector from the bolt.

502. At the logic board, find J1 (shown in Figure 4 below). Grasp the plug connected to J1 and lift it until it is free from the board. Remove the transformer probe wires from the unit.

503. Connect the plug end of the new temperature probe wires to J1 on the logic board

504. Attach the ring connector on the other end of the wires to the comer of the transformer. Reattach the nut to secure the temperature probe and the transformer.

Section 600: Reconnecting the Battery and Putting the Cover on the UPS

601. Remove the tape from the end of the DC fuse you disconnected; then, move the fuse back into place. **Make sure the fuse connector is next to the battery cable connector on the bolt; do not put a washer between these connectors. See** Figure 6. Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

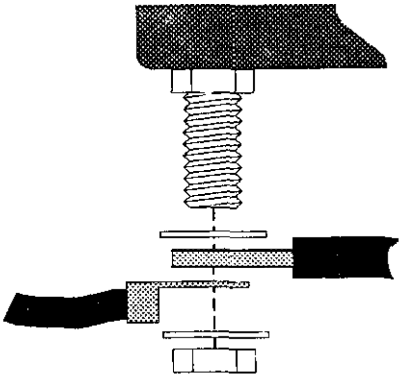

Figure 6

602. Slide the cover on the UPS using the slide rails on each side of the unit.

603. Tighten the screw in the lower right corner of the front panel and replace the sticker you removed in step 204 over the top of this screw.

604. Put the screw back into the top of the UPS and tighten the screw,

605. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

606. Startup the UPS,

607. Display parameters 80, 82, 84, and 86, and make sure you have changed them back to their original settings. See Section 100 for more information on the default settings and displaying the parameters. You should have written down the original settings as you followed the steps in Section 100.

608. Connect all load equipment and return the UPS to normal operation.

Best Power
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POWER SYSTEMS

TIP779
35
November 17, 1994

Replacing the Backfeed Relay and the Backfeed Relay Driver Board in FE and QFE 500,700, and 850 VA Models

This Technical Information Publication describes how to replace the backfeed relay and/or the backfeed relay driver board in FE and QFE 500,700, and 850 VA models. A qualified technician who is familiar with the FERRUPS unit must replace these parts. If you encounter problems during this procedure, please contact BEST's Technical Support Center at 1-800-356-5737.

Tools Needed - Use Insulated Tools

#1 and #2 Phillips Screwdrivers	1/2-inch Open End Wrench	Side Cutters
5/16-inch Nutdriver	Safety Equipment Required by Local Codes	Labeling Materials

WARNING

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the backfeed relay and/or backfeed relay driver board

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources: Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:
A) Remove rings, watches, and other jewelry before servicing the UPS.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries
C) Whenever you are **servicing** an energized unit **with the cover removed, electric shock is possible; follow all local safety codes.**

LPT-0779A

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1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. See **Figure 1.**

104. Next, find the sticker in the front panel with the BEST logo. Remove and save the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it.

105. Slide the cover forward until it is completely off the UPS.

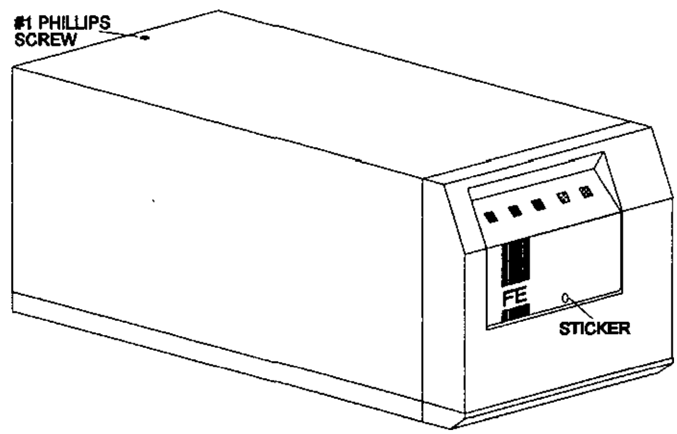

Figure 1

Section 200: Removing the Backfeed Relay and/or Backfeed Relay Driver Board

Caution: **Before you remove the backfeed relay or the driver board, you must disconnect the batteries by following steps 201 through 203 below. If you do not disconnect the batteries, the relay or hoard may be damaged when you remove and replace them.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page.

> **A WARNING!**
>
> **As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

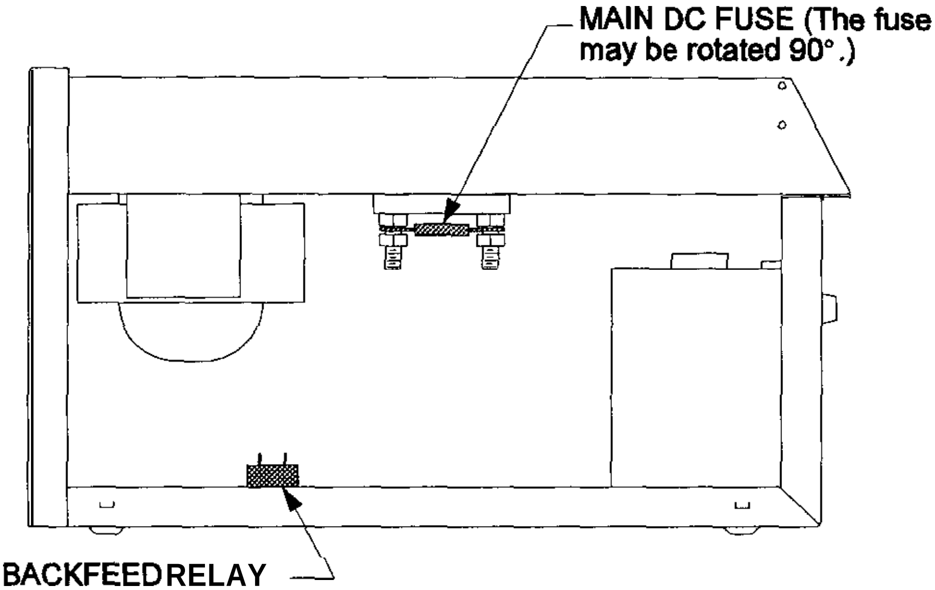

Figure 2

203. Using a 1/2-inch wrench or a 1/2-inch nutdriver, loosen both nuts at the DC fuse. Then, turn one end of the fuse out so it is disconnected. Tape the fuse end with electrical tape.

204. Find the backfeed relay and the backfeed relay driver board mounted on the bottom of the chassis toward the back of the unit. See Figure 2 to find the backfeed relay and Figure 3 to find the backfeed relay driver board.

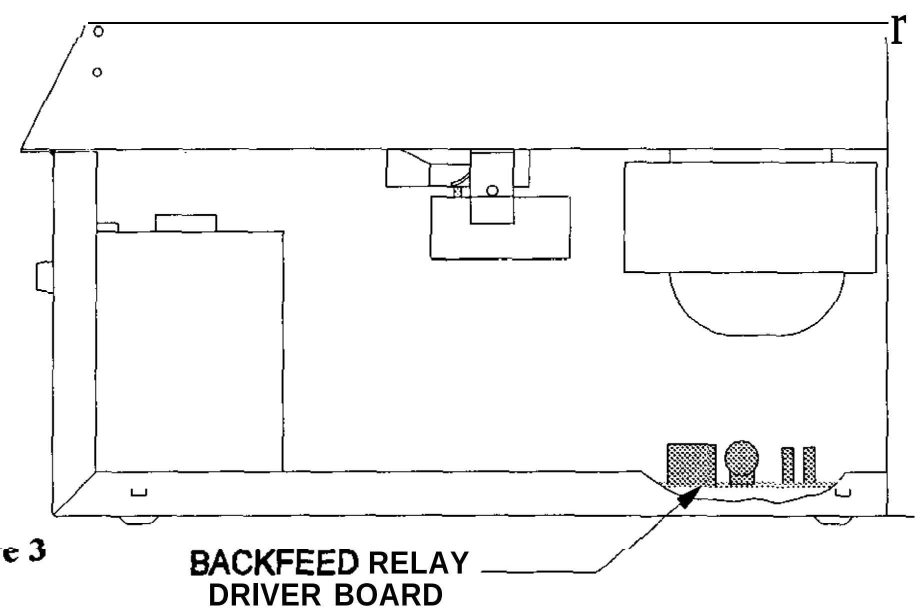

Figure 3

205. Notice that the terminals on the backfeed relay are number 0, 1, 2, 4, 6, and 8. Using masking tape or other labeling materials, label each wire connected to the relay with its terminal number. This will help you reconnect the wires correctly later.

206. Disconnect all wires from the backfeed relay.

207. Disconnect the plug (P1) from the backfeed relay driver board.

208. Next, try loosening the nut on the screws that hold the backfeed relay or the backfeed relay driver board in place.

If you can loosen the nut without the shaft (or standoff) moving, remove the nuts that hold the relay and/or the driver board in place and remove the relay and/or the board from the unit. Then, go to Section 300.

If the shaft or standoff **does** move, you must remove the battery from the unit and tip the unit on its side. Before you do this, read the battery warnings below.

WARNING

Full voltage and current are always present at the battery terminals. The batteries used in this system can produce dangerous voltages, extremely high currents, and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals as you remove the battery. Do not touch uninsulated battery terminals.

4 qualified technician who is familiar with battery systems and required precautions must remove the battery.

BEST recommends that you take these precautions:

1. Wear safety glasses with side shields, tubber gloves, electrical safety boots, and a safety apron. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the battery, and do not lay them where they could fall onto the batteries or into the cabinet.

Now, follow these steps:

a. Disconnect the battery cables from the battery and remove it from the unit.

b. Gently tip the unit on its side.

c. If you are replacing the backfeed relay, remove the Phillips screws that hold it in place and remove the relay from the unit.

d. If you are replacing the backfeed relay driver board, remove the Phillips screws that hold it in place and remove the board from the unit.

Section 300: Replacing the Backfeed Relay and/or Backfeed Relay Driver Board

30 1. If you removed the backfeed relay, put the new relay in place. Reattach it with the nuts or screws you removed.

302. If you removed the backfeed relay driver board, put the new board in place. Reattach the board using the nuts or screws you removed.

303. If you have tipped the unit on its side, gently turn the UPS upright.

304. If you have removed the battery from the UPS, put the battery in place and reconnect the battery; **do not connect the positive cable to the DC fuse at this time.**

> **WARNING**
>
> When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet. Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even **if the battery is moved.** Install the battery cables so they cannot be pinched by the battery cabinet or UPS doors.

305. Connect the plug (P1) to the backfeed relay driver board.

306. Reconnect the wires **you labeled to the correct backfeed relay** terminals. See Figure 4 below.

307. Move the DC fuse back into place. **Make sure the fuse connector is next to the other cable connector on the bolt; there should not be a washer in between.** (See Figure 5 on the next page.) Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to **the DC** fuse.

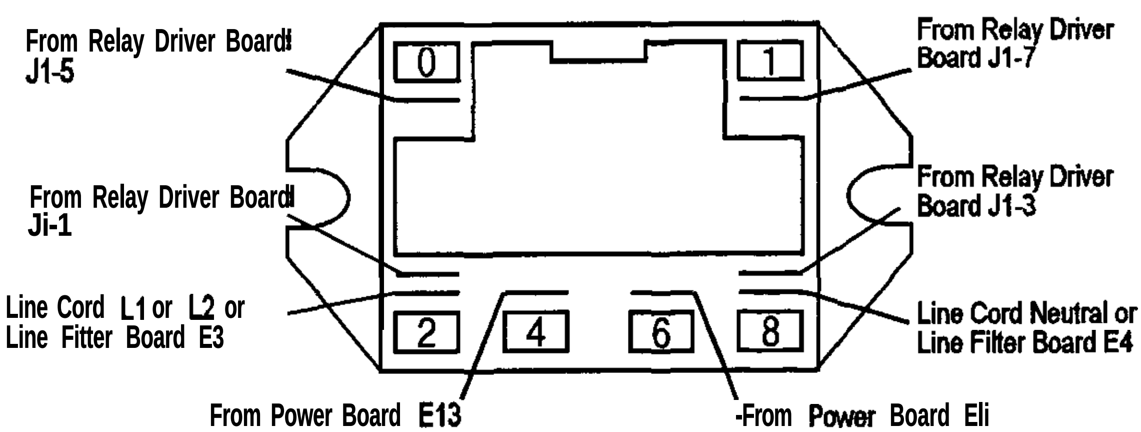

Figure 4

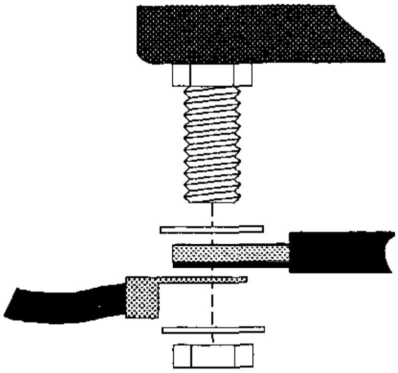

Figure 5

Section 400: Putting the Cover on the UPS

401. Slide the cover on the UPS using the slide rails on each side of the unit,

402. Tighten the screw in the front panel and replace the sticker you removed in step 104 over the top of this screw.

403. Put the screw back into the top of the UPS and tighten the screw.

404. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

Best Power
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OWER SYSTEMS

TIP780
35
November 17. 1994

Replacing the Backfeed Relay and the Backfeed Relay Driver Board in FE and QFE 1.15 and 1.4 KVA Models

This Technical Information Publication describes how to replace the backfeed relay and/or the backfeed relay driver board in FE and QFE 1.15 and 1.4 KVA models. A qualified technician who is familiar with the FERRUPS unit must replace these parts. If you encounter problems during this procedure, please contact BEST's Technical Support Center at l-800-356-5737.

Tools Needed - Use Insulated Tools

#1 and #2 Phillips Screwdrivers	1/2-inch Open End Wrench	Side Cutters
5/1 6-inch Nutdriver	Labeling Materials	1/4-inch Nutdriver
Safety Equipment Required by Local Codes		

WARNING

This procedure must be performed by a qualified technician ONLY! UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **TEST BEFORE TOUCHING!**

Turn off the UPS according to the procedure describing "How and When to Shut Down Your FERRUPS" in the FERRUPS User Manual. Make sure that the UPS' batteries and AC input are off or disconnected before you replace the backfeed relay and/or backfeed relay driver board.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

UPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

BEST recommends the following for qualified technicians servicing the UPS:

A) Remove rings, watches, and other jewelry before servicing the UPS.

B) Always wear proteetive clothing and eye protection and use insulated tools when working oear batteries.

C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible; follow all local safety codes.

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover

101. Shut down all load equipment plugged into (or hard-wired to) the UPS.

> **A WARNING**
>
> Make sure the On/Off switch on the back of the UPS is OFF, and make sure all AC and DC power to the unit is off.

102. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

103. Remove the #1 Phillips screw on the top of the UPS. See **Figure 1.**

104. Next, find the sticker in the lower right comer of the front panel with the BEST logo. Remove and save the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it.

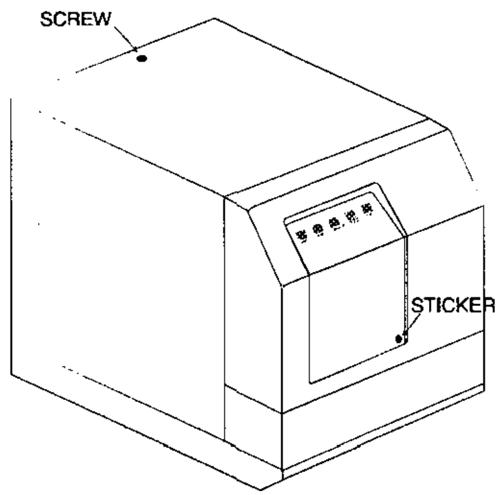

Figure 1

105. Slide the cover forward until it is completely off the UPS.

Section 200: Removing the Backfeed Relay and/or Backfeed Relay Driver Board

Caution: **Before you remove the backfeed relay or the driver board, you must disconnect the batteries by following steps 201 through 203 below. If you do not disconnect the batteries, the relay or board may be damaged when you remove and replace them.**

201. If the UPS has an external battery cabinet, you must turn off the DC Disconnect switch or unplug the connector between the UPS and the battery cabinet.

202. Inside the UPS, find the main DC fuse shown in Figure 2 on the next page

> **A WARNING!**
>
> **As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.**

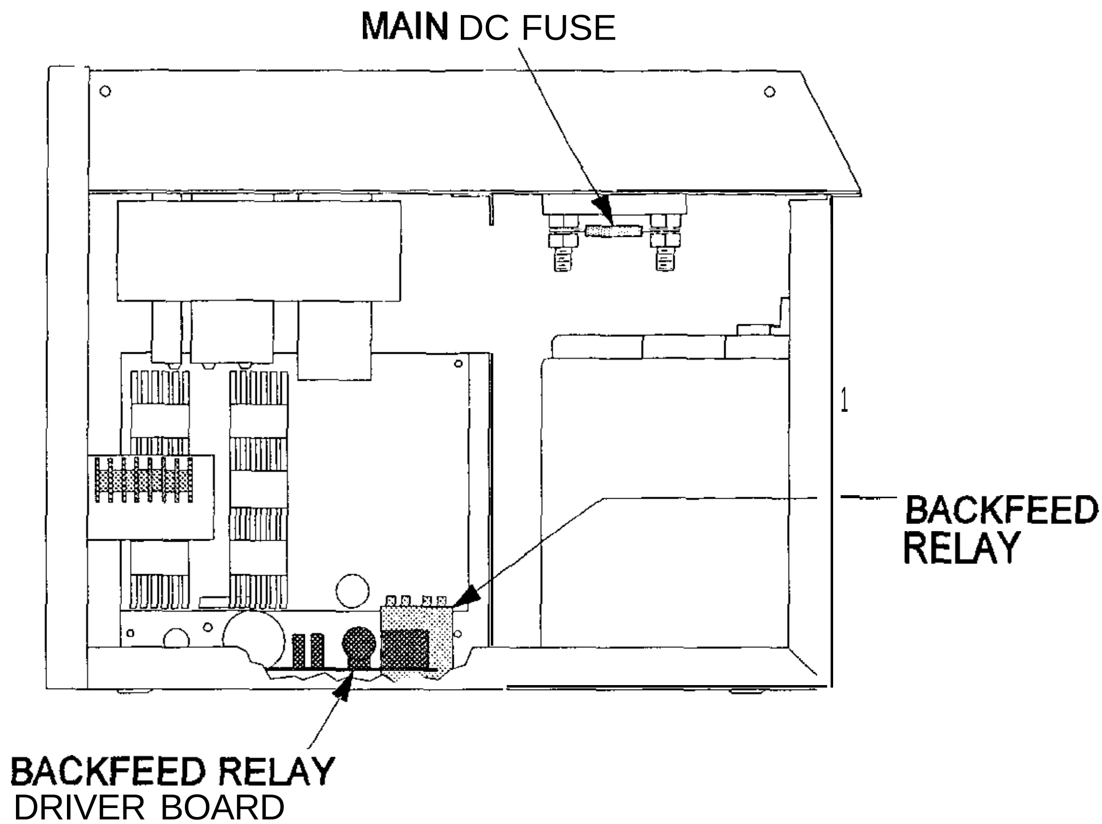

Figure 2

203. Using a 1/2-inch wrench or nutdriver, loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected. Tape the fuse end with electrical tape.

204 Find the backfeed relay and the backfeed relay driver board mounted on the bottom of the chassis toward the back of the unit. See Figure 2 to find the backfeed relay and the backfeed relay driver board.

205 Notice that the terminals on the backfeed relay are number 0, 1, 2, 4, 6, and 8. Using masking tape or other labeling materials, label each wire connected to the relay with its terminal number. This will help you reconnect the wires correctly later.

206. Disconnect all wires from the backfeed relay.

207. Disconnect the plug (P 1) from the backfeed relay driver board

208. If you are replacing the backfeed relay, use the S/16-inch nutdriver to remove the nuts that hold the relay on the bolts in the bottom of the chassis. Then, remove the relay from the UPS.

If you are replacing the backfeed relay driver board, use the 1/4-inch nutdriver to remove the two screws that hold the driver board to the bottom of the chassis. Then, remove the board from the UPS.

Section 300: Replacing the Backfeed Relay and/or Backfeed Relay Driver Board

301. If you removed the backfeed relay, put the new relay in place. Use the two nuts you removed to reattach the relay to the bolts in the bottom of the UPS.

302. If you removed the backfeed relay driver board, put the new board in place. Use the two screws you removed to attach the board and the standoffs to the chassis.

303. Connect the plug (P 1) to the backfeed relay driver board,

304. Reconnect the wires you labeled to the correct backfeed relay terminals. See Figure 3 below

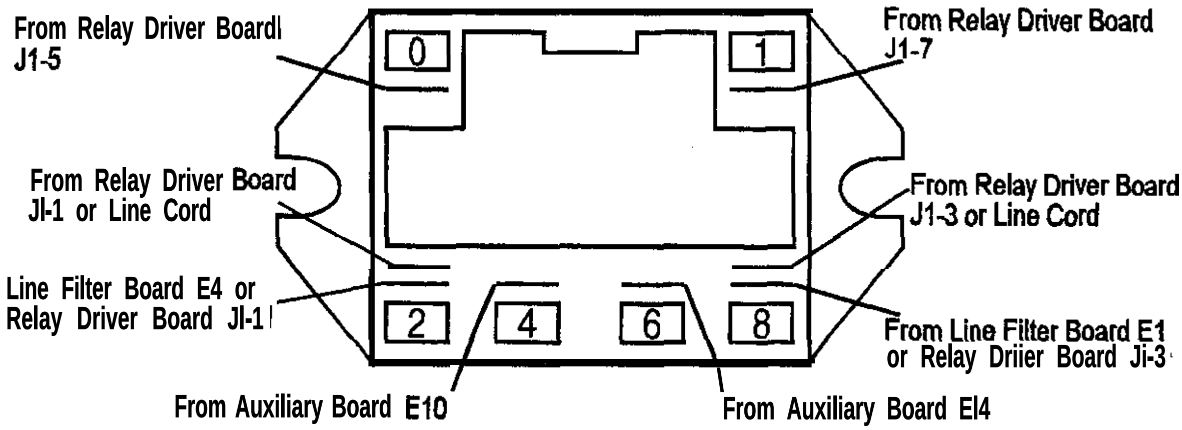

Figure 3

305. Remove the tape from the end of the DC fuse you disconnected; then, move the fuse back into place. **Make sure the fuse connector is next to the battery cable connector on the bolt; do not put a washer in between these connectors.** (See Figure 4.) Once the fuse is in position, use a 1/2-inch wrench to tighten the nuts that hold the cables to the DC fuse.

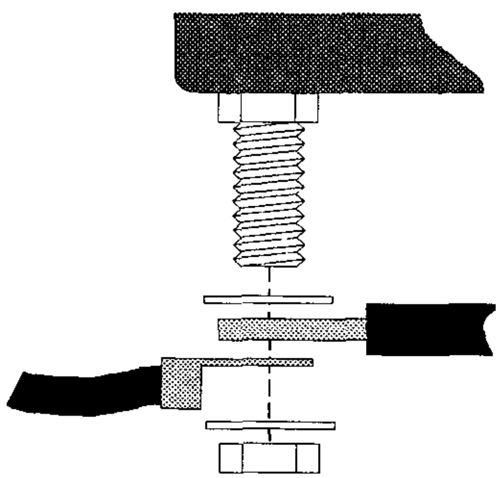

Figure 4

Section 400: Putting the Cover on the UPS

401. Slide the cover on the UPS using the slide rails on each side of the unit.

402. Tighten the screw in the lower right comer of the front panel and replace the sticker you removed in step 104 over the top of this screw.

403. Put the screw back into the top of the UPS and tighten the screw.

404. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

405. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

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(Q)TIP 709
5
February 17, 1997

Changing the Operating Voltage on the FERRUPS QFE 500–850 VA Models

This Technical Information Publication (TIP) describes the procedure to change the operating voltage in the QFE 500 to 850VA models. This publication is intended for use by a qualified service person familiar with the FERRUPS® QFE series unit. If you encounter problems at any time during this procedure, call Best Power Worldwide Service at l-608-565-2 100 or call your nearest Best Power office

Tools Needed-Use Insulated **Tools:**

Safety Equipment Required by Local Codes	Phillips Screwdriver	Shrink Tubing
Fluke 80i-410 Current Probe or Equivalent	True RMS AC Voltmeter	Needle-nose Pliers
Tie Wraps	Remote Control Panel	Wire Cutter

CAUTION!

This procedure must be performed by a qualified service person FERRUPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may he present even if AC lime or DC voltage is removed. TEST **BEFORE TOUCHING!**

Turn off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the FERRUPS' User Manual (Section 308). Make sure that the FERRUPS batteries and AC input are off or disconnected before you perform voltage changes.

This unit contains electrostatic-sensitive devices. If you do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

FERRUPS batteries are high current sources. Shorting battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:

A) Remove rings, watches, and other jewelry before servicing the FERRUPS unit.
B) Always wear protective clothing and eye protection and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover off, electric shock is possible; follow all local safety codes.

Make certain the UPS complies with all applicable electrical codes when you have finished changing the voltage.

T-0709A

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover from the UPS

CAUTION!
Make sure the On/Off (I/O) key on the front of the UPS is turned to OFF (O), and make sure all AC and DC power to the unit is off.

101. Shut down or bypass all load equipment. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

102. Remove the # 1 Phillips screw on the top of the UPS. (See Figure 1.)

103. Next, fmd the sticker in the lower right corner of the front panel with the BEST logo. Remove the sticker, and loosen the #2 Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker. (See Figure 1.)

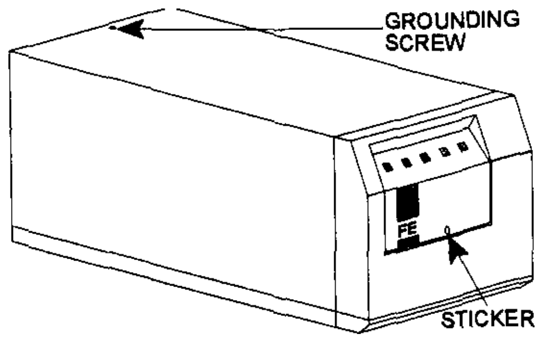

Figure 1

104. Slide the cover forward until it is completely off the UPS.

CAUTION! **Before you perform a voltage change, you most disconnect the batteries by following steps 105 through 107. If you do not disconnect the batteries, parts may be damaged as you perform the voltage change.**

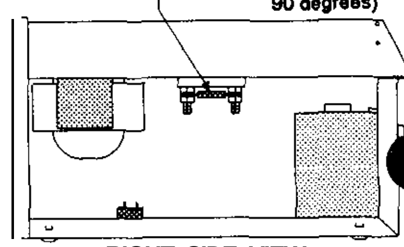

Figure 2

105. If your unit has an external battery cabinet, you must turn off the DC disconnect switch or unplug the connector between the UPS and the battery cabinet.

106. Inside the UPS, find the main DC fuse shown in Figure 2.

CAUTION!
As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

107 Use a 1/2-inch wrench or nutdriver to loosen both nuts connected to the DC fuse; then, turn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the battery cable.

Section 200: Changing the Operating Voltages

Find the power board at the top of the FERRUF'S. (See Figure 3 .)

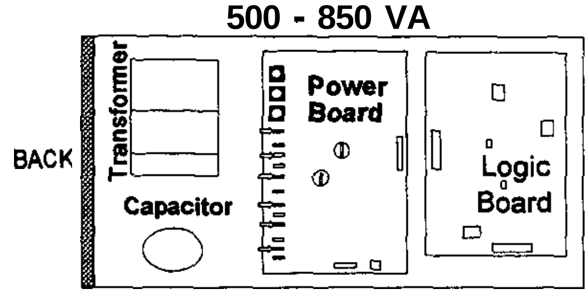

Figure 3

202. Remove the transformer lead from El4 on the power board. Find the AC Input voltage and the new Transformer Lead Number in Table 1. (The transformer leads that are not used are enclosed in an insulated covering and tied back to the transformer. Remove this covering to expose the transformer leads.) Connect this new transformer lead to E14. (See Figure 4 and Table 1.)

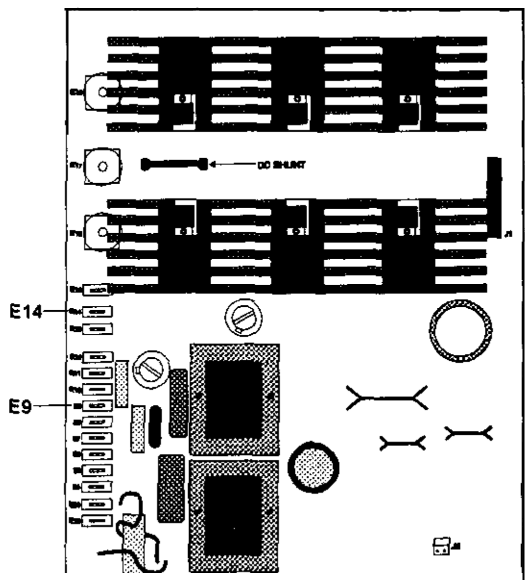

Figure 4

Table 1: Changing the Input Voltage, 50 Hz Models

AC Input	Transformer Lead Number	Power Board Connection
220 VAC	7	E14
230 VAC	6	E14
240 VAC	5	E14

For example: ***If the original input voltage was 220 VAC and the new voltage is 240 VAC, remove transformer lead #7 and connect transformer lead #5 in its place.***

203. Insulate the lead you disconnected with shrink tubing and position it so that it cannot contact any live terminals **or ground.** Fasten it in place with a tie wrap.

204. Remove the transformer lead from E9 on the power board. Find the AC Output voltage and the new Transformer Lead Number in Table 2 and connect this transformer lead to E9. (See Figure 4 on page 3 and Table 2 below.)

Table 2: Changing the Output Voltage, 50 Hz Models

AC Output	Transformer Lead Number	Power Board Connection
220 VAC	11	E9
230 VAC	12	E9
240 VAC	13	E9

For example: ***If the original input voltage was* 220 *VAC and the new voltage is 240 VAC, remove transformer lead #11 and connect transformer lead #13 in its place.***

205. Insulate the lead you disconnected with **shrink** tubing and position it so that it **cannot** contact any live terminals or ground. **Fasten** it in place with a tie **wrap**.

206. Make sure that the input and output voltage **terminal connections** are correct. Use Tables 1 and 2 as a guide.

Note: Good connections are ***essential.*** Tighten any **connections** that are loose by carefully pinching the **connector** tabs with the needle-nose pliers.

Section 300: Reconnecting DC to the UPS

301. Remove the tape from the disconnected end of the DC fuse; then, move the fuse back into place. Once the fuse is in position, **use** a **1/2-inch wrench or nutdriver** to tighten the nuts that hold the cables to the DC fuse.

Important: Make sure **the fuse connector** is next to the battery cable **connector** on the bolt; there should not be a washer in between. **(See** Figure 5.)

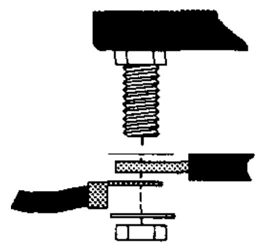

Figure 5

302. If your UPS has external batteries, **reconnect** it to the batteries or turn on the DC switch.

Section 400: Calibrating the FERRUPS Unit after the Voltage Change

Complete **the** voltage change procedure by calibrating the FERRUPS. You must recalibrate several parameters **to** match your new voltage configuration, To do this you will need a handheld Remote Control Panel or a terminal. The **steps** below arc **written** for a **remote** control panel. Refer to TIP 407 if you are using the **Remote** Control Panel and TIP 503 if you arc using the communications port and a terminal.

401. With the On/Off (l/O) key in the "OFF" (0) position, **connect** the UPS to the AC service which will supply the new operating voltage.

402. Tum the On/Off (I/O) key to the "ON" (I) position. The UPS should operate normally. A "High AC" output or "Low AC" output alarm may sound. This is normal. The alarm will stop when you recalibrate the **UPS.** To silence the alarm, press [CONTROL] **[5]** [ENTER] [ENTER]; the alarm will not sound, but the **alarm** will appear on the scrolling display until the unit is calibrated.

403. **Connect** the. handheld Remote **Control** Panel to the RS232 **interface** port on the back of the FERRUPS unit. You will usc the **Remote** Control Panel to **enter the** commands and parameter changes shown in the following **steps**.

404. From the **"=>"** prompt, **enter** the Factory password by pressing [PROGRAM] **[1] [8] [4] [7] [3] [ENTER]**

405. Apply a load to the FERRUPS unit. The load mast be 50% or more of the UPS KW rating.

406. If you changed the input voltage, you most calibrate parameters 43 and 1 by doing the following:

a. Display parameter 43 (Nom VIn) by pressing [DISPLAY] [4] [3] [ENTER]. Your old nominal input voltage should appear. To change this value, press [PROGRAM], enter the new nominal AC input voltage, and press [ENTER]. The Remote Control Panel should now display your new nominal AC input voltage.

b. Measure the input voltage with a true RMS voltmeter at "Nin" and "Lin" on the input terminal.

c. Next, display the input voltage by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value to your measurement by pressing [PROGRAM], entering your AC input voltage measurement, and pressing [ENTER].

407. If you changed the output voltage, you most change parameters 44, 2, and 4 by doing the following:

a. Display parameter 44 (Nom VOut) by pressing [DISPLAY] [4] [4] [ENTER]. Your old nominal output voltage should appear. To change this value, press [PROGRAM], enter the new nominal AC output voltage, and press [ENTER]. The Remote Control Panel should now display your new nominal AC output voltage.

b. Measure the AC output voltage. For plug-in models, measure at the output receptacles. For hardwired models, measure between output terminals "N" and "L 1".

c. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement. Press [PROGRAM], enter your output AC voltage measurement, and press [ENTER].

Note: Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you entered in parameter 44.

d. Measure the AC current by clamping the current probe around the two wires from "L" on the output terminal.

e. Next, display parameter 4 (I Out) on the control panel by pressing [DISPLAY] [4] [ENTER]. If your measurement do-es not match the value displayed for parameter 4, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC current, and pressing [ENTER].

408. Clear the Factory password by pressing [CLEAR] twice or until the message "Password Cleared" appears on the control panel display.

409. Clear the remote communication mode by pressing [CLEAR] and [.] at the same time. This will clear the port and allow you to use it for CheckUPS software or terminal communication.

410. Remove all AC and external DC power

Section 500: Putting the Cover on the UPS

501. Using the slide rails on each side of the unit, slide the cover on the UPS.

502. At the front of the UPS, tighten the screw in the lower right corner of the front panel. Cover the screw with the round sticker you removed. (See Figure 1 on page 2.)

503. Put the screw back in the top of the UPS and tighten the screw. (See Figure 1 on page 2.)

504. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

505. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

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(Q)TIP 716
5
February 17.1997

Changing the Operating Voltage on FERRUPS QFE 1.15 and 1.4 KVA Models

This Technical Information Publication (TIP) describes how to change the operating voltage in QFE 1.15 and 1.4 KVA models. This publication is intended for use by a qualified service person familiar with the FERRUPS® FE series tit. If you encounter problems at any time during this procedure, call Best Power Worldwide Service at l-608-565-2100 or call your nearest Best Power office.

Tools **Needed** – Use **Insulated** Tools:

- Remote Control Panel
- Safety Equipment Required by Local Codes
- Fluke 80i-4 10 Current Probe or Equivalent
- 5/16-inch and 7/16-inch Wrenches or Nutdrivers
- Wire Cutter
- #1 and #2 Phillips Screwdrivers
- True RMS AC Voltmeter
- Tie Wraps
- Shrink Tubing
- Needlenose Pliers

CAUTION!

This procedure must be performed by a qualified service person, FERRUPS units are designed to provide power under a variety of operating conditions, Dangerous voltages may be present even if AC line or DC voltage is removed. TEST BEFORE TOUCHING!

n off the FERRUPS unit according to the procedure describing "How (and When) to Shut Down Your FERRUPS" in the FERRUPS *User Manual* (Section 308). Make sure that the FERRUPS batteries and AC input are off or disconnected before you perform voltage changes.

This unit contains electrostatic-sensitive devices. lfyou do not follow proper ESD procedures, you may cause severe damage to the electrical circuitry.

FERRUPS **batteries are high current sources. Shorting** battery terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

Best Power recommends the following for qualified service personnel servicing the FERRUPS unit:

A) **Remove rings, watches, and** other jewelry **before servicing the FERRUPS unit.**
B) **Always wear protective clothing and eye protection and use insulated tools when working near batteries.**
C) **Whenever you are servicing an energized unit with the cover off, electric shock is possible: follow all local safety codes.**

Make certain the UPS complies with all applicable electrical codes when you have fmished changing the voltage.

T-0716A

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

Section 100: Removing the Cover from the UPS

CAUTION!

Make sure the **On/Off** (I/O) key on the **front** of the UPS is **turned** to OFF (0), and make sure **all** AC and DC power to the **unit** is off.

101. Turn off the UPS. If the UPS has an AC input plug, unplug it. If not, make sure the unit cannot receive AC power.

102. Remove the **#1** Phillips screw on the top of the UPS. (**See** Figure 1.)

103. Next, fmd the sticker in the lower right corner of the **front** panel with the BEST logo. Remove the sticker, and loosen the **#2** Phillips screw behind the sticker 5 or 6 turns to loosen (but not remove) it. Save the sticker. (See Figure 1.)

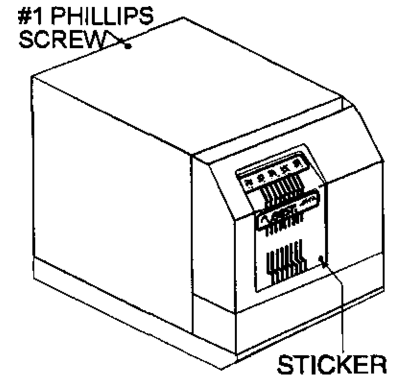


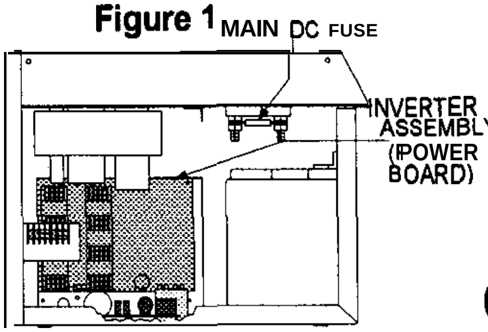
Figure 1

104. Slide the cover forward until it is completely off the UPS.

CAUTION! **Before you perform a voltage change, you most disconnect the batteries by following steps 105 through 107. If you do not disconnect the batteries, parts may be damaged as you perform the voltage change.**

105. If your unit has an external battery cabinet, you must torn off the DC disconnect switch or unplug the connector between the UPS and the battery cabinet.

106. Inside the UPS, fmd the main DC fuse shown in Figure 2.



RIGHT SIDE VIEW
(COVER REMOVED)

Figure 2

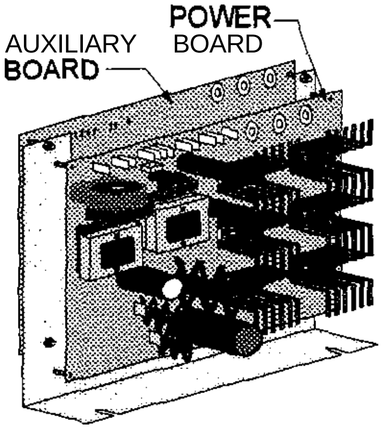
CAUTION!

As you follow the next step, be careful not to contact any battery terminals with tools or with the cable terminal. Use insulated tools.

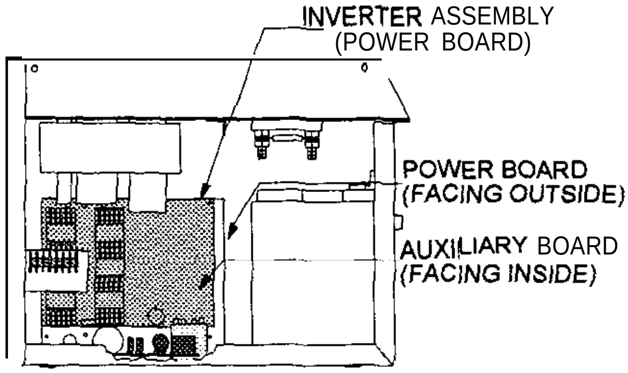
107. Use a **1/2-inch** wench or nutdriver to loosen both nuts connected to the DC fuse; **then,** torn one end of the fuse out so it is disconnected from the battery. Tape the fuse end so it cannot contact the **battery** cable.

Section 200: Changing the Operating Voltage

201. Find **the auxiliary board in the FERRUPS unit. The auxiliary board and the power board are** part of the same assembly. (See **Figure** 3.) The power board faces the outside of the unit, and the auxiliary board faces the inside of the unit. (See Figure 4.)



POWER BOARD ASSEMBLY
Figure 3



RIGHT SIDE VIEW
(COVER REMOVED)
Figure 4

202. Refer to Figure 5 and Table 1 on the *next page to change the* input voltage of the LJPS. Remove the transformer leads from E6, E7, and E8 on the auxiliary board. Find the AC Input voltage and the new Transformer Lead Numbers from Table 1 and place the transformer leads on the appropriate auxiliary board terminals for the new voltage.

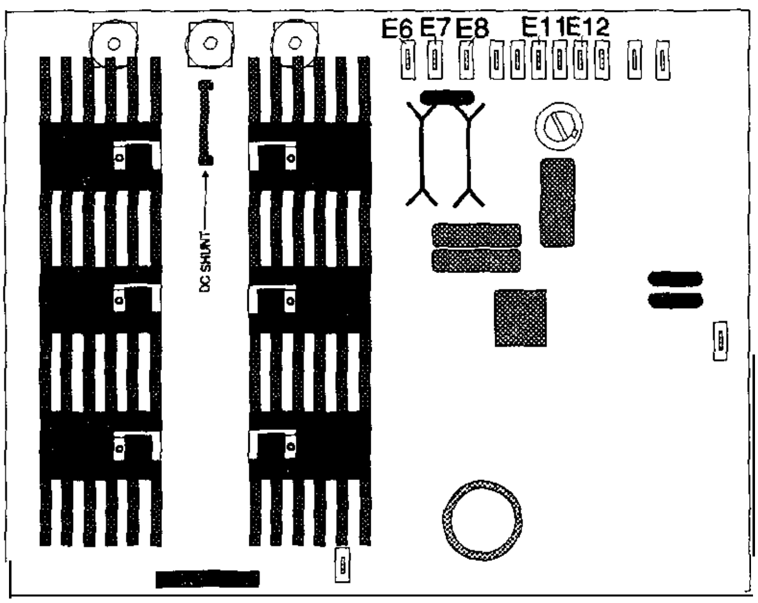


Figure 5 Auxiliary Board

Table 1: Input Voltage Connections; Auxiliary Board

AC Input	Transformer Lead Numbers	AUXILIARY Board Connection
220 VAC	7	E6
	5	E7
	6	E8
230 VAC	6	E6
	5	E7
	7	E8
240 VAC	5	E6
	6	E7
	7	E8

For *example: If the original input voltage was 220 VAC and the new voltage is 240 VAC, transformer lead #5 goes to auxiliary E6, transformer lead #6 goes to auxiliary E7, and transformer lead #7 goes to auxiliary E8.*

203. Insulate the leads you removed with shrink tubing and position them so that they cannot contact any live terminals or ground. Fasten these leads in place with a tie wrap.

204. Refer to Table 2 to change the output voltage. Remove the transformer leads from E9 on the power board (see Figure 6 on the next page) and El 1 and El2 on the auxiliary board (see Figure 5 on page 3). Find the AC Output voltage and the new Transformer Lead Numbers in Table 2 and connect the transformer leads to the appropriate terminals.

Table 2: Output Voltage Connections; Power Board and Auxiliary Board

AC Output	Transformer Lead Numbers	Board Connection
220 VAC	11	E9 POWER Board
	12	E 11 AUXILIARY Board
	13	El2 AUXILIARY Board
230 VAC	12	E9 POWER Board
	11	El I AUXILIARY Board
	13	El2 AUXILIARY Board
240 VAC	13	E9 POWER Board
	11	El 1 AUXILIARY Board
	12	E12 AUXILIARY Board

For *example: If the original output voltage was 220 VAC and the new voltage is 240 VAC, transformer lead #11 goes to auxiliary E11, transformer lead #12 goes to auxiliary E12, and transformer lead # 13 goes to power E.9*

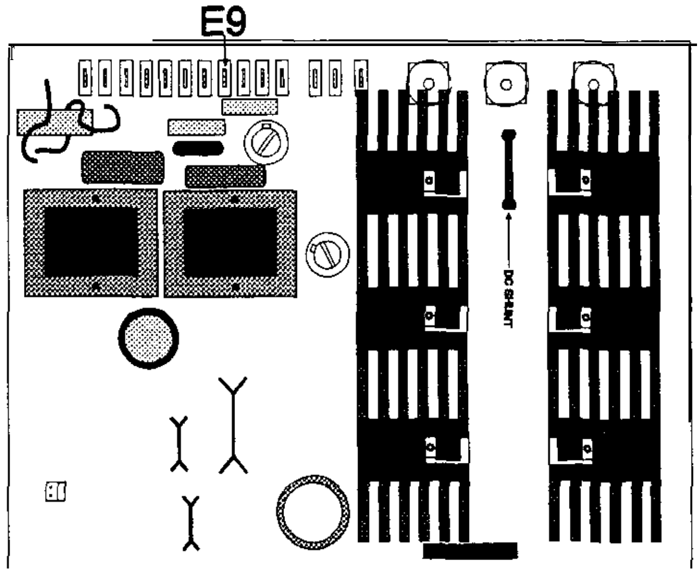


Figure 6 Power **Board**

205. Insulate the leads you removed with shrink tubing and position them so that they cannot contact any live terminals or ground. Fasten these leads in place with a tie wrap.

206. Check that the input and output voltage terminal connections are correct.

Note: **Good connections are essential.** Tighten any connections that are loose by carefully pinching the connector tabs with the needle-nose pliers.

Section 300: **Reconnecting DC Power to the UPS**

301. Remove the tape from the disconnected end of the DC fuse; then, move the fuse back into place. Once the fuse is in position, use a 1/2-inch wrench or nutdriver to tighten the nuts that hold the cables to the DC fuse.

Important: Make sure the fuse connector is next to the battery cable connector on the bolt; there should not be a washer in between. (See Figure 7.)

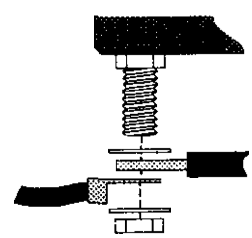


Figure 7

302. If your UPS has external batteries, reconnect it to the batteries or turn on the DC switch.

Section 400: Calibrating the FERRUPS Unit after the Voltage Change

Complete the voltage change procedure by calibrating the FERRUPS unit. You need to recalibrate several parameters to match your new voltage configuration. To do this you will need a handheld Remote Control Panel or a terminal. The steps below are written for a remote control panel. Refer to TIP 407 if you are using the Remote Control Panel or to TIP 503 if you are using the communications port and a terminal

401. With the On/Off (l/O) key in the "OFF" (0) position, connect the **UPS to the AC service which will supply the new operating voltage.**

402. Turn the On/Off (I/O) key to the "ON" (I) position. The UPS should operate normally. A "High AC" output or "Low AC" output alarm may sound. This is normal. The alarm will stop when you recalibrate the UPS. To silence the alarm, press [CONTROL] [5] [ENTER] [ENTER]; the alarm will not sound, but the alarm will appear on the scrolling display until the unit is calibrated.

403. Connect the handheld Remote Control Panel to the RS232 interface port on the back of the FERRUPS. You will use the Remote Control Panel to enter the commands and parameter changes shown in the following steps.

404. First, enter [CLEAR] [1] [2] [3] [DISPLAY]. /CONTROL] [PROGRAM] [ENTER]. Your control panel should display "FERRUPS BY BEST." Your controlpanel is now communicating with your FERRUPS.

405. Next, enter the Factory password by pressing [PROGRAM] [1] [8] [4] [7] [3] [ENTER].

406. Apply a load to the FERRUPS unit. The load must be 50% or more of the UPS KW rating.

407. If you changed the input voltage, you must calibrate parameters 43 and 1 by doing the following:

a. Display parameter 43 (Nom VIn) by pressing [DISPLAY] [4] [3] [ENTER]. Your old nominal input voltage should appear. To change this value, press [PROGRAM], enter the new nominal input voltage, and press [ENTER]. The Remote Control Panel should now display your new input AC voltage.

b. Measure the input voltage with a true RMS voltmeter at "Nin" and "Lin"on the input terminal.

c. Next, display the input voltage by pressing [DISPLAY] [1] [ENTER]. If your measurement does not match the value displayed for parameter 1, change the parameter value to your measurement by pressing [PROGRAM], entering your input AC voltage measurement, and pressing [ENTER].

408. If you changed the output voltage, you must calibrate parameters 44, 2, and 4 by doing the following:

a. Display parameter 44 (Nom VOut) by pressing [DISPLAY] [4] [4] [ENTER]. Your old nominal output voltage should appear. To change this value, press [PROGRAM], enter the new output AC voltage, and press [ENTER]. The Remote Control Panel should now display your new output AC voltage.

b. Measure the AC output voltage.

For plug-in models, measure at the output receptacles.

For hardwired models, measure between "L"and the appropriate "N" terminal for the output voltage selected. (See Figure 8 for the appropriate "N" terminal.)

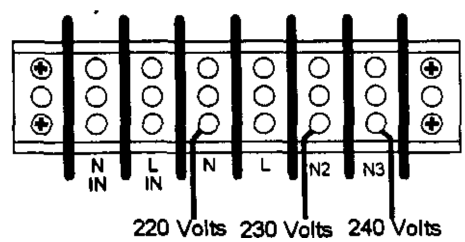


Figure 8

c. Next, display parameter 2 (V Out) on the control panel by pressing [DISPLAY] [2] [ENTER]. If your measurement does not match the value displayed for parameter 2, change the parameter value to your measurement by pressing [PROGRAM], entering your output AC voltage measurement, and pressing [ENTER].

Note: Make sure the measured value you enter into parameter 2 is acceptable for the nominal value you entered in parameter 44.

d Measure the AC current by clamping the current probe around the two wires from "L" of "LOAD OUT" on the output terminal.

e. Next, display parameter 4 (I Out) on the control panel by pressing [DISPLAY] [4] [ENTER]. If your measurement does not match the value displayed for parameter 4, change the parameter value to your measurement by pressing [PROGRAM], then entering your output AC current, and pressing [ENTER].

409. Clear the Factory password by pressing [CLEAR] twice or until the message “Password Cleared” appears on the control panel display.

410. Remove all AC and external DC power

Section 500: Putting the Cover on the UPS

501. Using the slide rails on each side of the unit, slide the cover on the UPS,

502. At the front of the UPS, tighten the screw in the lower right corner of the front panel. Cover the screw with the round sticker you removed. (See. Figure 1 on page 2.)

503. Put the screw back in the top of the UPS and tighten the screw. (See Figure 1 on page 2.)

504. Reapply all AC power to the UPS. If the UPS has external batteries, reapply DC power to the UPS. (Units with internal batteries should already have DC power applied.)

505. Startup the UPS, connect all load equipment, and return the UPS to normal operation.

SECTION 800

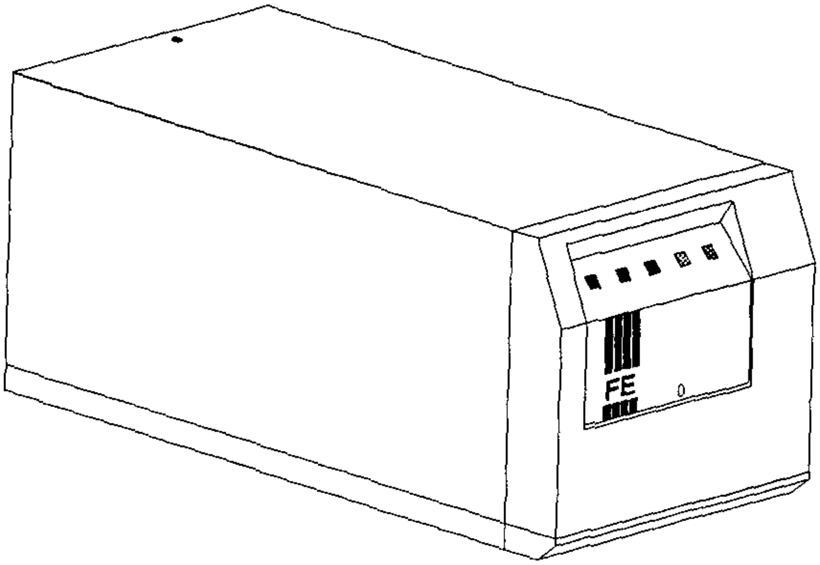
SECTION 800

Section 800 Pictorial Lavouts and Svstem Schematics

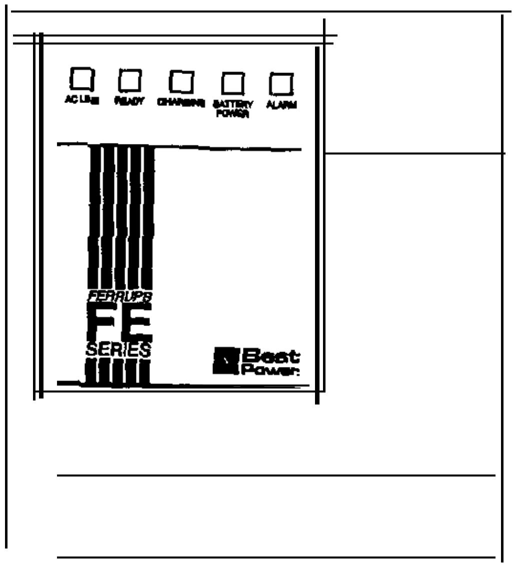
801 Unit Pictorials

Front Panel

500-850 VA

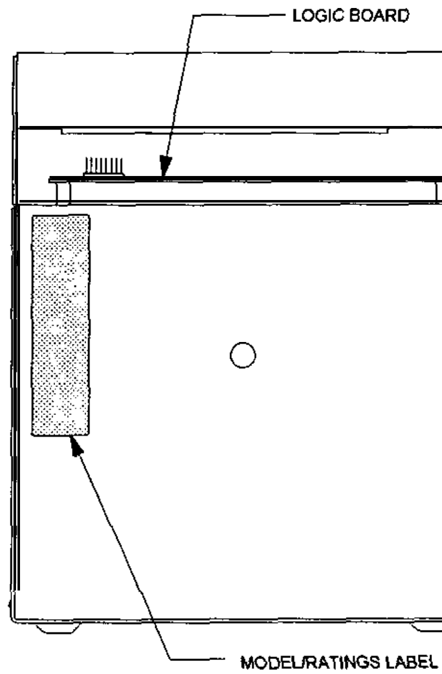


1.15 and 1.4 KVA

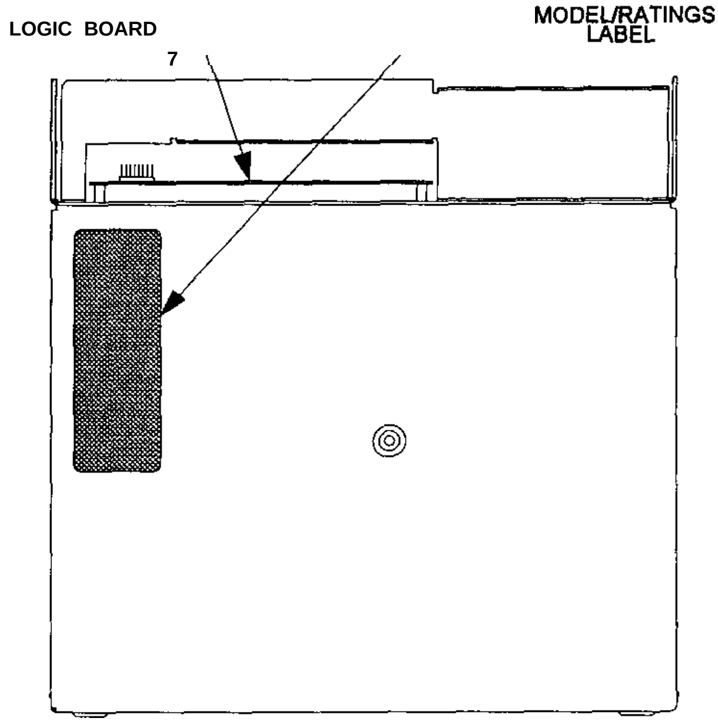


Front Panel (Cover Removed)

500,700, and 850 VA

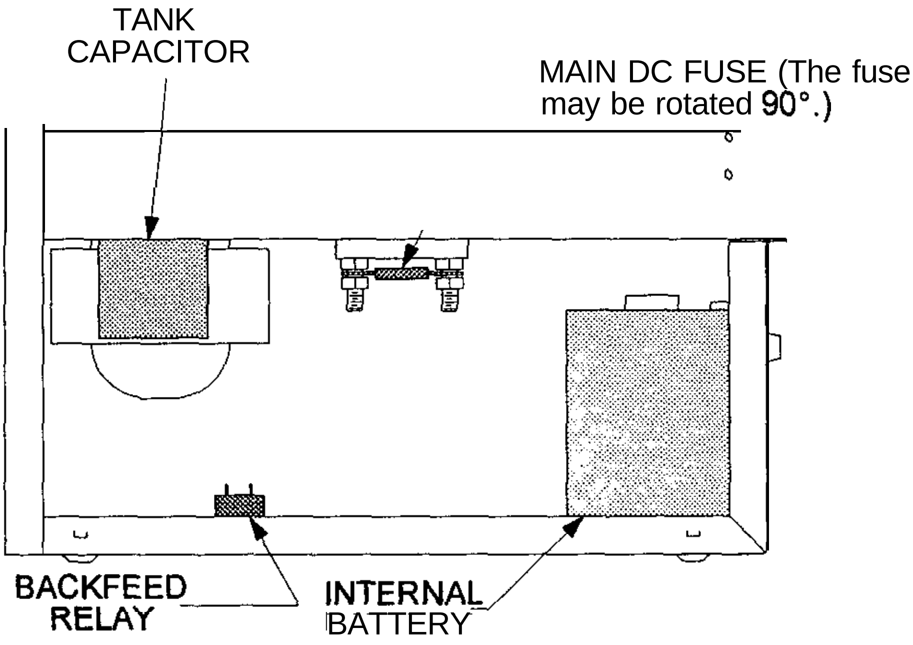


1.15 and 1.4 KVA

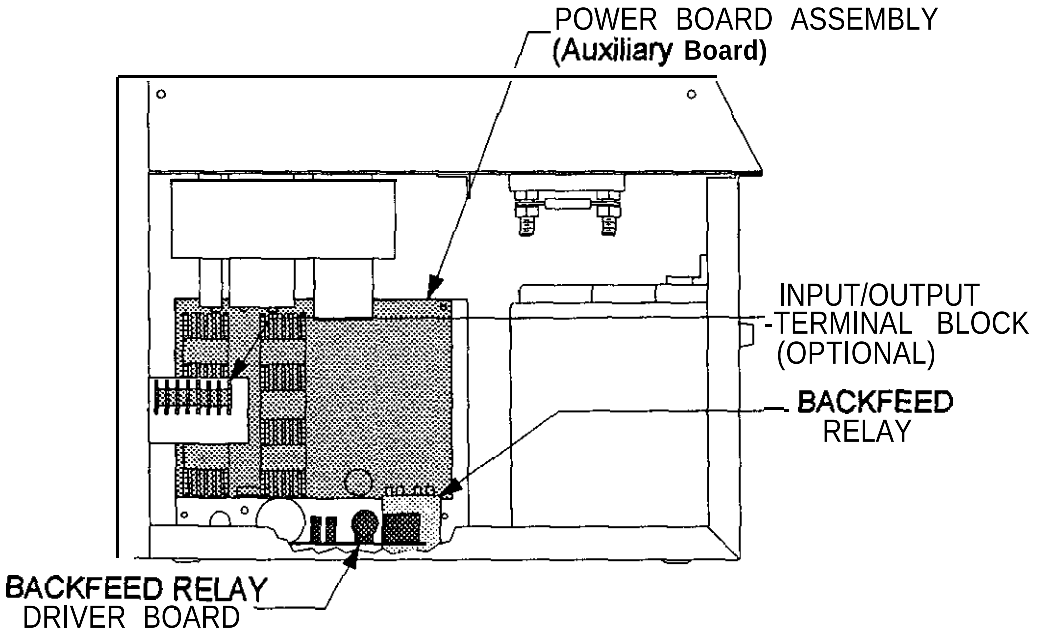


Right Side View (Cover Removed)

500,700, and 850 VA

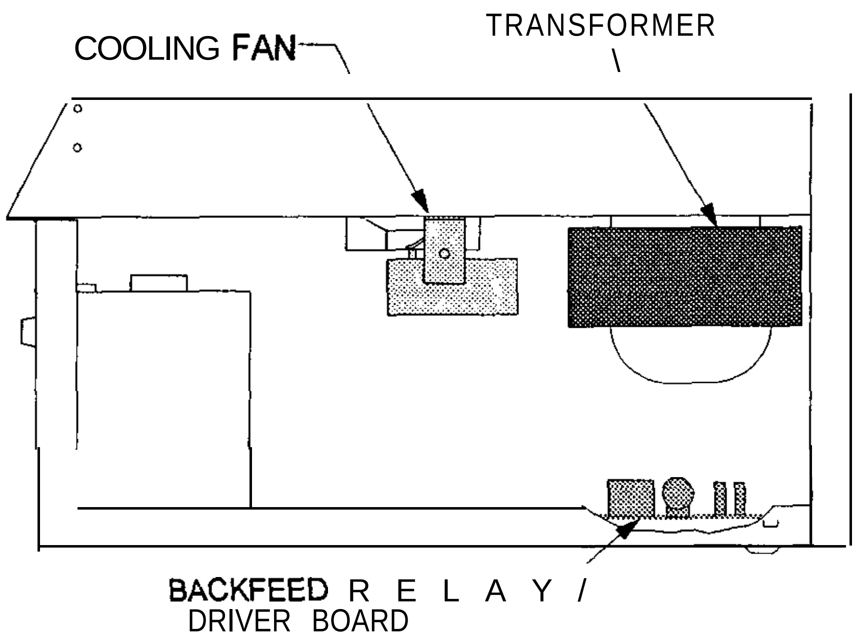


1.15 and 1.4 KVA

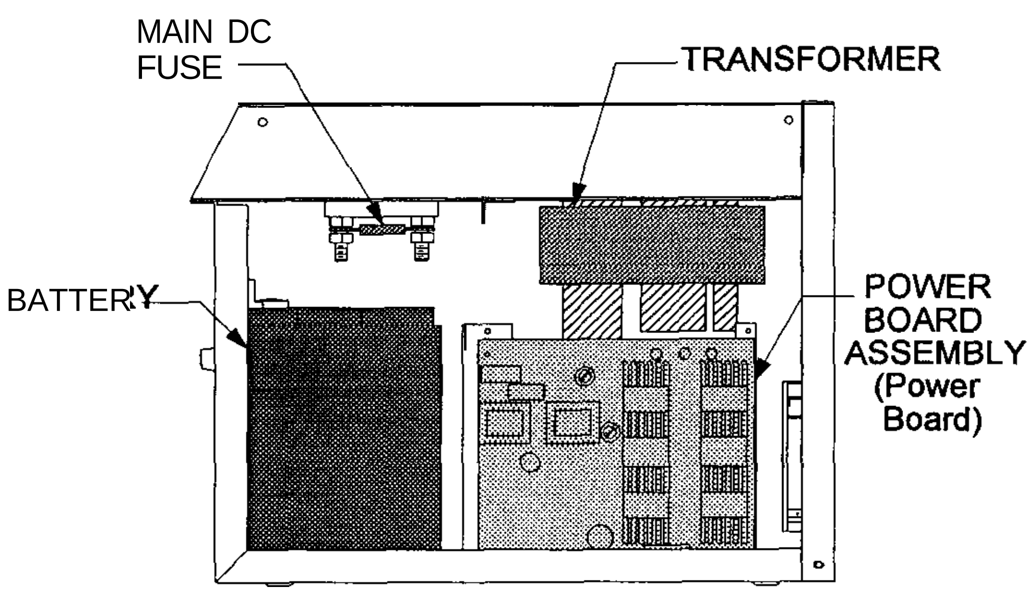


Left Side View (Cover Removed)

500,700, and 850 VA

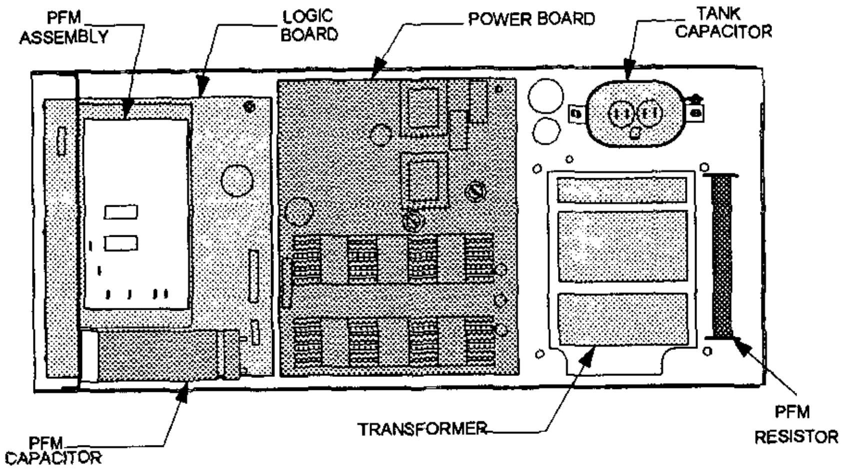


1.15 and 1.4 KVA

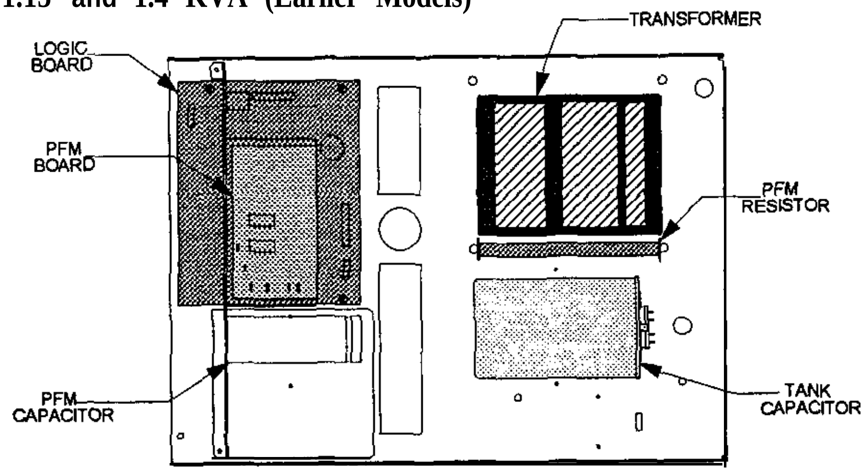


Top View (Panels Removed)

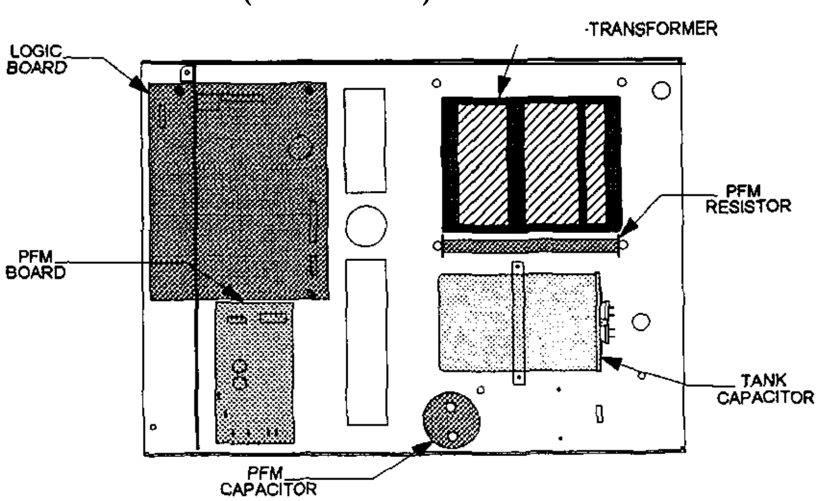
500,700, and 850 VA



1.15 and 1.4 KVA (Earlier Models)

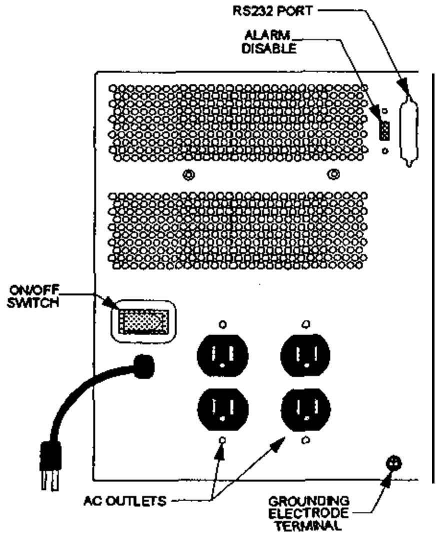


1.15 and 1.4 KVA (Later Models)

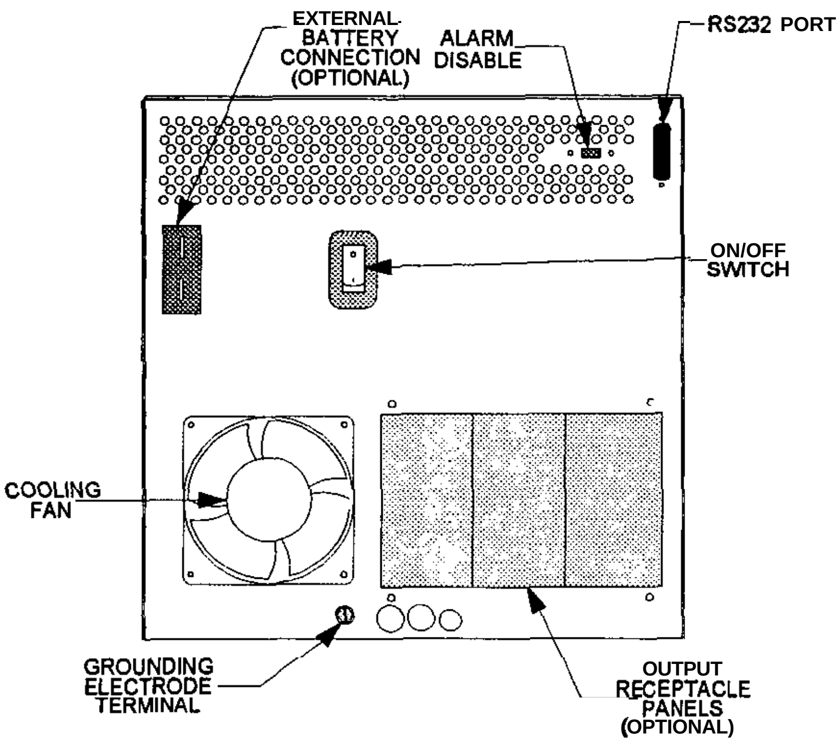


Back Panel

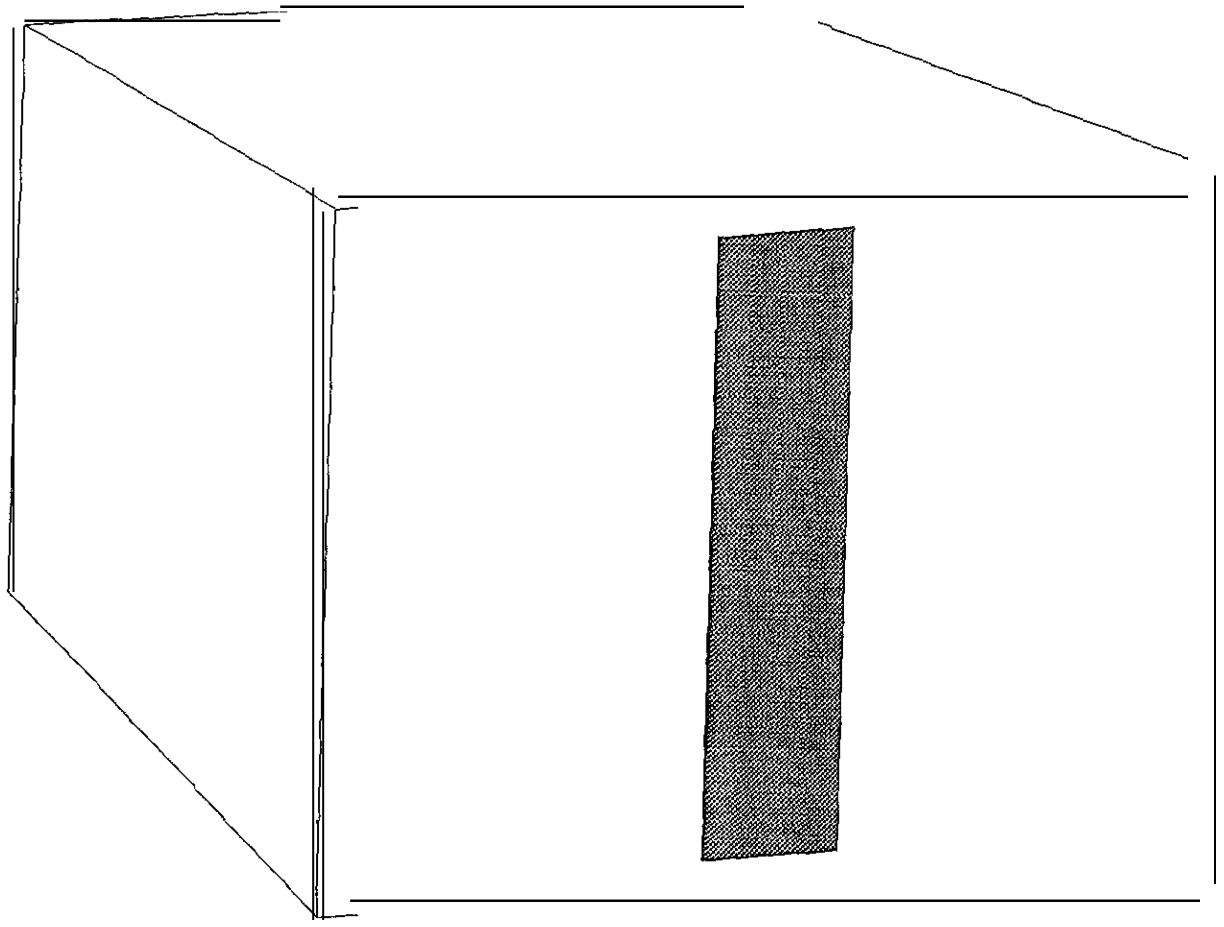
500,700, and 850 VA



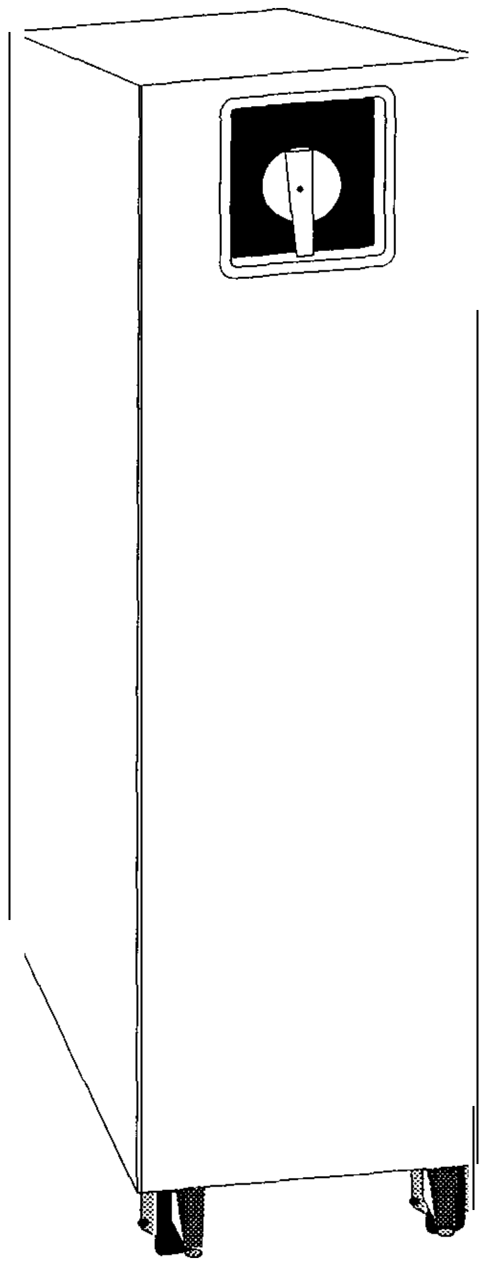
1.15 and 1.4 KVA



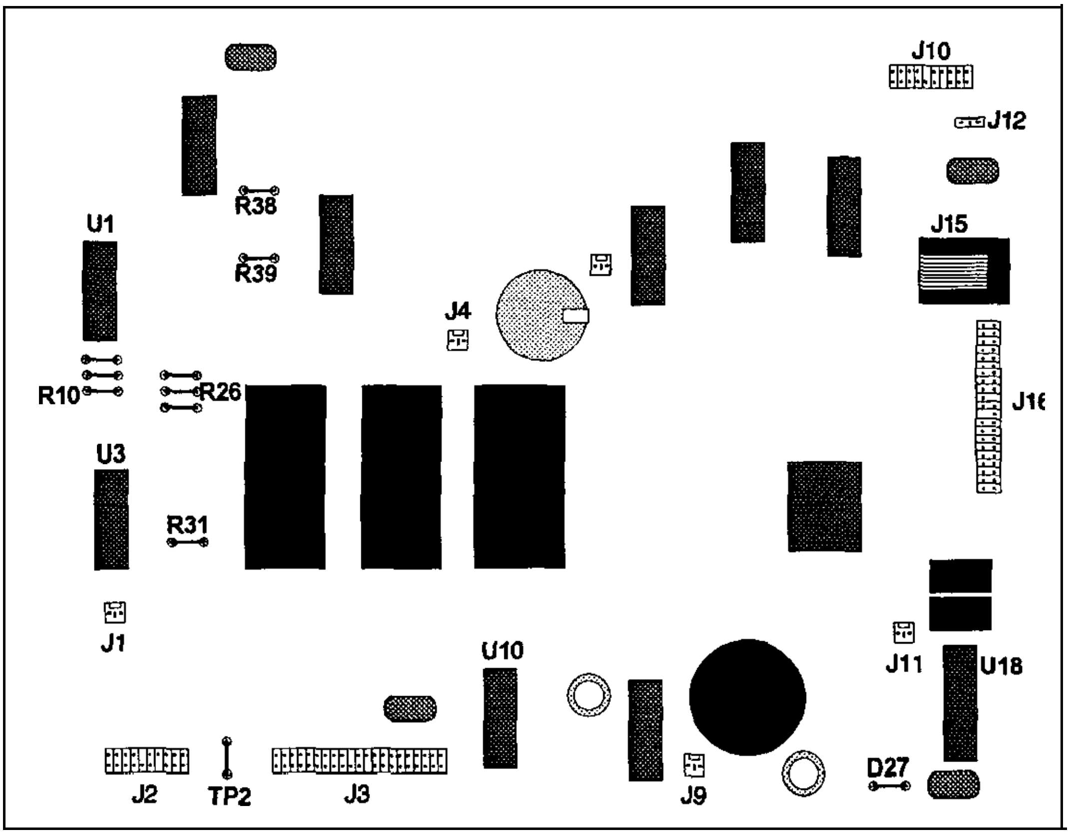
Battery Cabinet - "M" Style



Battery Cabinet – "N" Style



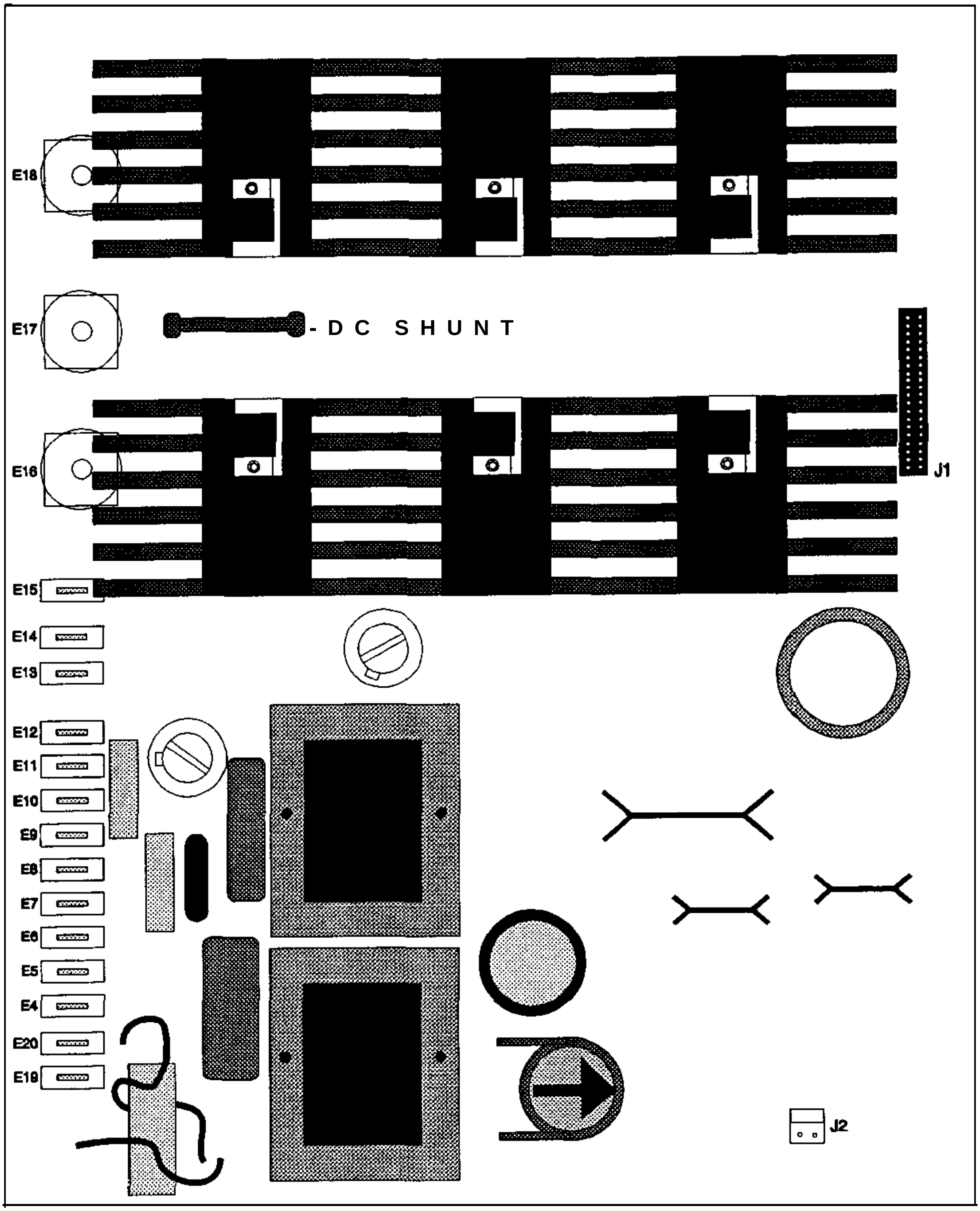
Logic Board Layout



All Models:	
Logic Board Connection	**Description**
J3 (POWER)	Ribbon cable from the power board.
J4 (AMB)	Ambient temperature probe.
J9 (B. SWITCH)	Wires to the Alarm Silence switch.
J11 (PFCT)	PFM temperature probe.
J12 (ME/FD)	Jumper; make sure the jumper jumps pins "1" and "2."
J16 (CONSOLE)	Ribbon cable to the RS232 port.

1.15 and 1.4 KVA Only:	
Logic Board Connection	**Description**
J1 (XFT)	Transformer temperature probe.

Power Board Layout (500,700, and 850 VA)



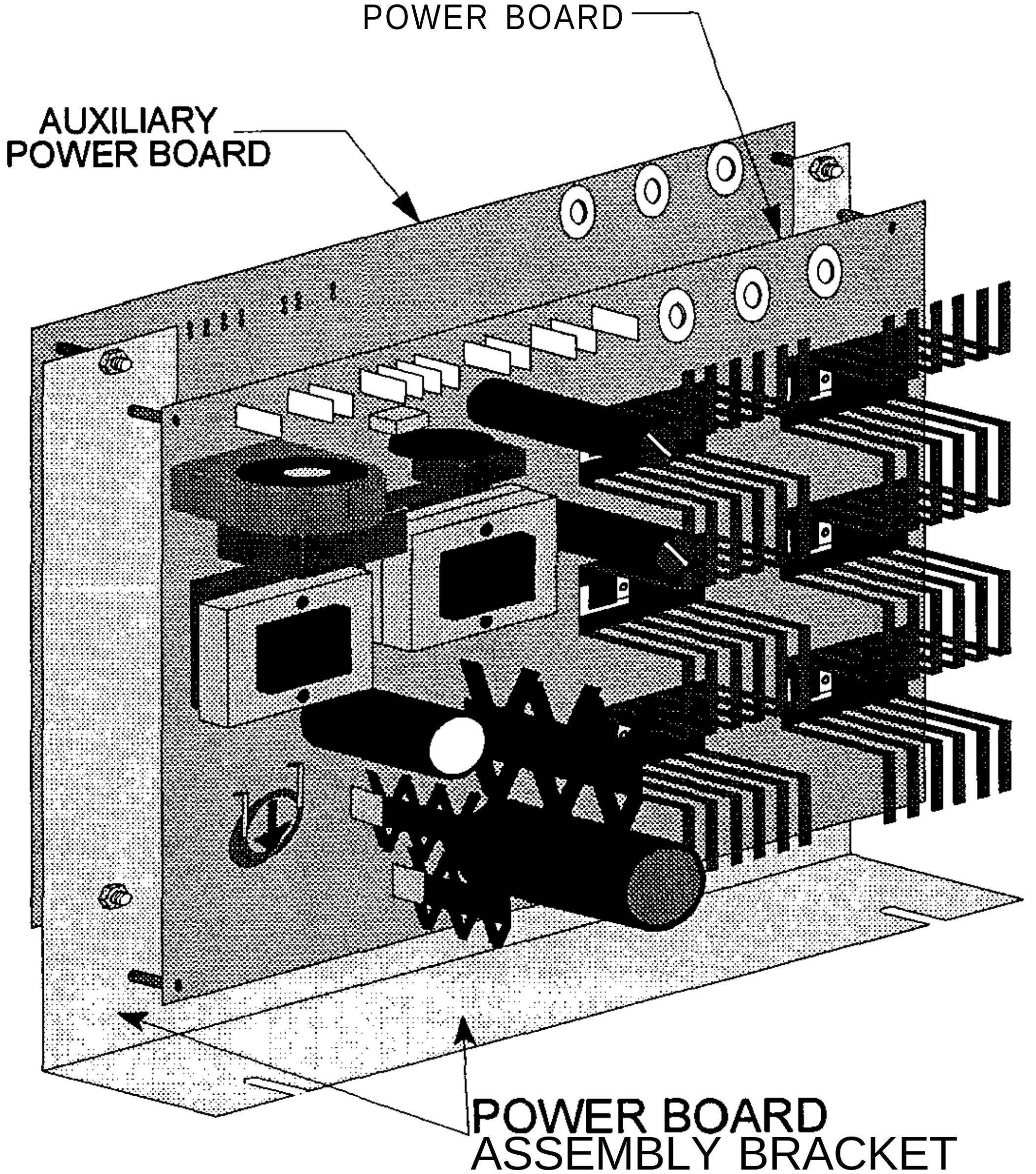
60 Hz 120-volt Only Models: Power Board Connections	
Power Board Connection	**Wire Description**
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
J3 (units with optional chargers inside)	Wire from the optional charger.
E4	Wiie from the closest output receptacle (ifapplicable).
E5	Wii from one (1) side of the fan.
E6	Transformer wire 10.
E7	Wire from one (1) side of the fan.
E8	Wire to cabinet ground.
E9	Transformer wire 11.
E10	Wire from the closest output receptacle (iapplicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	Transformer wire 5.
E15	Wire from the DC fuse.
E16	Transformer wire 4.
E17	Negative (-) battery cable.
E18	Transformer wire 1.

60 Hz, 208 and 240 VAC Input Models: Power Board Connections	
Power Board Connection	**Wire Description**
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
J3 (units with optional chargers inside)	Wire from the optional charger.
E4	*Depends on output voltage:* 120 only: Wire from receptacle. 208 or 240 only: Jumper wire to E20 (already connected). 120/208 or 120/240: Wire from receptacle.
E5	Wiie from one (1) side of the fan.
E6	Transformer wire 10.
E7	Wire from one (1) side of the fan.

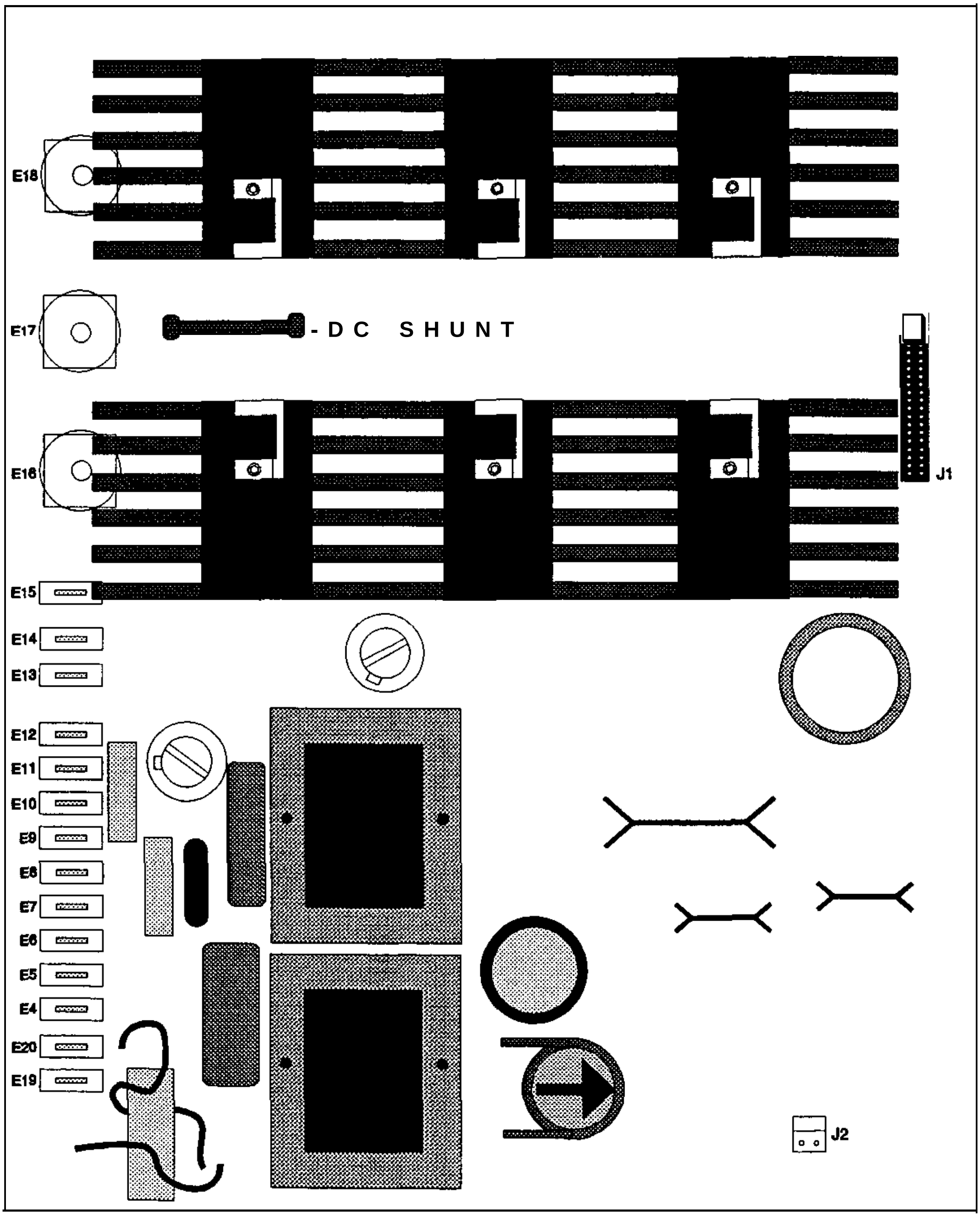
60 Hz, 208 and 240 VAC Input Models: Power Board Connections	
Power Board Connection	**Wire Description**
ES	***Depends on output voltage:*** With single output voltage: No connection. With 120/208 or 120/240: Wire to cabinet ground.
E9	***Depends on output voltage:*** 120 only: Transformer wire 11. 208 only: Transformer wire 12. 240 only: Transformer wire 13. 120/208 or 120/240: Transformer wire 11.
E10	Wire from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	*Depends on input voltage:* 208 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E15	Wire from the DC fuse.
E16	Transformer wire 4.
E17	Negative (–) battery cable.
E18	Transformer wire 1
E19	***Depends on output voltage:*** 120 only: No connection. 208 or 240 only: Wire from output receptacle (ii applicable). 120/208: Transformer wire 12. 120/240: Transformer wire 13.
E20	***Depends on output voltage:*** 120 only: No connection. 208 or 240: Jumper wire to E4 (already connected). 120/208 or 120/240: Wire from output receptacle L2 (ifapplicable).

50 Hz 220,230, or 240 VAC Models: Power Board Connections	
Power Board Connection	**Wire Description**
J1	Ribbon cable from the logic board.
J2	Wires from the On/Off switch.
J3 (units with optional chargers inside)	wire from the optional charger.
E4	Jumper wire to E20 (already connected).
E5	Wire from one (1) side of the fan.
E6	Transformer wire 10.
E l	Wire from one (1) side of the fan.
E8	Wire to cabinet ground.
E9	*Depends on output voltage:* 220 VAC: Transformer wire 11. 230 VAC: Transformer wire 12. 240 VAC: Transformer wire 13.
E10	Wire from the closest output receptacle (if applicable).
E11	Wire from backfeed relay terminal 6.
E12	Transformer wire 9.
E13	Wire from backfeed relay terminal 4.
E14	*Depends on input voltage:* 220 VAC: Transformer wire 7. 230 VAC: Transformer wire 6. 240 VAC: Transformer wire 5.
E15	Wii from the DC fuse.
E16	Transformer wire 4.
E17	Negative (–) battery cable.
E18	Transformer wire 1.
E19	Wire from the output receptacle (if applicable).
E20	Jumper wire to E4 (already connected).

‘Power Board Assembly Layout (1.15 and 1.4 KVA)



Power Board Layout

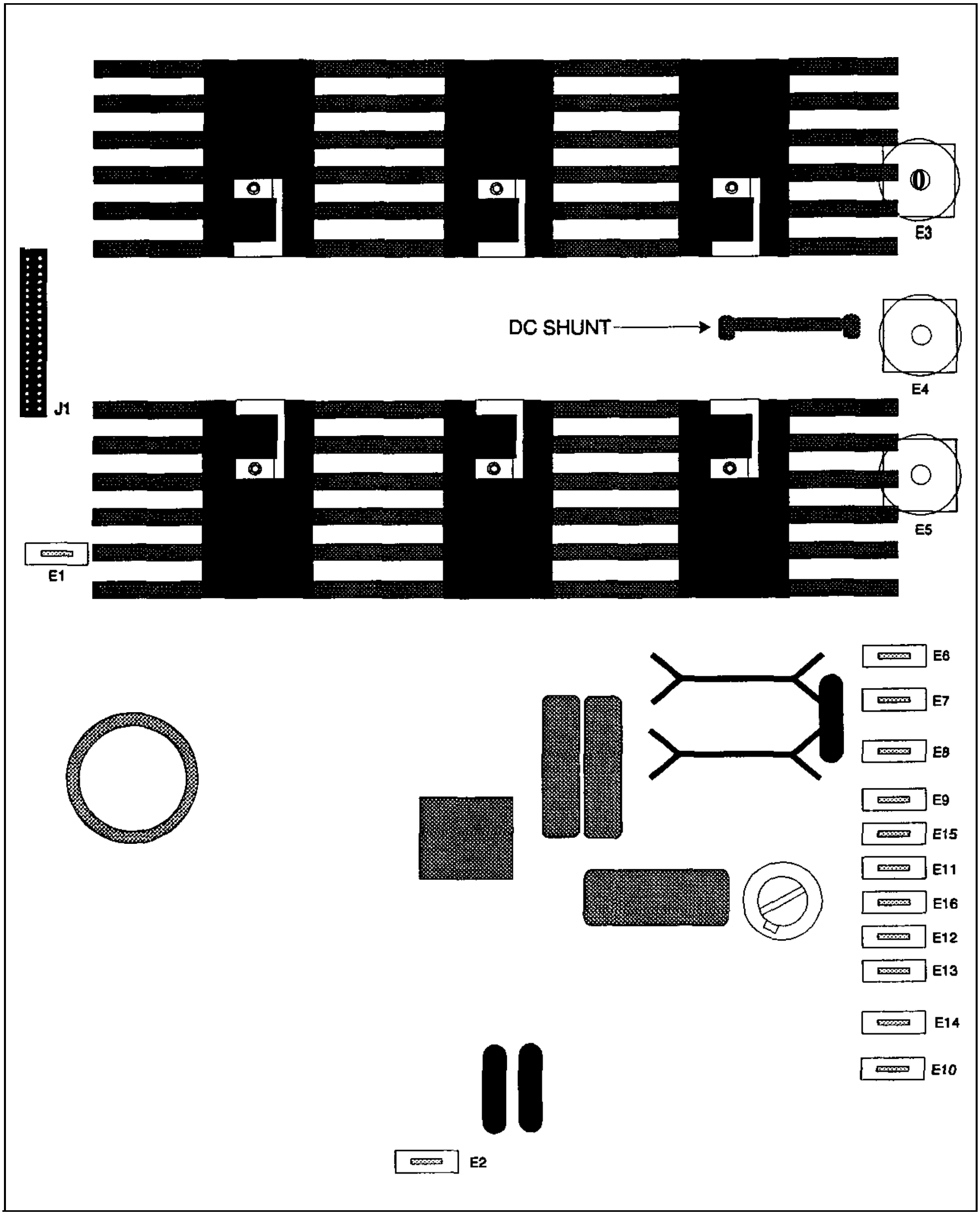


50 Hz 220, 230, or 240 VAC Input Models: Power Board Connections	
POWER Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
J2	Two (2) wires to the On/Off switch.
E5	Wire to the tank capacitor.
E6	Transformer wire 10.
E8	Wire to cabinet ground.
E9	*Depends on output voltage:* 220 VAC: Transformer wire 11. 230 VAC: Transformer wire 12. 240 VAC: Transformer wire 13.
E10	Wire to the middle terminal block terminal.
E12	Transformer wire 9.
E15	Wire to the DC fuse.
E16	Transformer wire 4A.
E17	Negative (-) battery cable.
E18	Transformer wire 1A.
E19	Wire from the terminal block terminal closest to the backfeed relay driver board.

60 Hz, 120 VAC Only Models: Power Board Connections	
POWER Board Connection	**Wire Description**
J1	Ribbon Cable to Jl on the auxiliary board.
J2	Two (2) wires to the On/Off witch.
E4	Wire to the terminal block terminal closest to the backfeed relay driver board.
ES	Wire to the tank capacitor.
E6	Transformer wire 10.
E8	Wii to cabinet ground.
E9	Transformer wire 11.
E10	Wiie to the middle terminal block terminal.
E12	Transformer wire 9.
E15	wire to the DC fuse.
E16	Transformer wire 4A.
E17	Negative (-) battery cable.
E18	Transformer wire 1A.

60 Hz, 208 or 240 VAC Input Models: Power Board Connections	
POWER Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the auxiliary board.
J2	Two (2) wires to the On/Off switch.
E4	*Depends on output voltage:* 208 or 240 VAC only: Jumper wire to E20 (already connected). 120, 120/208, or 1201240 VAC: Wire to the terminal block.
E5	Wire to the tank capacitor.
E6	Transformer wire 10.
E8	*Depends on output voltage:* 120, 120/208, or 1201240 VAC: Wiie to cabinet ground. 208 or 240 VAC: No connection.
E9	*Depends on output voltage:* 208 VAC only: Transformer wire 12. 240 VAC only: Transformer wire 13. 120, 120/208, or 120/240 VAC: Transformer wire 11.
E10	Wire to the terminal block.
E12	*Depends on input voltage:* 120 VAC: Transformer wires 7 and 9. All other input voltages: Transformer wire 9.
E15	Wire to the DC fuse.
E16	Transformer wire 4A.
E17	Negative (–) battery cable.
E18	Transformer wire 1 A.
E19	*Depends on output voltage:* 208 or 240 VAC: Wire to the terminal block. 120 VAC: No connection. 120/208 VAC: Transformer wire 12. 120/240 VAC: Transformer wire 13.
E20	*Depends on output voltage:* 208 or 240 VAC: Jumper wire to E4. 120 VAC: No connection. 120/208 or 120/240 VAC: Wire to the terminal block.

Auxiliary Board Layout

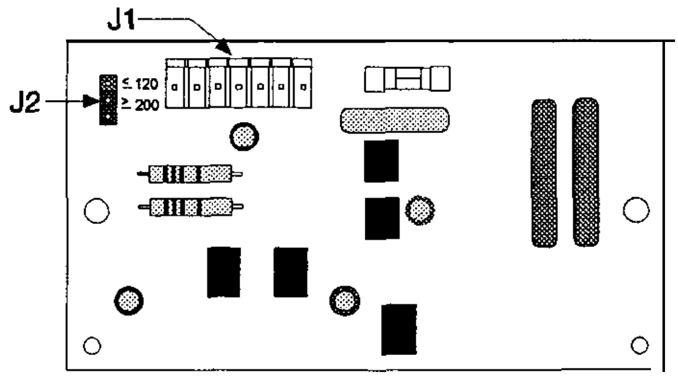


50, Hz 220/230/240 VAC Models: Auxiliary Board Connections	
AUXILIARY Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
E3	Transformer wire 1
E4	Negative (–) battery cable.
E5	Transformer wire 4.
E6	***Depends on input voltage:*** *220* VAC: Transformer wire 7. *230* VAC: Transformer wire 6. *240* VAC: Transformer wire 5.
E7	***Depends on input voltage:*** *220 or 230* VAC: Transformer wire 5. *240* VAC: Transformer wire 6.
E8	***Depends on input voltage:*** *220* VAC: Transformer wire 6. *230 or 240* VAC: Transformer wire 7.
E10	Wire to backfeed relay terminal 4.
E11	***Depends on output voltage:*** *220* VAC: Transformer wire 12. *230 or 240* VAC: Transformer wire 11.
E12	***Depends on input voltage:*** *220 or 230* VAC: Transformer wire 13. *240* VAC: Transformer wire 12.
	Wire to backfeed relay terminal 6.

60 Hz, 120 VAC Only Models: Auxiliary Board Connections	
AUXILIARY Board Connection	**Wire Description**
J1	Ribbon Cable to J1 on the power board and to J3 on the logic board.
E3	Transformer wire 1.
E4	Negative (–) battery cable.
E5	Transformer wire 4.
E6	Transformer wire 5.
E10	Wire to backfeed relay terminal 4.
E14	Wire to backfeed relay terminal 6.

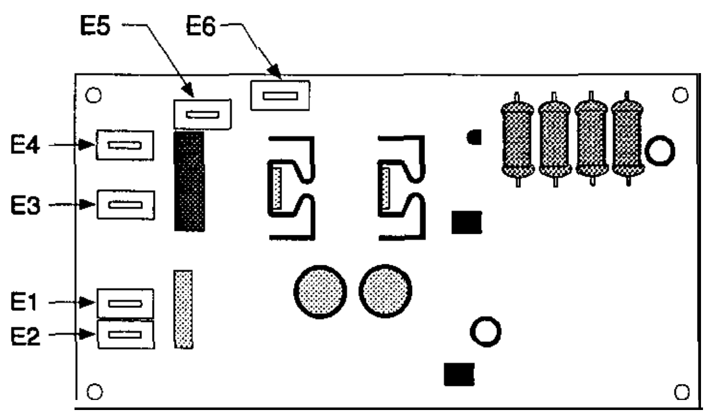
60 Hz, 120/208/240 VAC Models: Auxiliary Board Connections	
AUXILIARY Board Connection	**Wire Description**
J1	Ribbon Cable to Jl on the power board and to J3 on the logic board.
E3	Transformer wire 1.
E4	Negative (-) battery cable.
E5	Transformer wire 4.
E6	*Depends on input voltage:* *120* VAC: Transformer wires 5 and 8. *208* VAC: Transformer wire 6. *240* VAC: Transformer wire 5.
E7	*Depends on input voltage:* 120 VAC: Transformer wire 6. *208* VAC: Transformer wire 5. *240* VAC: Transformer wire 6.
E8	*Depends on output voltage:* 120 VAC only: No connection. *208* VAC or 120/208 VAC: Transformer wire 13. *240* VAC or 120/240 VAC: Transformer wire *12*.
E10	Wire to backfeed relay terminal 4.
E11	*Depends on input voltage.* 120 VAC: No connection. *208 or 240* VAC: Transformer wire 7.
E12	*Depends on output voltage:* *208 or 240* VAC onlv: Wire to cabinet ground. 120 only, 120/208 or 1201240 VAC: No connection.
E14	Wire to backfeed relay terminal 6.
E15	*Depends on input voltage:* 120 VAC: No connection. *208 or 240* VAC: Transformer wire 8.
E16	*Depends on output voltage:* *208 or 240* VAC only: Transformer wire 11. 120, 120/208 or 120/240 VAC: No connection

Backfeed Relay Driver Board Layout



Backfeed Relay Driver Board Connections	Description:
J1	Wire harness to backfeed relay posts "0," "1," "2," and "8."
J2	Jumper; set for either ≤ 120 or ≥ 200.

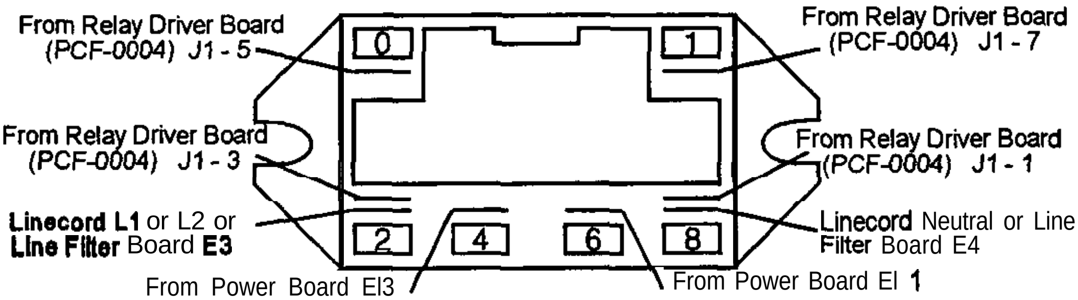
Power Factor Module Board Layout



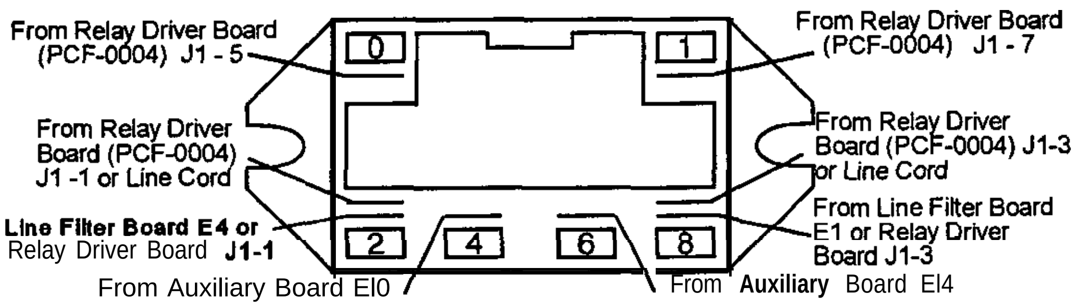
PFM Circuit Board Connection	Wire Description 500,700, and 850 VA	Wire Description 1.15 and 1.4 KVA
E1	Wire to the side of the PFM resistor closest to the tank capacitor.	Wire to the closest side of the PFM resistor.
E2	Wire to the positive (+) PFM capacitor terminal.	Wii to the closest PFM capacitor terminal.
E3	Wire to the tank capacitor.	Wiie to middle terminal block terminal.
E4	Wire to E9 on the power board.	Wire to end terminal block terminal.
E5	Wire to the negative (-) PFM capacitor terminal.	Wiie to the far PFM capacitor terminal.
E6	Wire to the remaining side of the PFM resistor.	Wire to the far end of the PFM resistor.

Backfeed Relay Layouts

500,700, and 850 VA



1.15 and 1.4 KVA



Backfeed Relay Connections	Description (500,700, **and** 850 VA)	Description (1.15 and i.4 KVA)
0	From Relay Driver Board Jl, pin 5.	
1	From Relay Driver Board Jl, pin 7.	
2	From Relay Driver Board Jl , pin 1 **and** From Line Cord L1 *or* L2 *or* Line Filter Board E3.	From Relay Driver Board Jl , pin 1 or Line Cord **and** From Line Filter Board E4 or Relay Driver Board Jl , pin 1.
4	From Power Board E13.	From Auxiliary Board E 10.
6	From Power Board El 1.	From Auxiliary Board E14.
8	From Relay Driver Board Jl, pin 3 **and** From Line Cord Neutral *or* Line Filter Board E4.	From Relay Driver Board Jl , pin 3 *or* Line Cord **and** From Line Filter Board El or Relay Driver Board J1 ,

802 Connection Tables

Logic Board Connections

Jack	Pin	Function
J1		Transformer Temp
	1	+5 Volts Reference
	2	Transformer Temp
J2		Auxiliary Power
	1	Power Switch A
	2	Power Switch B
	3	Power Switch A
	4	Power Switch B
	5	Transformer Temp Ref
	6	Not Used
	7	Not Used
	8	AC Amps In (-)
	9	Transformer Temp
	10	AC Amps In (+)
	11	Auxiliary +12 Volts
	12	Digital Ground
	13	Auxiliary +12 Volts
	14	Digital Ground
J3		Power
	1	Static Switch On (-)
	2	Relay Snubber (-)
	3	AC Volts Out (-)
	4	AC Volts Out (+)
	5	AC Volts In (-)
	6	AC Volts In (+)
	7	AC Amps Out (-)
	8	AC Amps Out (+)
	9	Charger Gate (-)
	10	Fail Safe (+)
	11	Auxiliary Shunt
	12	Not Used
	13	Not Used
	14	+ Battery
	15	Charger Shunt (-)
	lb	Charger Shunt (+)
	17	Heatsink Temp (+)
	18	Heatsink Temp (-)
	19	Digital Ground
	20	Let? Gate
	21	Digital Ground
	22	Right Gate
	23	Digital Ground
	24	+12 Volts In
	25	Digital Ground
	26	+12 Volts In

Logic Board Connections

Jack	Pin	Function
J4		Ambient Temp
	1	+5 Volts Reference
	2	Ambient Temp
J5		Battery Select
	1	+3 Volts DC Battery
	2	+3 Volts DC Battery Backup
J6		ROM
	1	ROM Address Line
	2	Common
	3	+5 Volts DC
J8		Beeper Frequency
	1	CPU Timer
	2	Common
	3	Ripple counter
J9		Beeper
	1	Beeper
	2	Digital Ground
J10		Light Emitting Diode (LED) Panel
	1	Power Switch B
	2	Power Switch B
	3	Not Used
	4	Not Used
	5	Power Switch A
	6	Power Switch A
	7	Not Used
	8	Ready LED (-)
	9	Charger LED
	10	Inverter LED (-)
	11	Fail Safe (+)
	12	Alarm LED (-)
	13	+12 Volts DC
	14	+12 Volts DC
	15	FD Select
	16	Digital Ground
J11		PFM Temp
	1	+5 Volts DC
	2	PFM Temp
J12		User Power Select
	1	+12 Logic
	2	+12 Fused
	3	+12 Auxiliary
J13	1	Ready to Send
	2	Ready to Receive
	3	Chassis Ground
J14	1	Clear to Send
	2	Ready to Receive
	3	Chassis Ground

Logic Board Connections		
Jack	**Pin**	**Function**
J15		Handheld
	1	Digital Ground
	2	Transmit
	3	Ready to Transmit
	4	Ready to Receive
	5	Ready to Receive
	6	Fused +12 Volts DC
J16		Console
	1	Not Used
	2	Fused +12 Volts DC
	3	Ready to Transmit
	4	Not Used
	5	Transmit
	6	Not Used
	7	Clear to Send
	8	Not Used
	9	Ready to Send
	10	+12 Volt DC Level
	11	+12 Volt DC Level
	12	Not Used
	13	Digital Ground
	14	Not Used
	15	Not Used
	16	Emergency Power On
	17	Not Used
	18	Not Used
	19	Not Used
	20	Alarm Normally Open
	21	Inverter Normally Closed
	22	Alarm Common
	23	Inverter Normally Open
	24	Alarm Normally Closed
	25	Inverter common
	26	Not Used
J17		External
	1	External
	2	Digital Ground

500-	;0VA I	wer Board Connections
Jack	Pin	Function
E4		AC Volts Out
ES		TransformerOut
E6		TransformerOut
E7		AC Volts Out
E8		AC Volts Out
E9		AC Volts Out
El0		TransformerOut
E11		AC Volts In
E12		AC Volts In
El3		AC Volts In
El4		Transformer In
El5		(+) Battery
El6		Inverter Drive A
El7		(-) Battery
El8		Inverter Drive B
El9		AC Volts Out
E20		AC Volts Out
J1		Logic Cable
	1	Static Switch Drive
	2	Relay Drive
	3	AC Volts Out (-)
	4	AC Volts Out (+)
	5	AC Volts In (-)
	6	AC Volts In (+)
	7	AC Amps Out (+)
	8	AC Amps Out (-)
	9	Charger Enable
	10	(+) Fail Safe
	11	Auxiliary Shunt
	12	Keyed
	13	Keyed
	14	(+) Battery
	15	Charger Shunt (-)
	16	charger Shunt (+)
	17	Heatsink Temp (+)
	18	Heatsink Temp (-)
	19	Gate common
	20	Gate A
	21	Gate common
	22	Gate B
	23	Ground
	24	(+) 12 VDC
	25	Ground
	26	(+) 12 VDC
J2		On/Off Switch
	1	(+) DC to On/Off Switch
	2	(+) DC from On/Off Switch
J3		optional charger
	1	Charger Enable
	2	Ground
	3	(+) 12 VDC
	4	Keyed
	5	(+) 12 VDC

1.15 and 1.4 KVA Power Board Assembly Connections
Power Board Connections

Jack	Pin	Function
E4		AC Volts Out
E5		Transformer Out
E6		Transformer Out
E7		AC Volts Out
E8		AC Volts Out
E9		AC Volts Out
E10		Transformer Out
E11		AC Volts In
E12		AC Volts In
E13		AC Volts In
E14		Transformer In
E15		(+) Battery
E16		Inverter Drive A
E17		(-) Battery
E18		Inverter Drive B
E19		AC Volts Out
E20		AC Volts Out
J1		Logic Cable
	1	Static Switch Drive
	2	Relay Drive
	3	AC Volts Out (-)
	4	AC Volts Out (+)
	5	AC Volts In (-)
	6	AC Volts In (+)
	7	AC Amps Out (+)
	8	AC Amps Out (-)
	9	Charger Enable
	10	(+) Fail Safe
	11	Auxiliary Shunt
	12	Keyed
	13	Keyed
	14	(+) Battery
	15	Charger Shunt (-)
	16	Charger Shunt (+)
	17	Heatsink Temp (+)
	18	Heatsink Temp (-)
	19	Gate Common
	20	Gate A
	21	Gate Common
	22	Gate B
	23	Ground
	24	(+) 12 VDC
	25	Ground
	26	(+) 12 VDC
J2		On/Off Switch
	1	(+) DC to On/Off Switch
	2	(+) DC from On/Off Switch

1.15 and 1.4 KVA Power Board Assembly Connections Power Board Connections		
Jack	**Pin**	**Function**
J3		Optional Charger
	1	Charger Enable
	2	Ground
	3	(+) 12 VDC
	4	Keyed
	5	(+) 12 VDC

1.15 and 1.4 KVA Power Board Assembly Connections
Auxiliary Board Connections

Jack	Pin	Function
E1		Suppressor Capacitor
E2		Ground
E3		Drive B
E4		(-) Battery
ES		Drive A
E6		Transformer In
E1		(Refer to Transformer Schematic)
ES		(Refer to Transformer Schematic)
E9		AC Volts In
E10		AC Volts In
E11		(Refer to Transformer Schematic)
E12		(Refer to Transformer Schematic)
E13		AC Volts In
E14		AC Volts In
E15		(Refer to Transformer Schematic)
E16		(Refer to Transformer Schematic)
J1		Logic Cable
	1	Static. Switch Drive
	2	Relay Drive
	3	AC Volts Out (-)
	4	AC Volts Out (+)
	5	AC Volts In (-)
	6	AC Volts In (+)
	7	AC Amps Out (+)
	8	AC Amps Out (-)
	9	Charger Enable
	10	(+) Fail Safe
	11	Auxiliary Shunt
	12	Keyed
	13	Keyed
	14	(+) Battery
	15	Charger Shunt (-)
	16	Charger Shunt (+)
	17	Heatsink Temp (+)
	18	Heatsink Temp (-)
	19	Gate Common
	20	Gate A
	21	Gate Common
	22	Gate B
	23	Ground
	24	(+) 12 VDC
	25	Ground
	26	(+) 12 VDC

Power Factor Module Board Connections

Connection	Function
E1	PFM Capacitor (+)
E2	PFM Resistor Hot
E3	AC Volts In Hot
E4	AC Volts In Neutral
E5	PFM Capacitor (-)
E6	PFM Resistor Neutral

Backfeed Relay Driver Board Connections

Jack	Pin	Function
J1	1	AC Input Hot
	2	Not Used
	3	AC Input Neutral
	4	Not Used
	5	Relay Coil AC Hot
	~~6~~	[redacted]
	7	Relay Coil AC Neutral
J2	1	Relay Reference ≤ 120 Volts AC
	2	AC Volts In –
	3	Relay Reference ≥ 200 Volts AC*

500-850VA Line Filter Board Connections (TÜV Option, Not Used on Newer Models)

Jack	Function
E1	AC Line
E2	AC Line
E3	AC Line
E4	AC Line

1.15 and 1.4 KVA Line Filter Board Connections (TÜV Option)

Jack	Function
E1	AC Line Out to Relay
E2	No Connection
E3	No Connection
E4	AC Line Out to Relay
E5	AC Line in from Line Cord or Hardwire
E6	AC Line in from Line Cord or Hardwire

Best Power

803 Block Diagram

e

804 System Schematics

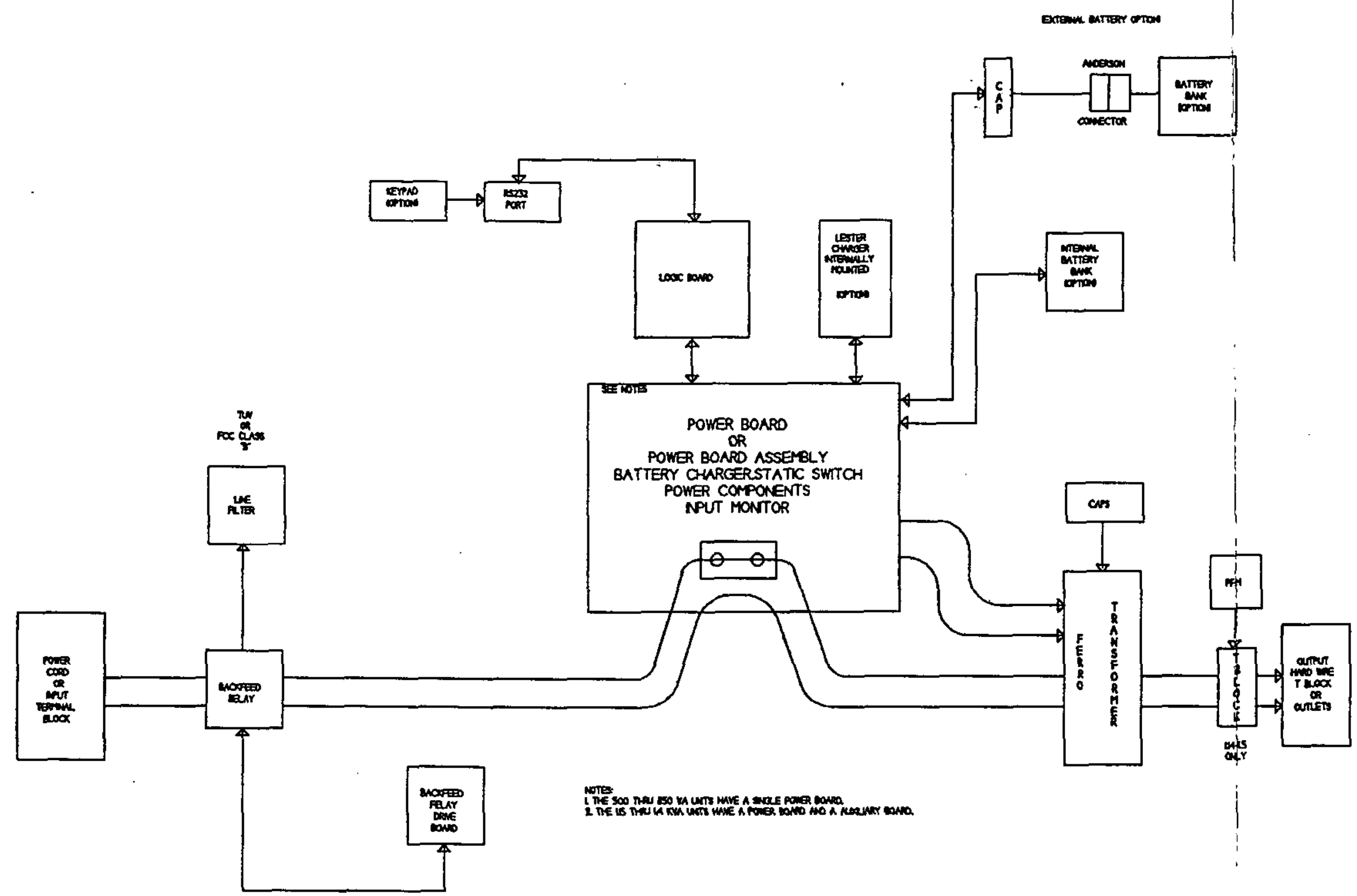
FE/QFE 500,700, and 850 VA

FE/QFE 1.15 and 1.4 KVA

DWG NO.	SH	REV

REVISIONS

REV	CHG. NO.	DESCRIPTION	DATE	BY	CHKR	ENGR



NOTES:
1. THE 500 THRU 850 VA UNITS HAVE A SINGLE POWER BOARD.
2. THE 1.15 THRU 1.4 KVA UNITS HAVE A POWER BOARD AND A AUXILIARY BOARD.

PROPRIETARY

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DUAL DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS [ ] TOLERANCES ARE:
INCHES ±	MILLIMETERS ±
DEC. DIM. .XX = ± .02	DEC. DIM. .X = ± .5
DEC. DIM. .XXX = ± .010	DEC. DIM. .XX = ± .25
ANGLES ± 2°	ANGLES ± 2°

DO NOT SCALE DRAWING

APPROVED	DATE
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QUALITY ASSURANCE:	
PART NO.	

BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE:
BLOCK DIAGRAM
FE 500-850 VA
AND
1.15-1.4 KVA

SIZE B | DWG NO. | REV

SCALE: | SHEET 1 OF

D4754S01 | 1 | A

REVISIONS

REV	DESCRIPTION	DATE	BY	CHKR	ENGR
A	RELEASE TO PRODUCTION	10/31/94	TMW		

TABLE #2

220/230/240V IN/OUT 50HZ TRANSFORMERS

220 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#7 TRANSFORMER WIRE

230 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#6 TRANSFORMER WIRE

240 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#5 TRANSFORMER WIRE

220 VOLT OUTPUT CONNECTIONS

E9	#11 TRANSFORMER WIRE
E8	GROUND WIRE
E4	JUMPER WIRE TO E20
E20	JUMPER WIRE TO E4
E19	BROWN WIRE FROM RECEPTACLE

230 VOLT OUTPUT CONNECTIONS

E9	#12 TRANSFORMER WIRE
E8	GROUND WIRE
E4	JUMPER WIRE TO E20
E20	JUMPER WIRE TO E4
E19	BROWN WIRE FROM RECEPTACLE

240 VOLT OUTPUT CONNECTIONS

E9	#13 TRANSFORMER WIRE
E8	GROUND WIRE
E4	JUMPER WIRE TO E20
E20	JUMPER WIRE TO E4
E19	BROWN WIRE FROM RECEPTACLE

120/208/240V IN/OUT 60HZ TRANSFORMERS

208 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#6 TRANSFORMER WIRE

240 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#5 TRANSFORMER WIRE

120 VOLT OUTPUT CONNECTIONS

E9	#11 TRANSFORMER WIRE
E8	GROUND WIRE
E4	BLACK WIRE FROM RECEPTACLE
E20	NO CONNECTION
E19	NO CONNECTION

208 VOLT OUTPUT CONNECTIONS

E9	#12 TRANSFORMER WIRE
E8	NO CONNECTION
E4	JUMPER WIRE TO E20
E20	JUMPER WIRE TO E4
E19	BLACK WIRE FROM RECEPTACLE
7	GND WIRE AND #11 TRANSFORMER WIRE JUMPERED TOGETHER

240 VOLT OUTPUT CONNECTIONS

E9	#13 TRANSFORMER WIRE
E9	NO CONNECTION
E4	JUMPER WIRE TO E20
E20	JUMPER WIRE TO E4
E19	BLACK WIRE FROM RECEPTACLE
7	GND WIRE AND #11 TRANSFORMER WIRE JUMPERED TOGETHER

120/208 VOLT OUTPUT CONNECTIONS

E9	#11 TRANSFORMER WIRE
E8	GROUND WIRE
E4	BLACK WIRE FROM RECEPTACLE "L1" OUT
E20	RED WIRE FROM RECEPTACLE "L2" OUT
E19	#12 TRANSFORMER WIRE

120/240 VOLT OUTPUT CONNECTIONS

E9	#11 TRANSFORMER WIRE
E8	GROUND WIRE
E4	BLACK WIRE FROM RECEPTACLE "L1" OUT
E20	RED WIRE FROM RECEPTACLE "L2" OUT
E19	#13 TRANSFORMER WIRE

120V IN/OUT ONLY 60HZ TRANSFORMERS

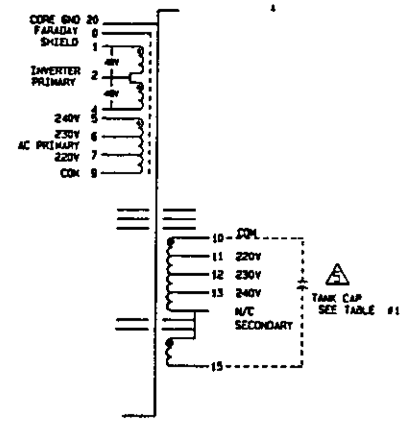
120 VOLT INPUT CONNECTIONS

E12	#9 TRANSFORMER WIRE
E14	#5 TRANSFORMER WIRE

120 VOLT OUTPUT CONNECTIONS

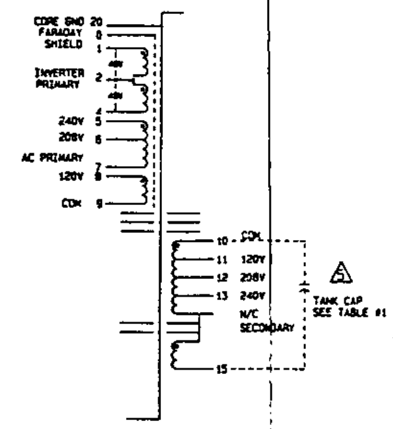
E9	#11 TRANSFORMER WIRE
E8	GROUND WIRE
E4	BLACK WIRE FROM RECEPTACLE
E20	NO CONNECTION
E19	NO CONNECTION

TRANSFORMER DRAWING #1



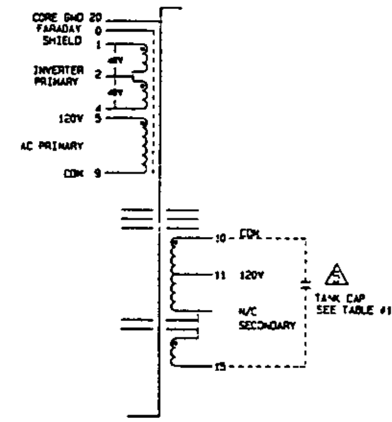
500 - 850 VA 50HZ 220/230/240 IN/OUT

TRANSFORMER DRAWING #2



500 - 850 VA 60HZ 120/208/240 IN/OUT

TRANSFORMER DRAWING #3



500 - 850 VA 60HZ 120 IN/OUT

FOR TRANSFORMER #2 ONLY

INPUT VOLTAGE	JUMPER	INPUT
120V	5 to 8 7 to 9	5, 9
208V	7 to 8	6, 9
240V	7 to 8	5, 9

COMMON CONNECTIONS FOR ALL TRANSFORMERS

E18	#1 TRANSFORMER WIRE
E17	NEGATIVE BATTERY CABLE
E16	#4 TRANSFORMER WIRE
E15	RED WIRE FROM FUSE HOLDER
E13	DARK BROWN WIRE FROM THE RELAY (L)
E11	DARK BLUE WIRE FROM THE RELAY (N)
E10	BLUE WIRE FROM THE RECEPTACLE (50HZ ONLY) RED WIRE FROM THE RECEPTACLE (60HZ HIGH VOLTAGE) WHITE WIRE FROM THE RECEPTACLE (60HZ LOW VOLTAGE)
E7	FAN WIRE
E5	#10 TRANSFORMER WIRE FROM CAPACITOR
E5	FAN WIRE

TABLE #1

UNIT SIZE	220/230/240 50HZ	120/208/240 60HZ	120 60HZ
500 VA	15 uF	12 uF	12 uF
700 VA	20 uF	15 uF	15 uF
850 VA	25 uF	20 uF	18 uF

NOTES:

1. WIRE COLORS WILL VARY FOR INPUT AND OUTPUT WIRING. 60 HZ USES BLK AND RED FOR HOTS, WHT FOR NEUTRAL, AND GRN/YEL FOR GND. 50 HZ USES BRN FOR HOTS, BLU FOR NEUTRAL, AND GRN/YEL FOR GND.
2. BECAUSE OF THE NUMEROUS RECEPTICAL OUTPUT WIRING OPTIONS OF THIS UNIT THEY WILL NOT BE SHOWN ON THIS SYSTEM SCHEMATIC. SEE THE TECHNICAL REFERENCE MANUAL.
3. NUMBERS IN BOXES REPRESENT TRANSFORMER LEAD NUMBERS WHICH DO NOT CHANGE. SOME TRANSFORMERS DO NOT USE ALL LEADS.
4. ONLY ONE (1) OF THESE OPTIONS ARE USED.
5. IF A TANK CAPACITOR SHOULD NEED REPLACING OBSERVE THE CAPACITOR CASE TO SEE IF THERE IS A COLORED TOLERANCE DOT INDICATOR. REPLACE THE CAPACITOR WITH ONE OF THE SAME VALUE AND COLORED TOLERANCE DOT INDICATOR. IF TANK CAPACITORS ARE AVAILABLE BUT WITHOUT THE TOLERANCE DOT, MEASURE THE TANK CAPACITORS THAT ARE AVAILABLE AND INSTALL THE TANK CAPACITOR THAT BEST MATCHES THE ONE REMOVED. IF THE TANK CAPACITOR REMOVED HAS A RED DOT ADD 6% TO THE VALUE OF THE CAPACITOR AND THIS WILL BE THE NEW VALUE OF THE ONE THAT REPLACES IT. IF IT HAS A YELLOW DOT ADD 3%. A WHITE DOT SUBTRACT 3% AND IF IT HAS A BLACK DOT SUBTRACT 6%. THE MAIN GOAL TRYING TO BE ACHIEVED IS TO COME AS CLOSE TO THE REQUIRED CAPACITANCE FOR THE FERRO TRANSFORMER AS POSSIBLE.
6. THIS OPTION IS FOR EXTERNAL BATTERIES. THE INTERNAL BATTERIES MUST BE REMOVED TO MOUNT THIS OPTION IN THE BATTERY COMPARTMENT.
7. THESE CONNECTIONS ARE MADE EXTERNAL TO THE PC BOARD.

HOW TO USE THE VOLTAGE CHARTS

1). REFER TO THE COMMON CONNECTION TABLE.
This table is a list of common connections that must be made for all transformers and all input and output voltages.

2). SELECT THE CHART FOR THE APPROPRIATE TRANSFORMER.
This chart will have a list of all the input and output tables for that transformer.

3). FROM THAT CHART SELECT A TABLE FOR THE APPROPRIATE INPUT VOLTAGE.
This table is a list of common connections used to determine the input voltage.

4). SELECT A TABLE FOR THE APPROPIATE OUTPUT CONFIGURATION.
This table is a list of common connections used to determine the output voltage.

DUAL DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DECIMALS .XX = +/- .02 .XXX = +/- .010 ANGLES +/- 2°

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN [ ] ARE MILLIMETERS. TOLERANCES ARE: MILLIMETERS .X = +/- .5 .XX = +/- .25 ANGLES +/- 2°

DO NOT SCALE DRAWING

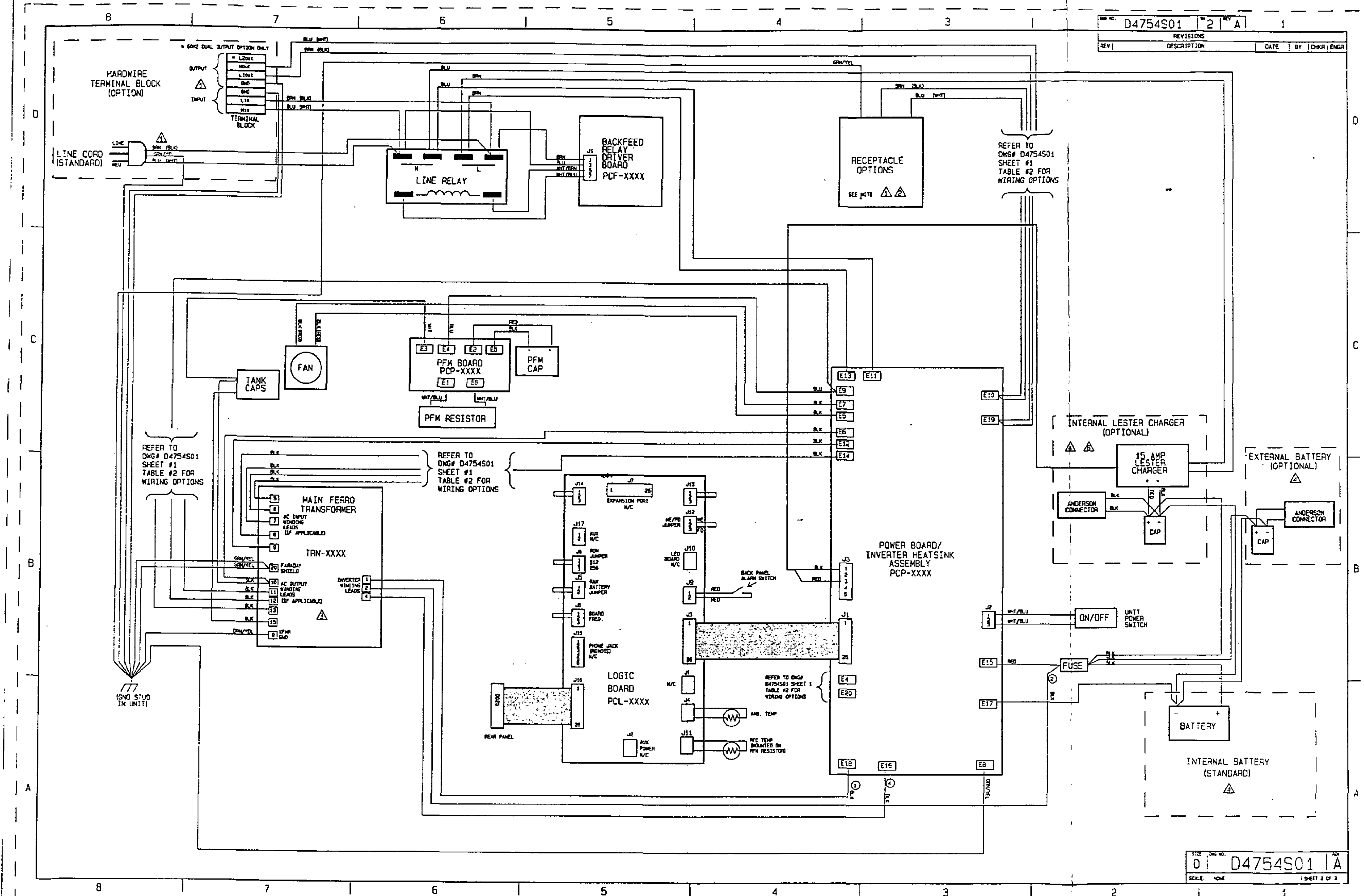
APPROVED — DRAWN BY: TIM WALSH, DATE 10/22/94; CHECKED BY; ENGINEER; STANDARDS ENGINEER; MANUFACTURING ENGINEER; QUALITY ASSURANCE; PART NO.

BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE: SYSTEM SCHEMATIC FE 500-850VA

SIZE: D | DWG NO.: D4754S01 | REV: A

SCALE: NONE | SHEET 1 OF 2


D4754S01
REVISIONS
REV
DESCRIPTION
DATE
BY
CHKR
ENGR
HARDWIRE
TERMINAL BLOCK
(OPTION)
TERMINAL BLOCK
LINE CORD
(STANDARD)
LINE RELAY
BACKFEED
RELAY
DRIVER
BOARD
PCF-XXXX
RECEPTACLE
OPTIONS
REFER TO
DWG# D4754S01
SHEET #1
TABLE #2 FOR
WIRING OPTIONS
FAN
PFM BOARD
PCP-XXXX
PFM
CAP
PFM RESISTOR
TANK
CAPS
INTERNAL LESTER CHARGER
(OPTIONAL)
15 AMP
LESTER
CHARGER
EXTERNAL BATTERY
(OPTIONAL)
ANDERSON
CONNECTOR
CAP
MAIN FERRO
TRANSFORMER
TRN-XXXX
EXPANSION PORT
LOGIC
BOARD
PCL-XXXX
POWER BOARD/
INVERTER HEATSINK
ASSEMBLY
PCP-XXXX
ON/OFF
UNIT
POWER
SWITCH
FUSE
BATTERY
INTERNAL BATTERY
(STANDARD)
(GND STUD
IN UNIT)
REAR PANEL
D D4754S01 A

DWG NO. D4755S01	SH 1	REV B

REVISIONS

REV	DESCRIPTION	DATE	BY	CHKR	ENGR
A	RELEASE TO PRODUCTION	10/31/94	TMW	BKB	GK
B	CHANGE PER ECN 3412	11/22/94	BJB		G.K.

TABLE #2

220/230/240V IN/OUT 50HZ TRANSFORMERS

220V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	N.C.
E5	TRANSFORMER LEAD #7
E7	TRANSFORMER LEAD #5
E8	TRANSFORMER LEAD #6
E15	N.C.
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

230V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	N.C.
E6	TRANSFORMER LEAD #6
E7	TRANSFORMER LEAD #5
E8	TRANSFORMER LEAD #7
E15	N.C.
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

240V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	N.C.
E6	TRANSFORMER LEAD #5
E7	TRANSFORMER LEAD #6
E8	TRANSFORMER LEAD #7
E15	N.C.
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

220V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E11	TRANSFORMER LEAD #12
E12	TRANSFORMER LEAD #13
E16	N.C.
MAIN POWER BOARD	
E4	BROWN JUMPER WIRE TO E20 OF MAIN POWER BOARD
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #11
E10	WHT (NEUTRAL) WIRE TO RECEPTACLE TERMINAL BLOCK
E19	BLK (HOT) WIRE TO RECEPTACLE TERMINAL BLOCK
E20	BROWN JUMPER WIRE TO E4 OF MAIN POWER BOARD

230V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E11	TRANSFORMER LEAD #11
E12	TRANSFORMER LEAD #13
E15	N.C.
MAIN POWER BOARD	
E4	BROWN JUMPER WIRE TO E20 OF MAIN POWER BOARD
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #12
E10	WHT (NEUTRAL) WIRE TO RECEPTACLE TERMINAL BLOCK
E19	BLK (HOT) WIRE TO RECEPTACLE TERMINAL BLOCK
E20	BROWN JUMPER WIRE TO E4 OF MAIN POWER BOARD

240V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E11	TRANSFORMER LEAD #11
E12	TRANSFORMER LEAD #12
E16	N.C.
MAIN POWER BOARD	
E4	BROWN JUMPER WIRE TO E20 OF MAIN POWER BOARD
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #13
E10	WHT (NEUTRAL) WIRE TO RECEPTACLE TERMINAL BLOCK
E19	BLK (HOT) WIRE TO RECEPTACLE TERMINAL BLOCK
E20	BROWN JUMPER WIRE TO E4 OF MAIN POWER BOARD

120/208/240V IN/OUT 60HZ TRANSFORMERS

120V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	GND. MOV (60HZ ONLY)
E5	TRANSFORMER LEADS #5 AND #8 (USE CHF-0056)
E7	TRANSFORMER LEAD #6
E11	N.C.
E15	N.C.
MAIN POWER BOARD	
E12	TRANSFORMER LEADS #7 AND #9 (USE CHF-0056)
E14	N.C.

208V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	GND MOV (50HZ ONLY)
E6	TRANSFORMER LEAD #6
E7	TRANSFORMER LEAD #5
E11	TRANSFORMER LEAD #7
E15	TRANSFORMER LEAD #8
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

240V INPUT CONNECTIONS

AUX. POWER BOARD	
E2	GND MOV (60HZ ONLY)
E5	TRANSFORMER LEAD #5
E7	TRANSFORMER LEAD #6
E11	TRANSFORMER LEAD #7
E15	TRANSFORMER LEAD #8
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

120/240V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E8	TRANSFORMER LEAD #12
E12	N.C.
E16	N.C.
MAIN POWER BOARD	
E4	BLACK WIRE TO RECEPTACLE TERMINAL BLOCK
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #11
E10	WHT (NEUTRAL) WIRE TO RECEPTACLE TERMINAL BLOCK
E19	TRANSFORMER LEAD #13
E20	RED WIRE TO RECEPTACLE TERMINAL BLOCK

120/208V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E8	TRANSFORMER LEAD #13
E12	N.C.
E16	N.C.
MAIN POWER BOARD	
E4	BLACK WIRE TO RECEPTACLE TERMINAL BLOCK
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #11
E10	WHT NEUTRAL WIRE TO RECEPTACLE TERMINAL BLOCK
E19	TRANSFORMER LEAD #12
E20	RED WIRE TO RECEPTACLE TERMINAL BLOCK

120V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E8	N.C.
E12	N.C.
E16	N.C.
MAIN POWER BOARD	
E4	BLACK WIRE TO RECEPTACLE TERMINAL BLOCK
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #11
E10	WHT (NEUTRAL) WIRE TO RECEPTACLE TERMINAL BLOCK
E19	N.C.
E20	N.C.

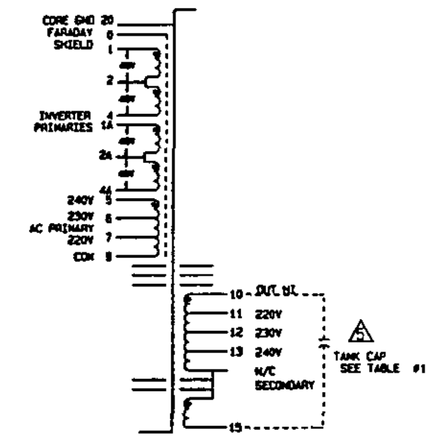
208V OUTPUT CONNECTIONS

AUX. POWER BOARD	
E8	TRANSFORMER LEAD #13
E12	GREEN GND WIRE
E16	TRANSFORMER LEAD #11
MAIN POWER BOARD	
E4	BROWN JUMPER WIRE TO E20 OF MAIN POWER BOARD
E7	N.C.
E8	N.C.
E9	TRANSFORMER LEAD #12
E10	RED WIRE FROM RECEPTACLE TERMINAL BLOCK
E19	BLACK WIRE FROM RECEPTACLE TERMINAL BLOCK
E20	BROWN JUMPER WIRE TO E4 OF MAIN POWER BOARD

240V OUTPUT CONNECTIONS

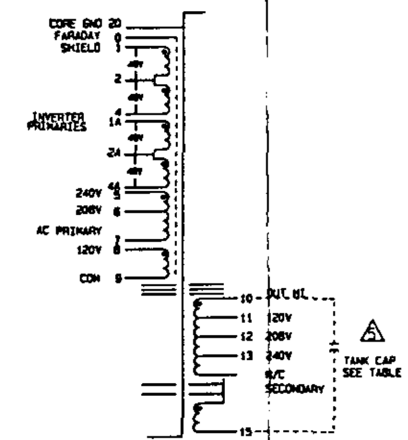
AUX. POWER BOARD	
E8	TRANSFORMER LEAD #12
E12	GREEN GND WIRE
E16	TRANSFORMER LEAD #11
MAIN POWER BOARD	
E4	BROWN JUMPER WIRE TO E20 OF MAIN POWER BOARD
E7	N.C.
E8	N.C.
E9	TRANSFORMER LEAD #13
E10	RED WIRE TO RECEPTACLE TERMINAL BLOCK
E19	BLACK WIRE TO RECEPTACLE TERMINAL BLOCK
E20	BROWN JUMPER WIRE TO E4 OF MAIN POWER BOARD

TRANSFORMER DRAWING #1



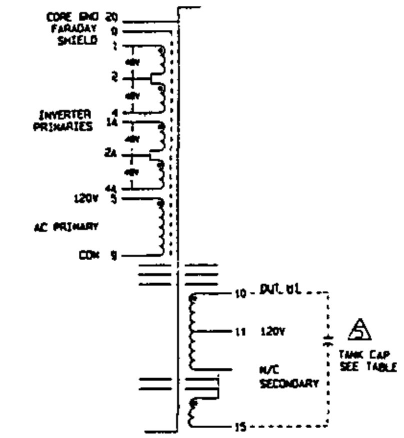
1.15 - 1.40 KVA 50HZ 220/230/240 IN/OUT

TRANSFORMER DRAWING #2



1.15 - 1.40 KVA 60HZ 120/208/240 IN/OUT

TRANSFORMER DRAWING #3



1.15 - 1.40 KVA 60HZ 120 IN/OUT

120V IN/OUT ONLY 60HZ TRANSFORMER

120V INPUT ONLY CONNECTIONS

AUX. POWER BOARD	
E2	GND MOV (60HZ ONLY)
E6	TRANSFORMER LEAD #5
E7	N.C.
E8	N.C.
E11	N.C.
E12	N.C.
E15	N.C.
MAIN POWER BOARD	
E12	TRANSFORMER LEAD #9
E14	N.C.

120V OUTPUT ONLY CONNECTIONS

MAIN POWER BOARD	
E4	BLK (HOT) WIRE TO RECEPTACLE TERMINAL BLOCK
E7	N.C.
E8	GREEN GND WIRE
E9	TRANSFORMER LEAD #11
E10	WHT (NEUTRAL) WIRE TO RECEPACLE TERMINAL BLOCK
E19	N.C.
E20	N.C.

TABLE #1

UNIT SIZE	220/230/240 50HZ	120/208/240 60HZ	120 60HZ
1.15 KVA	30 uF	25 uF	25 uF
1.40 KVA	40 uF	30 uF	35 uF

COMMON CONNECTIONS FOR ALL TRANSFORMERS

AUX. POWER BOARD	
E1	WHT JUMPER TO E1 OF MAIN POWER BOARD
E3	TRANSFORMER LEAD #1
E4	- BATTERY CONNECTION
E5	TRANSFORMER LEAD #4
E9	WHT/BLK JUMPER WIRE TO E13 OF MAIN POWER BOARD
E10	BROWN WIRE FROM BACK FEED RELAY
E13	WHT JUMPER WIRE TO E11 OF MAIN POWER BOARD
E14	BLUE WIRE FROM BACK FEED RELAY
MAIN POWER BOARD	
E1	WHT JUMPER WIRE TO E1 OF AUX. POWER BOARD
E5	BLACK WIRE FROM TANK CAPACITOR
E6	TRANSFORMER LEAD #10
E11	WHT JUMPER WIRE TO E13 OF AUX. POWER BOARD
E13	WHT/BLK JUMPER WIRE TO E9 OF AUX. POWER BOARD
E15	RED WIRE FROM LEFT STUD OF FUSE HOLDER
E16	TRANSFORMER LEAD #4A
E17	- BATTERY CONNECTION
E18	TRANSFORMER LEAD #1A

NOTES:

1. WIRE COLORS WILL VARY FOR INPUT AND OUTPUT WIRING.
60 HZ USES BLK AND RED FOR HOTS, WHT FOR NEUTRAL, AND GRN/YEL FOR GND.
50 HZ USES BRN FOR HOTS, BLU FOR NEUTRAL, AND GRN/YEL FOR GND.
2. BECAUSE OF THE NUMEROUS RECEPTICAL OUTPUT WIRING OPTIONS OF THIS UNIT THEY WILL NOT BE SHOWN ON THIS SYSTEM SCHEMATIC. SEE THE TECHNICAL REFERENCE MANUAL.
3. NUMBERS IN BOXES REPRESENT TRANSFORMER LEAD NUMBERS WHICH DO NOT CHANGE. SOME TRANSFORMERS DO NOT USE ALL LEADS.
4. ONLY ONE(1) OF THESE OPTIONS ARE USED.
5. IF A TANK CAPACITOR SHOULD NEED REPLACING OBSERVE THE CAPACITOR CASE TO SEE IF THERE IS A COLORED TOLERANCE DOT INDICATOR. REPLACE THE CAPACITOR WITH ONE OF THE SAME VALUE AND COLORED TOLERANCE DOT INDICATOR. IF TANK CAPACITORS ARE AVAILABLE BUT WITHOUT THE TOLERANCE DOT, MEASURE THE TANK CAPACITORS THAT ARE AVAILABLE AND INSTALL THE TANK CAPACITOR THAT BEST MATCHES THE ONE REMOVED. IF THE TANK CAPACITOR REMOVED HAS A RED DOT ADD 6% TO THE VALUE OF THE CAPACITOR AND THIS WILL BE THE NEW VALUE OF THE ONE THAT REPLACES IT. IF IT HAS A YELLOW DOT ADD 3%, A WHITE DOT SUBTRACT 3% AND IF IT HAS A BLACK DOT SUBTRACT 6%. THE MAIN GOAL TRYING TO BE ACHIEVED IS TO COME AS CLOSE TO THE REQUIRED CAPACITANCE FOR THE FERRO TRANSFORMER AS POSSIBLE.

HOW TO USE THE VOLTAGE CHARTS

1). REFER TO THE COMMON CONNECTION TABLE.
This table is a list of common connections that must be made for all transformers and all input and output voltages.
2). SELECT THE CHART FOR THE APPROPRIATE TRANSFORMER.
This chart will have a list of all the input and output tables for that transformer.
3). FROM THAT CHART SELECT A TABLE FOR THE APPROPRIATE INPUT VOLTAGE.
This table is a list of common connections used to determine the input voltage.
4). SELECT A TABLE FOR THE APPROPIATE OUTPUT CONFIGURATION.
This table is a list of common connections used to determine the output voltage.

DUAL DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
DECIMALS
.XX = +/- .02
.XXX = +/- .010
ANGLES
+/- 2°

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN ( ) ARE MILLIMETERS. TOLERANCES ARE:
MILLIMETERS
.X = +/- .5
.XX = +/- .25
ANGLES
+/- 2°

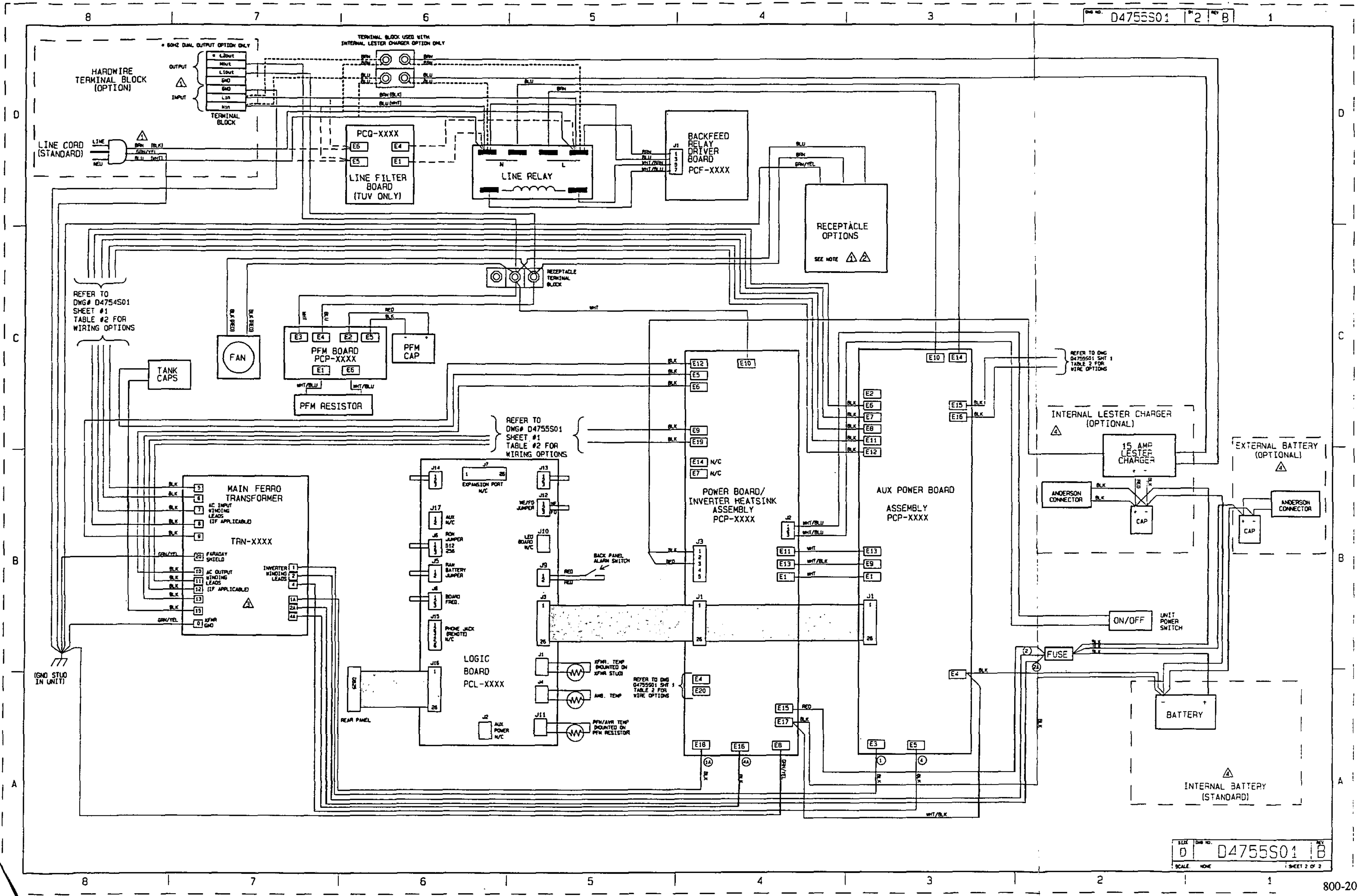
DO NOT SCALE DRAWING

APPROVED	DATE
DRAWN BY: TIM WALSH	08/08/94
CHECKED BY: B. BENSON	11/03/94
ENGINEER: M. HOGAN	11/03/94
STANDARDS ENGINEER: V. THOMPSON	11/03/94
MANUFACTURING ENGINEER: S. MILLER	11/03/94
QUALITY ASSURANCE: A. MANTHE	11/03/94
PART NO.	

BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE: SYSTEM SCHEMATIC FE 1.15-1.40 KVA

SIZE: D | DWG NO. D4755S01 | REV: B
SCALE: NONE | SHEET 1 OF 2


HARDWIRE TERMINAL BLOCK (OPTION)
TERMINAL BLOCK
LINE CORD (STANDARD)
TERMINAL BLOCK USED WITH INTERNAL LESTER CHARGER OPTION ONLY
PCQ-XXXX
LINE FILTER BOARD (TUV ONLY)
LINE RELAY
BACKFEED RELAY DRIVER BOARD PCF-XXXX
RECEPTACLE OPTIONS
RECEPTACLE TERMINAL BLOCK
REFER TO DWG# D4754S01 SHEET #1 TABLE #2 FOR WIRING OPTIONS
FAN
PFM BOARD PCP-XXXX
PFM CAP
PFM RESISTOR
TANK CAPS
REFER TO DWG# D4755S01 SHEET #1 TABLE #2 FOR WIRING OPTIONS
MAIN FERRO TRANSFORMER
TRN-XXXX
LOGIC BOARD PCL-XXXX
POWER BOARD/ INVERTER HEATSINK ASSEMBLY PCP-XXXX
AUX POWER BOARD ASSEMBLY PCP-XXXX
INTERNAL LESTER CHARGER (OPTIONAL)
15 AMP LESTER CHARGER
EXTERNAL BATTERY (OPTIONAL)
ANDERSON CONNECTOR
CAP
ON/OFF
UNIT POWER SWITCH
FUSE
BATTERY
INTERNAL BATTERY (STANDARD)
(GND STUD IN UNIT)
REAR PANEL
BACK PANEL ALARM SWITCH
D D4755S01 B