Best Power Technology Sales Corporation, Inc.

MICRO-FERRUPS SERVICE.MANUAL

for

ME1.8KVA QME1.8KVA
ME2.1KVA QME2.1KVA
ME3.1KVA QME3.1KVA

Overview

To ensure ease of use, this manual has different types of information given in each section. Information in each section includes:

Section 100 General manual and Technical Support Center information;

Section 200 System description and theory of operation;

Section 300 System operation, communications, and software information;

Section 400 Maintenance and component replacement;

Section 500 Troubleshooting;

Section 600 Part lists;

Section 700 Technical Information Publications (TIP and QTIP);

Section 800 Pictorial layouts (parts identification) and system schematics.

Support and Specifications

100 General Information

This Service Manual supplements the User's Manual. You should be familiar with the User's Manual before proceeding with any material in this Service Manual.

READ ME FIRST

This service manual contains operational, technical, maintenance, and repair information for the Best Power Technology MICRO-FERRUPS systems with the following model numbers:

60 Hertz	50 Hertz
ME1.8KVA	QME1.8KVA
ME2.1KVA	QME2.1KVA
ME3.1KVA	QME3.1KVA

The information presented herein is applicable to all 1.8 KVA, 2.1 KVA, and 3.1 KVA models, both 50 and 60 Hertz. All 50 Hertz models are prefixed with a ***Q (e.g. QME1.8KVA)***. **Any references specifically applicable to 50 Hertz units will be designated *in italics*.**

The models covered by this manual have SERIAL NUMBERS in the following format:

MEsKnnnnn and QMEsKnnnnn where:

"s" refers to the size (e.g. 1.8, 2.1 or 3.1) and
"nnnnn" refers to the unique serial number

The information in this manual is accurate for all units with software versions of F6.06 and below as noted on the logic board EPROM. Changes may occur on later versions. Please contact Best Power Technology Customer Support Center for any questions.

101 Technical Support

Best Power Technology, Inc. has an outstanding Technical Support Center. Please write or call if you have a problem or a question about your MICRO-FERRUPS. When contacting the Technical Support Center, it is important that you have your system serial number. The MICRO-FERRUPS serial number is stamped on a specification plate located on the back of the unit, below the RS232 port. All service records and system modifications arc tiled by serial number.

The Technical Support Center is open every business day from 7:00 a.m. to 11:00 p.m. Central Time. Customers outside the United States may wish to use the TELEX number. If you need to send drawings or diagrams, you may do so by calling our facsimile number. If you have a sales inquiry, you may call the sales department toll-free in the U.S. and Canada.

Technical Support.....	800-356-5737 (U.S. and Canada)
Technical Support Fax...	(608) 565-2509
General Fax.....	(608) 565-2221
TELEX.....	701934
Sales.....	800-356-5794 (U.S. and Canada)
General Office.....	(608) 565-7200
BBS.....	(608) 565-7424

Mailing Address:

Best Power Technology, Inc.
P.O. Box 280
Necedah, WI 54646

Shipping Address:

Best Power Technology, Inc.
Route 1, Box 106
Necedah, WI 54646

A variety of technical services are available from BEST's Technical Support Center.

101-l Telephone Support

If you have a question about a MICRO-FERRUPS system, such as how to install or repair it, call the technical support hotline at 800-356-5737. BEST's staff of Field Service Technicians are available 24 hours a day to help customers with any type of problem relating to a MICRO-FERRUPS system.

101-2 Field Support

In the unlikely event that your MICRO-FERRUPS system should fail, you can make arrangements to have your system repaired by a BEST factory-trained technician. Call the technical support hotline for price and scheduling information.

101-3 Service Training

If you would like to arrange factory training for your in-house service technicians, call the technical support hotline for more information.

102 Warranty

As stated in the Warranty Section of the user's manual, the warranty period is one year from the date of purchase. If within the one-year period you return a MICRO-FERRUPS system or

component or circuit board to BEST's Technical Support Center, BEST will repair or replace it free of charge. The customer is responsible for all freight charges to and from BEST.

Customers who purchase the Customer Protection Plan (CPP) receive on-site service and extended warranty coverage. Contact the Technical Support Center for detailed information about the CPP.

103 Ordering Exchange Parts

BEST products are warranted for one year. If a product fails while under warranty, you may order replacement parts for exchange, or you may send in the failed part for repair.

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 Parts pricing.

To send in a failed part for repair or exchange, contact the Technical Support Center, give the serial number of your system, and ask for a Return Material Authorization (RMA) number. Once you have been issued an RMA, ship the failed part back to BEST. Do not ship returned parts COD, as such shipments will be refused by BEST. Please be sure to mark the RMA number clearly and plainly on the outside of the shipping carton. When the failed parts are received by the service department, repaired and reconditioned replacement parts will be sent out within two days and you will be invoiced for shipping charges. If the failed parts are judged by BEST to be out of warranty, the replacement parts will be sent COD for the value of the parts plus shipping charges.

104 MICRO-FERRUPS Specifications 50 Hertz Models

	MODEL		
	QME1.8KVA	**QME2.1KVA**	**QME3.1KVA**
AC Input Voltage/Service Requited (Amps)	220VAC/10 Amp 230VAC/10 Amp 240VAC/10 Amp	220VAC/15 Amp 230VAC/15 Amp 240VAC/15 Amp	220VAC/15 Amp 230VAC/15 Amp 240VAC/15 Amp
AC Output/Max. Amps	220VAC/8.1 Amp 230VACf7.8 Amp 240VACf7.5 Amp	220VAC/9.5 Amp 230VAC/9.1 Amp 240VAC/8.8 Amp	220VAC/14.1 Amp 230VAC/13.5 Amp 240VAC/12.9 Amp
Audible Noise	51 dB	51 dB	51 dB
DC Amps Max.	35	42	58
Efficiency (Line)	90%	90%	91%

	MODEL		
	QME1.8KVA	**QME2.1KVA**	**QME3.1KVA**
Frequency-line (Inverter)	60Hz +/-3Hz (+/-.5Hz)	60Hz +/-3Hz (+/-.5Hz)	60Hz +/-3Hz (+/-.5Hz)
Harmonic Distortion	5%THD 3%Single Harmonic	5%THD 3% Single Harmonic	5%THD 3% Single Harmonic
Heat Dissipation BTU/Hr	474	568	742
Isolation	<2 pF	<2pF	<2pF
Noise Rejection Common Mode Transverse Mode	>120 dB >60 dB	>120 dB >60 dB	>120 dB >60 dB
Operating Temp.	0 to 40 deg. C. 32 to 104 deg F	0 to 40 deg. C. 32 to 104 deg F	0 to 40 deg. C. 32 to 104 deg F
Relative Humidity	0 to 95% non-condensing	0 to 95% non-condensing	0 to 95% non-condensing
Output Power	1800VA	2100VA	3100VA
Overload Capability	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)
Runtime Min. Full Load (Half)	31 (73)	24 (58)	14 (35)
Weight	232 (105.5 kg)	244 (110.9 kg)	256 (116.4 kg)
Voltage Regulation (Nominal)	+/- 3%	+/- 3%	+/- 3%

105 MICRO-FERRUPS **Specifications** 60 Hertz Models

	MODEL		
	ME1.8KVA	**ME2.1KVA**	**ME3.1KVA**
AC Input Voltage/Service Required (Amps)	120VAC/20 Amp 208VAC/10 Amp 240VAC/10 Amp	120VAC/20 Amp 208VAC/15 Amp 240VAC/15 Amp	120VAC/30 Amp 208VAC/15 A m p 240VAC/15 Amp

	MODEL		
	ME1.8KVA	**ME2.1KVA**	**ME3.1KVA**
AC Output/Max. Amps	120VAC/15 Amp 208VACn.2 Amp 240VAC/6.25 Amp	120VAC/17.5 Amp 208VAC/9.62 Amp 240VAC/8.33 Amp	120VAC/25.8 Amp 208VAC/14.9 Amp 240VAC/7.5 Amp
Audible Noise	51 dB	51 dB	51 dB
DC Amps Max.	35	42	58
Efficiency (Line)	90%	90%	9 1 %
Frequency-line (Inverter)	60Hz +/-3Hz (+/-.5Hz)	60Hz +/-3Hz (+/-.5Hz)	60Hz +/-3Hz (+/-.5Hz)
Harmonic Distortion	5%THD 3%Single Harmonic	5%THD 3% Single Harmonic	5%THD 3% Sinele Harmonic
Heat Dissipation BTU/Hr	474	568	742
Isolation	<2 pF	<2 pF	<2 pF
Noise Rejection Common Mode Transverse Mode	 >120 dB >60 dB	 >120 dB >60 dB	 >120 dB >60 dB
Operating Temp.	0 to 40 deg. C. 32 to 104 deg F	0 to 40 deg. C. 32 to 104 deg F	0 to 40 deg. C. 32 to 104 deg F
Relative Humidity	0 to 95% non-condensing	0 to 95% non-condensing	0 to 95% non-condensing
Output Power	1800VA	2100VA	3100VA
Overload Capability	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)	150% Surge 125% 10 Min (Line) 110% 10 Min (Inv.)
Runtime Min. Full Load (Half)	31 (73)	24 (58)	14 (35)
Weight	224 (101.8 kg)	236 (107.3 kg)	248 (112.7 kg)
Voltage Regulation (Nominal)	+/- 3%	+/- 3%	+/- 3%

System Description and Theory of Operation

200 MICRO-FERRUPS System Description

MICRO-FERRUPS protects sensitive electronic equipment against sags, surges, noise, lightning, spikes, brownouts, and glitches while providing continuous, computer-grade power. MICRO-FERRUPS is a true, no-break uninterruptible power supply. MICRO-FERRUPS comes equipped with an onboard microprocessor-based control system that provides the operator with control, monitoring, metering, and diagnostics. The serial data port allows connection to an external terminal, computer, hand-held remote, or modem, and PC. Microprocessor sophistication provides easy change and calibration of system set points, and functions from the front panel keyboard. It also makes the MICRO-FERRUPS system extremely easy to install, operate, and maintain.

Best Power Technology selected the MICRO-FERRUPS name because of the unique ferroresonant transformer used to achieve uninterruptible power. In the normal operating mode, the ferroresonsant transformer filters line power and protects the critical load. The ferroresonant transformer stores energy in its magnetic field and capacitor circuit, and when line power fails, it continues to provide power to the load. This "flywheel effect" can carry the full-rated load from eight to sixteen milliseconds; much longer than the two milliseconds it takes to bring the inverter on line.

If AC line fails or drifts out of tolerance, the MICRO-FERRUPS microprocessor detects the problem in as little as 260'microseconds. MICRO-PERRUPS then switches off the line input and turns on the inverter, in phase. The inverter changes DC power from the batteries into pulsed 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 continuous, no-break output power.

When input power returns to normal, the microprocessor synchronizes the inverter to the phase of the incoming line. The microprocessor evaluates line voltage quality and stability. If 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, no-break AC output.

Figure 1 is an actual oscilloscope photo of what happens during a complete AC line loss. Notice that although the input failed, there was no AC output loss.

201 System Theory of Operation

The theory of operation for both the 1.8 KVA, 2.1 KVA, and the 3.1 KVA units is the same. The logic board is the only subassembly that is interchangeable (only if it is programmed for the model in which it is installed).

The MICRO-PERRUPS has four system modes. "System Mode Auto", is used in normal operation; "System Mode Inverter", "System Mode Line Condition", and "System Mode Off' can be accessed by the RS232 port. These modes are covered in more detail in Section 300. During normal operation (System Mode Auto), both AC and DC are available. Refer to **Figure 2** for the diagram of the MICRO-PERRUPS during normal operation. AC line is applied to the #1 primary of the ferroresonant transformer and the loads are powered by the secondary. In this mode, AC line is powering the loads; commercial AC is being filtered and regulated by the transformer. The incoming AC line is continuously monitored by the control electronics under supervision of the control program. Monitored parameters arc compared to preset parameters and me program makes real-time decisions based on these comparisons. Other operating parameters also being monitored are input current, output AC voltage and current, battery voltage and current, ambient temperature, heatsink temperature, and ambient humidity (optional).

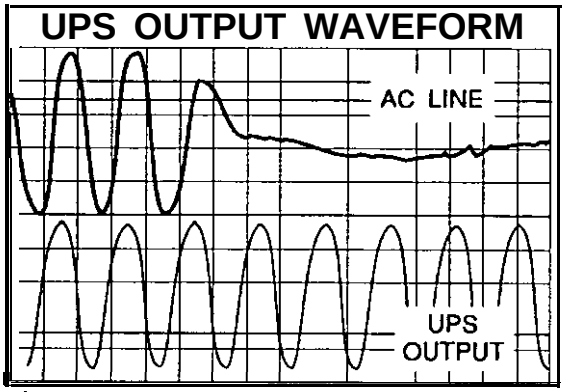


Figure 1 - Oscilloscope Trace of an AC Line Loss and the FERRUPS' Response

If any of these parameters exceed preset limits, the MICRO-FERRUPS will emit an audible morse code alarm and enter the cause of the alarm condition into an internal log which is available for future reference. If certain values exceed preset limits, the MICRO-FERRUPS may shutdown to protect the loads or the unit from damage.

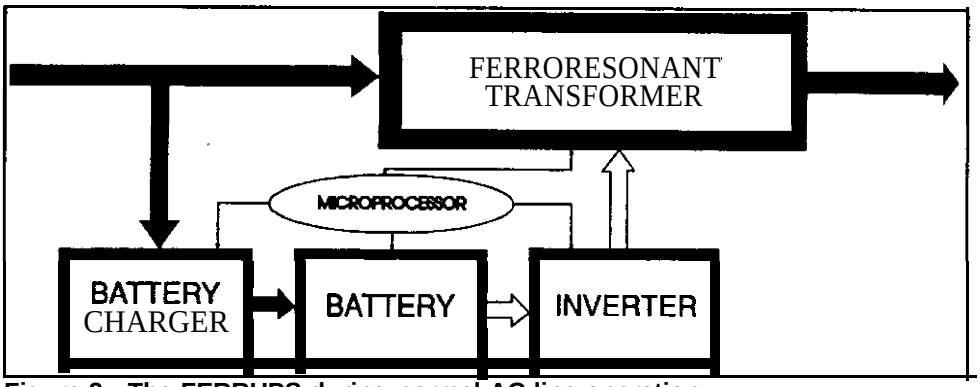


Figure 2 - The FERRUPS during normal AC line operation.

The battery voltage is also monitored by the battery charger circuitry and the batteries are automatically charged as necessary. Once fully charged, the batteries are "floated" to maintain full charge.

When the incoming line fails to meet minimum requirements, the control electronics turns off the static switch, removing the AC line from the #1 primary of the transformer. Refer to Figure 3 for the diagram of the MICRO-FERRUPS during line failure This begins a sequence of steps resulting in powering the #2 primary of the transformer with pulsed DC from the inverter. The inverter provides output energy in phase before any significant decay in output voltage has

occurred. The resonant reactance of the ferroresonant transformer smooths the pulsed DC input and yields a high quality sine-wave output. This sequence of events requires two milliseconds. During this time the energy stored in the ferroresonant tank circuit supplies the full rated output power to the load.

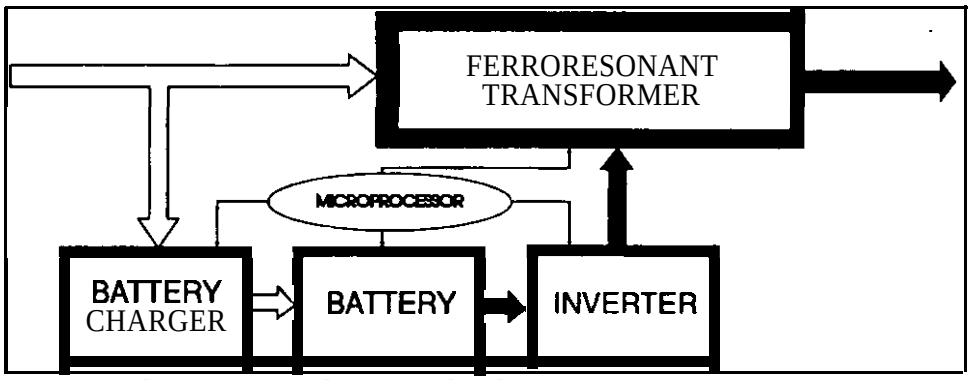


Figure 3 - The FERRUF'S during AC line loss.

With the MICRO-FERRUPS running on battery power, the control program continues to monitor all parameters and generates an audible beep every **20** seconds to let the user know the system is on battery power. Since the battery is now being discharged, the battery current and voltage are monitored. These measurements, along with the stored battery capacity parameter and calculated VA load value, are used to calculate a runtime remaining. This parameter, stored in minutes, is available for display as parameter #9 on the front panel or through the RS232 port. When this value reaches five minutes (the default value) a low runtime alarm sounds. If the battery continues to discharge, it will reach another programmable value called "near low battery" (the default is 44 volts), and the audible alarm changes. If the battery is discharged further, and reaches a preset low voltage value of 105 volts, the alarm will change to "low battery" and the MICRO-FERRUPS will shut itself down to prevent deep discharge damage to the battery.

While running on battery power in the AUTO mode, the control program continues to monitor the incoming AC line. After determining that AC line is stable, the system will match the inverter phase to the incoming AC phase and begin a transfer back to line. This is done by turning off the inverter and closing the AC static switch. The ferro tank once again powers the load during this brief transition and the loads are now back on AC line.

To better understand the System Theory of Operation it is necessary to break the system down into its major components and examine the function performed by each in detail.

202 Maior System Components

The basic system is composed of three major assemblies and their respective subassemblies plus wiring and cabinetry. The three major assemblies are the logic board, the heatsink assembly and the ferroresonant transformer. Let us examine the functions of the logic board while the system is operating in the AUTO mode, the normal mode of operation for the MICRO-FERRUPS.

202-l The Logic Board

The logic board controls all the functions in the MICRO-FERRUPS with the exception. of the battery charger. The heart of the board is an NEC 78C10 microprocessor running at 14.74 Mhz. The control program is software resident in EPROM (permanent memory) located on this board. In addition, there are many subsystems located on this board which make up the control and monitoring circuitry. In all modes of operation, the monitoring circuitry receives its conditioned and scaled signals from the heatsink assembly, the current transformers, or the DC shunt.

-202-1.1 Logic Board Subsystem Functions

Multiplexer

The monitored signals, along with preset parameters and external commands, are used by the logic board to make decisions for control of the MICRO-FERRUPS. There am a limited number of A/D (analog-to-digital) port connections on the microprocessor. In order to sample all of these signals, a multiplexer circuit is used. This makes it possible to monitor more signals than the processor could by itself.

AID Converter

Monitored voltages and currents are analog in nature; they do not have discrete or fixed values. In order for the monitored signals to be useful to the microprocessor, they must be converted to digital values. This is the purpose of the analog-to-digital (A/D) converter. When the MICRO-FERRUPS parameters have been properly calibrated, A/D calibration factors are stored in memory. Calibration factors are necessary because components used in manufacturing will normally have slightly different performance values. These factors are used to offset the actual reading and will change only when another calibration is performed. These values are available for readout through the RS232 port.

Phase-Locked-Loop

In order for the MICRO-FERRUPS to switch from line to inverter and back to line smoothly and in phase, a circuit called the phase-locked-loop (PLL) is used. The PLL compares the external frequency (AC line) to the oscillator variable frequency and corrects the oscillator frequency to match the phase of the line. The rate of phase shift or “slew rate” can be accelerated by a hardwired jumper located on the logic board. This is usually done to accommodate an unstable AC source, such as a generator.

Snubber SCR Drive

When the system goes to inverter operation, the static switch opens. Before the MOSFETs can begin switching DC, the logic board generates a gate signal for a series SCR located between the center tap bifilar inverter winding in the transformer and the positive battery. This gate signal sends DC to the MOSFETs, which can now turn on. This snubber SCR drive, originating on the logic board, is amplified and optoisolated on the power board before passing to the SCR on the heatsink assembly. This SCR is also allowed to shut off on zero crossover thereby snubbing any high voltage spikes and preventing damage to the

MOSFETs. The SCR is turned on again before the next MOSFET drive signal occurs.

Interface

The logic board contains the interface circuitry for commands entered via the keypad or terminal. The line drivers and UARTs are located on this board. In addition, the LEDs and the DIP switch are also part of the Interface.

Power Supplies

The logic board operates on 12 volts supplied from the heatsink assembly and derives other required voltages from the battery supply. It also contains a three-volt lithium battery to back up volatile RAM when the DC supply is off.

Miscellaneous

Additional components on the logic board include a pair of relays provided for external annunciation of inverter on or alarm conditions (available at the intelligent interface port), a DIP switch for allowing a hardware override of several software parameters, and adjustment potentiometers for peak current and PLL circuitry. The board also contains the jumper for changing the slew rate of the PLL and an audio beeper.

-202-1.2 Monitoring Functions

AC Line

This is a scaled-value representative of the incoming line. This value originates at the input, step-down monitor transformer (T1) on the heatsink assembly (which provides spike protection) and enters the logic board for signal conditioning. This is the AC sensing signal for the line detect circuitry. This signal lights the LINE LED on the indicator panel and is available for true RMS readout via the RS232 port.

AC Output

The output voltage from the ferroresonant transformer is tapped and fed to the heatsink assembly, where it is scaled (stepped-down) through output monitor transformer (T2). This voltage enters the logic board and is used to determine proper output voltage. Low and high AC out alarms are based on this level. This parameter is used to calculate the VA out plus phase angle and is available for true RMS readout via the RS232 port.

AC Amps Out

A toroid is located by the terminal block to sense output current. The AC output passes through this coil and generates the AC Amps output signal. This signal is passed through the heatsink assembly for scaling and sent to the logic board. This signal is used to calculate the VA out plus the phase angle and is available for readout via the RS232 port.

Battery Current

This signal originates on the heatsink assembly from the DC current shunt. The shunt, a precision resistor, generates a voltage proportional to the current that passes through it. This voltage is passed on to the logic board. In the AUTO mode, with the system on AC

line, there is no battery current and no voltage across the shunt. When running on battery power, this DC current signal is used to calculate (with DC voltage, battery capacity, and VA load) the runtime remaining. It is available for readout via the RS232 port.

DC Voltage

This battery reference voltage is a scaled proportional voltage which originates on the heatsink assembly. It is used for calculating runtime while on battery power, for determining low and near low battery alarms and is available for readout via the RS232 port.

Temperature

Three additional monitored values include ambient temperature, heatsink temperature. Ambient temperature is monitored directly from a temperature-sensitive resistor connected to the logic board. Heatsink temperature originates from another temperature-sensitive resistor on the heatsink assembly. These signals are monitored and compared to stored parameter settings to determine a possible alarm condition. These signals are also available for readout via the RS232 port.

-202-1.3 Control Signals

The logic board monitors signals to control system operation. These control signals originate on the logic board (except for the battery charger) but are conditioned or amplified on the heatsink assembly. These signals consist of:

Static Switch Drive

In the AUTO mode, AC line is applied to the #1 primary of the ferroresonant transformer. When the system is turned off or must switch to the inverter mode, AC line must be removed from the transformer to avoid damage. This drive signal controls the state of the static switch to turn AC line on or off. This switch is a single sealed module which consists of two thyristors (SCRs) connected back-to-back. This module is located on the heatsink assembly. The logic board generates the drive signal that ultimately is applied to the gates of these SCRs. The static switch drive is conditioned by the heatsink assembly and incorporates soft-start circuitry which is enabled whenever the system is initially turned on. The logic board must time the static switch drive to turn off before the inverter comes on when transferring to inverter. When switching back to line, it must turn on only after the inverter has turned off.

Inverter Gate Drive

In the AUTO mode, with the system operating normally and AC line applied, the inverter section of the system is not operating. When requited to transfer to invener, a gate-drive signal is necessary to control the power MOSFET transistors. These are located on the heatsink assembly. This drive signal originates on the logic board and actually consists of two timed signals, A and B drive, corresponding to the two “sides” of the’inverter. The basic frequency of these signals is 60 Hz (50 Hz) and is derived from the clock on the microprocessor. These A and B drive signals are amplified by the heatsink assembly

before. being applied to the gates of the MOSFETs. This basic timing is controlled by the PLL circuit on the logic board.

202-2 The Heatsink Assembly

The heatsink assembly conditions and amplifies signals to and from the logic board, supplies the main 12-volt source for the logic board, and contains the battery charger and inverter section which originates from the battery supply. This is fused by F3, a one-amp fuse.

-202-2.1 Heatsink Assembly Subsystem Functions

Fail Safe

If the MICRO-FERRUPS is operating from AC line and loses the DC battery supply, a circuit on the heatsink assembly continues to supply DC to the logic board by deriving a DC source from the AC input monitor transformer T1. This enables the system to perform an orderly shutdown in case of DC loss and also provides a DC source to operate the system in Line Condition Mode. With loss of DC in the AUTO mode, the system would shutdown ***on*** low battery and would continue to alarm as long as AC were present on the input.

Static Switch Drive and Soft-start

The static switch drive signal from the logic board is conditioned by the heatsink assembly, which uses transformer T3 to provide gate pulses to the static switch. When the MICRO-FERRUPS is initially turned on, the inrush current to the ferroresonant transformer would exceed the input breaker requirements due to the large energy storage capacity of the tank circuit. To eliminate any problem with this inrush, the heatsink assembly circuitry incorporates a soft-start. Instead of allowing the gate signal from the logic board to fully turn on the static switch, the heatsink assembly alters the signal phase so the switch initially comes on very late in the half cycle. After a number of cycles, the signal reverts back to the timing dictated by the logic board.

Inverter Gate Drive

These signals (A and B drive) from the logic board arc amplified, pulse-height limited, and provided as test points before being passed to the MOSFETs. The heatsink assembly also receives sensor signals from the MOSFET drains and can shutdown the drive signals in case of transistor damage.

Snubber SCR Drive

This drive signal from the logic board is conditioned and optoisolated by the heatsink assembly. In addition, the current across the SCR is monitored by the heatsink assembly. The snubber SCR located on the heatsink assembly is in the current path of the MOSFETs and can shutdown inverter operation when required.

MOSFET Snubber

The heatsink assembly contains active snubbing networks for both sections of the MOSFET transistors.

Battery Charger

The heatsink assembly contains the battery charger and control circuitry. The charger is a three-step, phase-controlled charger. Charger current is supplied by a 65 volt RMS winding in the main ferro. The first step of the charger occurs when the batteries are below the float level of 2.42 volts per cell; the charger puts out full rated current. The second step reduces current while maintaining a constant voltage, and the third step is a trickle charge. Charger output is applied to a full-wave bridge rectifier located on the heatsink assembly. The charger uses a soft-start circuit when turning on.

-202-2.2 Signal conditioning

The signals conditioned on the heatsink assembly are:

AC Input

This signal comes from the input monitor transformer (T1) and is passed directly to the logic board with no change except for spike protection.

AC Output

This signal, coming from the terminal block, is fused on the heatsink assembly by F2, a five-amp fuse, and is stepped down by transformer T2, then passed to the logic board.

AC Amps Out

This signal is generated by a current transformer located by the terminal block and 'is attenuated by the heatsink assembly before passing to the logic board.

I Battery

This signal, originating from the DC shunt on the heatsink assembly, is passed to the logic board unchanged except for providing test points.

DC Voltage

This signal, originating from the battery, is precision-scaled and provided to the logic board.

202-3 Inverter

The inverter consists of power switching devices mounted on a large, finned aluminum heatsink. These devices are the power MOSFETs, the snubber SCR, and a temperature sensor. On the 1,8, 2.1, and 3.1 KVA models, the fan runs continuously.

202-4 Ferroresonant Transformer

The ferroresonant transformer consists of two bifilar wound primary windings, one for AC at 240/208 (*220/230/240*) volts input, and a second for 120 volts pulsed DC. The output windings are 240/208 AC (*220/230/240*), a 65-volt charger winding, and a tank winding for the tank capacitors.

202-S Battery Bank

The standard battery bank consists of four, 12-volt batteries, connected in series for a nominal voltage of 48VAC. The batteries may be either gelled electrolyte or an absorbed glass mat (AGM) construction. These batteries are totally sealed, non-gassing, non-spillable batteries, and are contained in a separate battery cabinet. The battery cabinet also contains the DC switch and main DC fuse. Additional series strings of ten batteries may be added in parallel to increase runtime.

Unit Size	Standard Battery (AH)	Type
1.8 KVA	31 A.H.	AGM
2.1 KVA	31 A.H.	AGM
3.1 KVA	31 A.H.	AGM

System Operation

300 Svstem Operation, Communication, and Software Informatibn

NOTE: The information in this chapter is provided to refresh and enhance material provided in the USER'S MANUAL. Basic information on startup and operation is covered more thoroughly in the user's manual. Some additional material is provided in more depth in this section.

301 ON/OFF Switch

The MICRO-FERRUPS can be turned ON and OFF by using the rocker switch. This switch is located in the upper left comer of the receptacle panel. By turning this switch to the ON position, it will cause the unit to come on in five seconds, (ten seconds if no AC line is yet applied).

302 Svstem Modes

The system modes control the operating state of the UPS. They am an indication to both the software and the operator of how the unit should respond to a change in commercial power. The mode names (e.g. SMODE F) are the same commands entered from a hand-held, terminal computer, or a modem and a computer connected to the RS232 port. [CONTROL][X] am the commands via the hand-held to access these modes.

SMODE F (System MODE OfF) - [CONTROL][1]

The unit is off. There is no output from the unit.

SMODE A (System MODE Auto) - [CONTROL][2]

The unit is in automatic mode. This is the normal operating state of the UPS. When line is present, the loads are powered by conditioned line power. If line fails, the inverter takes over to supply power to the ferro, provided the UPS is in a ready state (the READY LED is lit).

SMODE L (System MODE Line Condition) - [CONTROL][3]

The unit is in line condition mode. In this mode, conditioned power is only supplied to the load when AC line is present. If line fails, power to the load is lost. This mode is useful for several reasons. Some loads have a high start-surge current that may cause the UPS to turn the inverter on. These loads can be started with the unit in this mode. If the battery fails, the loads can still receive conditioned power in this mode until the batteries are replaced. If the unit is on generator power, this mode will give the actual input line frequency from the generator on parameter #8. This helps in adjusting the "frequency window" on the UPS to accept generators that may be somewhat unstable in frequency. This is used as a Troubleshooting Mode.

SMODE 1 (System MODE INVERTER Run) - [CONTROL][4]

This is a manual inverter start. The inverter will run in this mode until the battery is exhausted, the mode is changed, or a failure occurs. Power to the loads continues as if them had been an actual power failure. This is used as a Troubleshooting Mode.

In order for the system to respond to a mode change, certain conditions must exist that will allow it. Some of the reasons that modes cannot be changed are:

CHANGING		Reason for Inability to Change
FROM:	TO:	
OFF	AUTO	Cannot lock the PLL
AUTO	AUTO	Cannot lock the PLL
AUTO	LINE COND	Line voltage below a minimum level or frequency is out of tolerance
LINE COND	AUTO	Line voltage below a minimum level or frequency is out of tolerance
LINE COND	INVERTER	Cannot lock the PLL
INVERTER	AUTO	Cannot lock the PLL

303 The Battery Charging System

The 48-volt battery systems use a phase-control charger. The charger is a float charger and is on whenever line is present and the unit is either in SMODE A or SMODE L. If the inverter is running, the charger will be off. Software controls the charger. It will shut off any time a high battery condition exists.

304 Svstem Parameters

System parameters provide comparison set points that can be read by software to compare to values acquired in real-time. These are available for display or change via the RS232 port. These values are either loaded at the factory or by qualified field service personnel and are calibration factors, operational limits or default parameters based on the model of the unit. Many parameters require a password to display or change. The password level is directly related to the sensitivity of the parameter. The lowest password is USER, followed by SERVICE and FACTORY.

NOTE: The parameter name is a mnemonic and is shown here as it actually appears on the front panel, hand-held remote, or a terminal. In the explanation that follows the summary list, an expansion of the name is given.

P#	Name	Range	Default	PASSWORD REQUIRED
0	Time	0-2359 HRS	12:00:00am	SERVICE
1	V In	0-500 AC Volts	Approx	SERVICE
2	V Out	0-300 AC Volts	Approx	SERVICE
3	I In	0-300 AC Amps	Approx	SERVICE
4	I Out	0-300 AC Amps	Approx	SERVICE
5	VA Out	Value calculated as factor of I Out and V Out	---	None
6	I Batt	0-300 DC Amps	Approx	SERVICE
7	V Batt	0-175 DC Volts	Approx	SERVICE
8	Freq	Output frequency; cannot be calibrated	---	NC
9	RnTm	Calculated from V Batt, Watts and BatCap and RnTm K	---	NC
10	Date	0101-1231 Mo Day	Jan-01	SERVICE
11	Amb Temp	Actual display of sensor temperature	---	NC
12	HS Temp	Actual display of sensor temperature	---	NC
13	Reserved			
14	ID Number:	ME1.8K012224	None	SERVICE

P#	Name	Range	Default	PASSWORD REQUIRED
15	Model Number	ME500VA	1	Param. #41
16	Full Load%	0-999	Actual	NC
17	Watts	0-99999 Watts	Actual	NC
18	PF 1.00----	0.00-1.00	Actual: Lead, Lag, Dist	NC
19	VALimit	00000-99999 VA	Actual, at current PF	NC
20	#Pwr Out	0-9999 #	0	FACTORY
21	#Ovr Lds	0-9999	0	FACTORY
22	Sys Hrs	0-99999HRS	0	FACTORY
23	InvMin	0-9999.0MIN	0	FACTORY
24	Inverter Log NOTE: Records the last 16 inverter runs or resets. Cannot be changed, only cleared.			FACTORY
25	Alarm Log NOTE: Records the last 16 alarms Cannot be changed, only cleared.			FACTORY
26	Reserved			
27	Low Vout	90-300 AC Volts	108VAC or .90 * VoutNom	SERVICE
28	Hi Vout	100-300 AC Volts	130ACV or 1.08 # VoutNom	SERVICE
29	LowBat	0-175 DC Volts	10.5VDC	FACTORY
30	NLBatt	0-175 DC Volts	11VDC	SERVICE
31	HiBatt	0-200 DC Volts	14.9VDC	FACTORY
32	L RnTm	0-99MIN	5min	SERVICE

P#	Name	Range	Default	PASSWORD REQUIRED
33	A Otemp	25C-60C	60C	SERVICE
34	AT Shdn	25-80C	70C	SERVICE
35	S Otemp	---	---	NC
36	Low Humid	0-99		SERVICE
37	Hi Humid	0-99		SERVICE
38	Off Cnt	0-9999	0	USER
39	EPO Dly	1-9999 Seconds	20 Seconds	SERVICE
40	NVVers		Actual	NC
41	Model Indx	1-8	1	FACTORY
42	ARst Time	0-255	0 min	SERVICE
43	XferDly	3-99 Seconds	20sec	SERVICE
44	AutoRst	1)YES 2)NO	1	SERVICE
45	AC ShDn	1)YES 2)NO	1	FACTORY
46	ExBnOut	1)YES 2)NO	1	SERVICE
47	AltSetup	0-7	0	SERVICE
48	EPO Rst	1)YES 2)NO	2)NO	SERVICE
49	VinNom	100-500 AC Volts	120	FACTORY
50	VoutNom	100-300 AC Volts	120	FACTORY
51	BrownoutV	75V-240 AC Volts	95VAC (120V in) or 0.79 * VinNom	SERVICE
52	Lo Freq	57-60Hz (*47-50Hz*)	59.50Hz (*49.50Hz*)	SERVICE
53	Hi Freq	60-63Hz (*50-53Hz*)	60.50HZ (*50.50Hz*)	SERVICE

P#	Name	Range	Default	PASSWORD REQUIRED
54	Reserved			
55	Reserved			
56	Freq Delay	1-9	2	SERVICE
57	Glitch Cnt	1-5	2	SERVICE
58	Reserved			
59	Line Delt1	5-99	12	SERVICE
60	Line Delt2	5-99	16	SERVICE
61	V Reftbl	0-500 AC Volts	Actual	SERVICE
62	EBrownotV	75-400 AC Volts	Calculated	NC
63	Reserved			
64	Overlap	0-9	0	FACTORY
65	PhsDly	0-6142	0040	FACTORY
66	Reserved			
67	Reserved			
68	InvTest	1)YES 2)NO	1	SERVICE
69	TestRate	1-9999 MIN	1440	SERVICE
70	IPk	1-800 DC Amps	100	FACTORY
71	TestPhas	5-99	3200	NC
72	I Batt Pk	0-999 DC Amps	000	NC
73	Peak 1	0-9999 DC Amps	0000	NC
74	Peak 2	0-9999 DC Amps	0000	NC
75	AlmMask1	0-255	0	SERVICE
76	AlmMask2	O-255	0	SERVICE

P#	Name	Range	Default	PASSWORD REQUIRED
77	Reserved			
78	Baud NOTE: 1=300 baud, 2=1200 baud, 3=4800 baud and 4=9600 baud	1-4	2	SERVICE
79	ConMde	1)Norm 2)NoAM 3)NoEB 4)SndF	1	SERVICE
80	Ctl Pswd	1)YES 2)NO	2	SERVICE
81	# Bad PW	0-9999	0	FACTORY
82	Reserved			
83	RnTm K	1-99	57	FACTORY
84	BatCap	5-9999 AH	31	SERVICE
85	BTT	60-240 Seconds	60	FACTORY
86	BattTst	1)YES 2)NO	1	SERVICE
87	IntrvlDays	1-30 Days	30	SERVICE
88	RnTm Alm	5-9999 Minutes	0005 Changes with model	SERVICE
89	FctrAlm	0-99999 Minutes	00000	NC
90	BTRT	0-9999 Minutes	0000	NC
91	Reserved			
92	CFACVI	0-59999	3250	FACTORY
93	CFACVO	0-59999	3250	FACTORY
94	CFACAI	0-59999		FACTORY
95	CFACAO	0-59999	3800	FACTORY
96	CFDCV	0-59999	2800	FACTORY
97	CFDCA	0-59999	4000	FACTORY

P#	Name	Range	Default.	PASSWORD REQUIRED
9 8	CFREF	o-59999	3250	FACTORY
99	Reserved			

304-L Explanation of Parameters

0 Time - This is the current time of day, using the 24-hour clock format. It is a real-time clock and can be set to any valid time. If the unit is shut off, the time it was shut off will be the time displayed when it is turned on again.

1 V In - This is the input AC line voltage. This is initially calibrated at the factory to an actual value.

2 V Out - This is the output AC voltage. This is initially calibrated at the factory to an actual value.

3 I In - This is the AC input current, initially calibrated at the factory.

4 I Out - This is the value of the current applied to the load, and is initially calibrated at the factory.

5 VA Out - This is an internally-calculated value and is a factor of V Out and I 'Out. This parameter cannot be changed.

6 I Batt - This is the battery current being supplied to the unit. This is initially calibrated at the factory.

7 V Batt - This is the value of the battery voltage. This is initially calibrated at the factory.

8 Freq - This is the frequency of the input to the unit when the unit is in SMODE A and the inverter is off. If the inverter is on, this is the nominal design frequency of the unit. If the unit is in SMODE L, it is the frequency of the input to the unit. This parameter is a display of an actual value.

9 **RnTm** - This is the calculated **runtime** of the system on invener for the current load. This value is a factor of V Batt, I **Batt** and **BatCap**. It is only valid after the unit has been running on the inverter for two to three minutes. The formula used to calculate **runtime** is

$$Constant \times Battery\ AH \times \frac{(VDC - LowBat)^2}{(FullChgV - VDC) \times (LoadWatts + WattsLoss)}$$

The above formula is valid when running on inverter. If calculating this parameter while the unit is on line, use the following formula to derive the VDC value for the above formula.

$$New\ VDC = VDC_{actual} - ResidualChg - \frac{(0.036 \times LoadWatts + Wattloss)}{20 + (\frac{Battery\ AH}{3})}$$

10 Date - This is the current date. It is a real-time calendar and can be set to any valid date. If the unit is shut off,the date it was shut off will be displayed when it is turned on again.

11 Amb Temp - This is the actual ambient temperature of the unit's environment in degrees Celsius. It is derived from a probe inside the unit and cannot be changed.

12 HS Temp - This is the actual temperature of the invener **heatsink** in degrees Celsius. It is derived from a probe attached to the **heatsink** and cannot be changed.

13 Reserved

14 ID Number - The unit's serial number can be entered in this location. It is provided for installations with multiple units sharing a common terminal. If a mode change or alarm condition occurs, this ID number is also displayed.

15 **Model Number** - This value is set at the factory to identify the model number of the unit. Standard operating parameters, located in system ROM, are transferred to operational memory based on this value. This value is set at the factory but can be changed when the Model Index parameter (41) is entered.

16 **FullLoad%** - Percentage of actual rated load being provided by the unit. It is calculated using the formula:

$$FullLoad\% = \frac{VAOut}{VALimit}$$

17 Watts - The actual wattage being drawn from the unit. ,

18 PF - Power Factor is determined using the formula below. The power factor type (LEAD, LAG, or DIST) is determined by software and displayed with this parameter as well.

$$PF = \frac{wattage}{VA}$$

19 VALimit - The maximum VA that can be supplied to the load at the current power factor. This parameter is determined by the following formulas:

For lagging loads:

$$VALimit = unit\ watt\ rating$$

For 0.7 < PF < 1.0, leading or distortion:

$$VALimit = \frac{unit\ watt\ rating}{PF}$$

For PF < 0.7 leading or distortion:

$$VALimit = unit\ watt\text{~}atingxl.43$$

20 #Pwr Out - This is the cumulative number of power outages (actually, the number of times the inverter was run). This value can be manually set to zero and will be automatically cleared when a memory check alarm occurs.

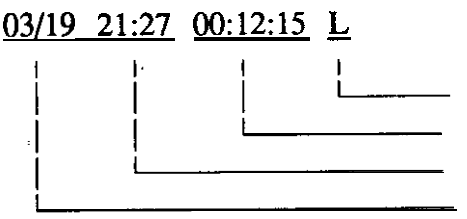
21 #Ovr Lds - This is the total number of output overloads. If the VA Out exceeds the VALimit (Parameter 19) this value increments. It can be set to zero and is reset when a memory check alarm occurs.

22 Sys Hrs - This is the total number of hours the unit has been in operation, regardless of system mode. The only time this counter does not update is when the unit is manually shut off with the switch. It can be set to zero and is reset when a memory check alarm occurs.

23 InvMin - This is the cumulative total minutes the inverter has been run. It can be set to zero and is reset when a memory check alarm occurs.

24 Inverter Log - The inverter log is a record of inverter activity. The log has room for the most recent 16 entries. It is cleared by a CLRLOG terminal command or a memory check alarm. On a terminal, the display also includes the number of seconds as well as an asterisk ("*") if the inverter is still active. Here is a description of a typical entry in the

log:

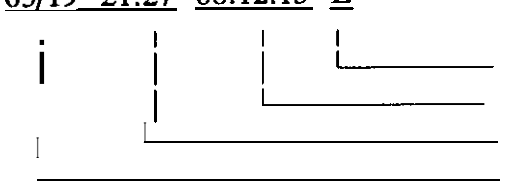


Reason for inverter run (see below)
Hours, minutes and seconds of runtime
Time the inverter turned on (9:27pm)
Date of inverter activity

Reason for inverter run:

L - Line loss has occurred. This is the normal SMODE A response to line failure.
M - Manual inverter run initiated by a [CONTROL][4] or SMODE I command,
F - Line frequency has exceeded tolerance.
R - A DC reset has occurred. (The DC breaker was turned OFF and then ON again.)
C - Battery test was activated.
B - Brownout has occurred.

25 Alarm Log - The alarm log is a record of alarm activity. The log has room for the most recent 16 entries. It is cleared by a CLRLOG terminal command, or a memory check alarm. On a terminal, the display also includes the number of seconds as well as an asterisk ("*") if the alarm is still active. Here is a description of a typical entry in the log:



Reason for alarm (see below)
Hours, minutes and seconds the unit alarmed
Start time of the alarm condition (9:27pm)
Date the alarm occurred (March 19)

Reason for Alarm:					
A	• -	Low Battery	I	· ·	Heatsink Overtemp
B	- • • •	Near Low Battery	J	• - - -	User Test Alarm
C	- • - •	High Battery	K	- • -	Check Cooling
D	- • •	Low Run Time Left	L	• - • •	Reserved Alarm
E	•	Low AC Out	M	- -	Check Battery
F	• • - •	High AC Out	N	- •	Check Inverter
G	- - •	Output Overload	O	- - -	Memory Check
H	• • • •	High Ambient Temp	P	• - - •	Shutdown Activated

26 Reserved

27 Low Vout - This is the set point at which the low AC out alarm triggers. If the voltage falls to five volts below this number, the unit will shutdown. Calculated by software as 90% of Vout Nominal.

28 Hi Vout - This is the set point at which the high AC out alarm triggers. Calculated by software as 108% of Vout Nominal.

29 LowBat - This is the set point for the low battery alarm. If the actual battery voltage falls below this point while the inverter is running, it forces the inverter to turn off.

30 NLBatt - This is the set point when the near low battery alarm sounds. This value should always be higher than the low battery set point.

31 HiBatt - This is the set point for the high battery alarm.

32 L RnTM - This is the set point at which the low runtime alarm activates. The value is entered in minutes.

33 A Otemp - This is the set point for the ambient overtemperature alarm. It is entered in degrees Celsius.

34 AT Shdn - This is the ambient temperature shutdown set point in degrees Celsius. This is the value' at which the unit will actually shutdown. The unit will alarm first at the ambient overtemperature set point (A Otemp). This can be user-defined but is factory-set to a nominal value.

35 S OTemp - This is the set point for the inverter heatsink overtemperature alarm. It is entered in degrees Celsius. The alarm will sound 10 degrees before the inverter is forced off.

36 Reserved - If the humidity option is installed, this is the LowHumid set point for the low humidity alarm.

37 Reserved - If the humidity option is installed,, this is the HiHumid set point for the high humidity alarm.

38 Off Cnt - This is a counter, loadable from a remote computer or terminal, that will shut off the unit when it reaches zero. If this parameter is manually reset to zero, the timer is canceled. Used with CheckUPS software.

39 EPO Dly - Emergency Power Off Delay. This controls the length of time that pin 21 of the interface connector must be asserted before the system will shut down. This delay time is used only if parameter #48 (EPO Rst) is set to 1)YES.

40 NVVers - This is the software version number in the EPROM.

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

MODEL NUMBER	UNIT SIZE
6	1.8KVA
7	2.1KVA
8	3.1KVA

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

42 **ARst** Time - Number of minutes that the unit will remain in a "Not Ready" state after shutting down because of a low battery condition.

43 **XferDly** - This is the delay time, in seconds, that the UPS will wait before transfer back to line after a good line has been verified.

44 **AutoRst** - This is the automatic restart parameter. It determines how the unit will respond to a line loss. If it is set to 1)YES and the system shuts off due to a low battery condition, the UPS will indicate an AUTO and NOT READY state. If the line returns, the unit will continue to operate, but it will be in Line Condition Mode. When the battery voltage gets to 120% of low battery, and AC is good and no other shutdown alarms are in effect, the UPS will go back to the ready state. If it is set to 2)NO, the UPS will still indicate the same AUTO/NOT READY state, the inverter will not run, and the system will remain in a NOT READY condition.

45 AC **ShDn** - This parameter determines whether the unit will shutdown on a low AC out alarm. If this parameter is set to 2)N0 and you have a low AC out condition (such as a shorted output), the unit will keep on running. If it is set to 1)YES the unit will shutdown.

46 **ExBnOut** - If extended brownout is set to 1)YES, it allows the brownout voltage to be lower than set point P5 1, when there is less than the full load on the UPS. The minimum voltage on a 120VAC unit is 72V, with no load on the unit. When set to 2)NO, then set point of P51 is used.

47 **AltSetup** - Alternate setup is a way to change eight parameters at once. This is associated with the DIP switch on the logic board, switches 1, 2 and 3. See the table below. Dip switches 1, 2 and 3 will always be used if they are not equal to zero (all off). Each parameter can be changed normally, but will be forced to the value in the table when Altsetup is changed.

	SWITCHES			PARAMETERS CHANGED							
	SW1	Sw2	Sw3	P43	P51	P52	P53	P56	P57	P59	P60
0	OFF	OFF	OFF	20	79%	.50	.50	2	2	12	16
1	ON	OFF	OFF	20	79%	1.00	1.00	2	2	12	16

SWITCHES				PARAMETERS CHANGED							
	Sw1	Sw2	Sw3	P43	P51	P52	P53	P56	P57	P59	P60
2	OFF	ON	OFF	20	79%	3.00	3.00	2	2	12	16
3	ON	ON	OFF	3	71%	1.50	1.50	3	2	13	18
4	OFF	OFF	ON	10	65%	3.00	3.00	2	2	14	19
5	ON	OFF	ON	10	75%	1.50	1.50	2	2	16	21
6	OFF	ON	ON	5	75%	3.00	3.00	2	2	20	40
7	ON	ON	ON	3	63%	3.00	3.00	6	3	20	40

P51 BrownoutV - percentage of VinNom (e.g. 79% of 120VAC in)
P52 Lo Freq is nominal line frequency minus 0.5 Hz.
P53 Hi Freq is nominal line frequency plus 0.5 Hz.

48 EPO Rst - Emergency Power Off Restart. If set to the default value of 2)NO, the EPO function will shutdown the system immediately when pin 21 of the interface connector is asserted. If it is set to 1)YES, the restart feature is enabled. This means that pin 21 must be asserted for the length of time specified in parameter 39 (EPO Delay, default 20 seconds) before the system shuts down. In either case, once the shutdown has occurred, the MICRO-FERRUPS will alarm "shutdown activated" (code P). If EPO Rst is set to 1)YES, the system will also emit a short beep once every five seconds for a period of one minute. The system will only turn on again when all of the following conditions have been met:

1) The EPO signal (pin 21) is not asserted.
2) Input line voltage is OK.
3) The system has been off for at least one minute.

49 VinNom - AC input voltage nominal. Change this parameter to the desired AC input voltage. This parameter will also change P5 1 BrownoutV, to 79% of the set voltage.

50 VoutNom - AC output voltage nominal. Change this parameter to the desired AC output voltage. This parameter will also change P27 Low Vout and P28 Hi Vout.

51 BrownoutV - This is the set point at which the inverter will start, if the RMS input voltage is less than this value at full load. It is entered in AC volts.

52 Lo Freq - This is the set point for the low input line frequency limit. It can be set in 0.01 Hertz increments.

53 Hi Freq - This is the set point for the high input line frequency limit. It can be set in 0.01 Hertz increments.

54 Reserved

55 Reserved

56 Freq Delay - The microprocessor measures frequency of the AC input line once every ten cycles (166ms or *200ms*). Frequency delay is the number of samples, in a row, that must be out of the range of parameters 52 or 53 for the inverter to go on.

57 Glitch Cnt - This is the number of consecutive glitches that must occur before the inverter is started. The glitch count evaluates the results of the reference table and counts the glitches as they occur. The glitch counter is an up/down counter. This means that missed compares will increment the counter while good compares will decrement it (down to zero only).

58 Reserved

59 Line Deltl - Line Delta represents the maximum allowable absolute value difference (1=approximately .7 to 1.0 volt at 120VAC) between the present sample and the reference waveform. A line deviation in excess of this set point represents a glitch. Units are in A/D counts.

60 Line Delt2 - Same as Line Delta1 but used when transferring from inverter to AC line or changing to System Mode Auto.

61 V Reftbl - Voltage reference table is the true RMS value of the reference waveform. This should be calibrated with AC input at the desired brownout voltage. When AC input goes below the brownout, the inverter will be triggered.

62 EBrownotV - Extended brownout voltage. When the AC input voltage reaches this set point the inverter will come on. This is calculated with VinNom and VA out. If P46 ExBnOut is programmed to 2)NO, this function is not used.

63 Reserved

64 Overlap - The number of half cycles (8.3ms or *10ms*) before the invetter turns off on a return to line.

65 PhsDly - When the inverter is first turned on the gate pulse is delayed for this amount of time after the zero cross (falling edge of PLL 120Hz or PLL *100Hz* signal). Each half cycle after the turn on, the delay time is reduced (Phase Step) until the delay is about *208 s*.

66 Reserved

67 Reserved

68 InvTest - Enables or disables the automatic invener test.

69 TestRate - Inverter test frequency in minutes.

70 **IPk -** The minimum peak current for the inverter test. One current peak must be 50% and the other between 25% and 75% of this value.

71 **TestPhas -** Determines the phase at which the inverter test is performed. This parameter will automatically adjust to the proper test phase required to get the proper current peaks.

72 I Batt Pk - Displays the peak DC current, whether on inverter or AC line. Updated every 0.5 seconds. IBatt must be calibrated for this to work correctly. (During line operation, due to the small current levels, this may not be accurate.)

73 Peak 1 - Displays the first peak DC current captured at the instant the inverter test was activated. IBatt must be calibrated for proper operation of the invener test.

74 Peak 2 - Displays the second peak DC current captured at the instant the inverter test was activated. IBatt must be calibrated for proper operation of the inverter test.

75 **AlmMask1** - The purpose of these masks is to enable or disable associated relays. **AlmMask1** controls alarms A thru H. Each mask is a binary pattern of eight bits with each bit controlling its associated alarm. A “1” will enable an alarm and a "0" will disable it. The value entered is the decimal equivalent of the 8-bit binary alarm mask. For example, to enable alarms A, C and F:

$$\frac{HGFEDCBA}{00100101} = 37\ (decimal)$$

76 AlmMask2 - The purpose of these masks is to enable or disable associated relays. **AlmMask2** controls alarms I thru P. Each mask is a binary pattern of eight bits with each bit controlling its associated alarm. A “1” will enable an alarm and a "0" will disable it. The value entered is the decimal equivalent of the g-bit binary alarm mask. For example, to enable alarms I, K and N:

$$\frac{PONMLKJI}{00100101} = 37\ (decimal)$$

77 Reserved

78 Baud - This is the baud rate at which the RS232 portion’of the interface circuitry communicates with external devices. It is active only if DIP switch 4 on the logic board is off. If the switch is on, the baud rate is fixed at 1200.

79 **ConMde - When in 1)Norm,** the unit automatically displays inverter and alarm messages on a CRT connected to the RS232 port. A setting of **2)NoAM,** will suppress these messages. The **3)NoEB** setting is designed to be used with custom power monitoring software. (like **CheckUPS).** If this is changed to **4)SndF,** the "F" string is sent automatically **every** 15 seconds. This is primarily used by customers who would like to log the command status string.

80 CtlPswd - When this parameter is set to 1)YES, a USER password is needed to use the control functions. This is useful to prevent unauthorized tampering When set to 2)NO, no password is needed.

81 # Bad PW - This is a counter that increments whenever an invalid password is entered. It is a record of possible tampering.

82 Reserved

83 RnTm K - This is the constant in the run time formula.

84 BatCap - Battery capacity factor used in calculation of runtime. This parameter is entered as the manufacturer's ampere-hour (AH) rating number. If there is more than one string of batteries, multiply the number of strings times the ampere-hour rating of the battery. Typical entries in this position for standard factory configurations are:

1.8KVA = 31 AH
2.1KVA = 31 AH
3.1KVA = 31 AH

85 BTT - The amount of seconds the unit will run on inverter while doing the battery test.

86 BattTst - Enables or disables the automatic battery test.

87 IntrvlDays - Number of days between automatic battery tests.

88 RnTm Alm - Set point for the minimum full load runtime during a battery test.

89 FctrAlm - The full load runtime alarm factored by the current load. If this is greater than the Battery Test Runtime (Parameter #90), the battery test will fail.

90 BTRT - Battery test runtime. The actual runtime during the last battery test,

91 Reserved

92 CFACVI - This is a calibration factor for the line voltage. It is the multiplier used by the A/D converter in determining the value to be displayed in parameter #1.

93 CFACVO - This is the calibration factor for the output voltage. It is the multiplier the A/D converter uses in determining the value to be displayed in parameter #2.

94 CFACAI - This is the calibration factor for the input current. It is the multiplier the A/D converter uses in determining the value to be displayed in parameter #3.

95 CFACAO - This is the calibration factor for the output current to the load. It is the multiplier the A/D converter uses in determining the value to be displayed in parameter #4.

96 CFDCV - This is the calibration factor for the battery voltage. It is the multiplier the A/D converter uses in determining the value to be displayed in parameter #7.

97 CFDCA - This is the calibration factor for the battery current. It is the multiplier the A/D converter uses in determining the value to be displayed in parameter #6.

98 CFREF - This is the calibration factor for the true RMS value of the reference waveform. it is the multiplier the A/D converter uses in determining the value to be displayed in parameter #61.

305 The Remote Control Panel

This optional device is powered by the UPS. Once the remote is plugged in, via the RS232 port (refer to **Figure 1**), press [ENTER] until the "=>" prompt appears in the display. This is an indication that the remote is ready to receive commands. Next, press [123] followed by [DISPLAY], [CONTROL], [PROGRAM] [ENTER]. This sequence is called 123DCP. After the 123DCP entry, the display will show a "scrolling" sequence of information about the status of the unit. On the remote, the LED indicators will also show. the status of the unit. To enter a password, press [PROGRAM] at this point. The response will be "Password?". Enter the appropriate password for the action you will be performing and press [ENTER]. With the remote, be sure to clear it before unplugging it. This is done by pressing [CLEAR] until the scrolling display appears, then pressing [CLEAR] and [.] simultaneously until the "=>" prompt appears. This clears the 123DCP mode and prepares the unit for subsequent communications.

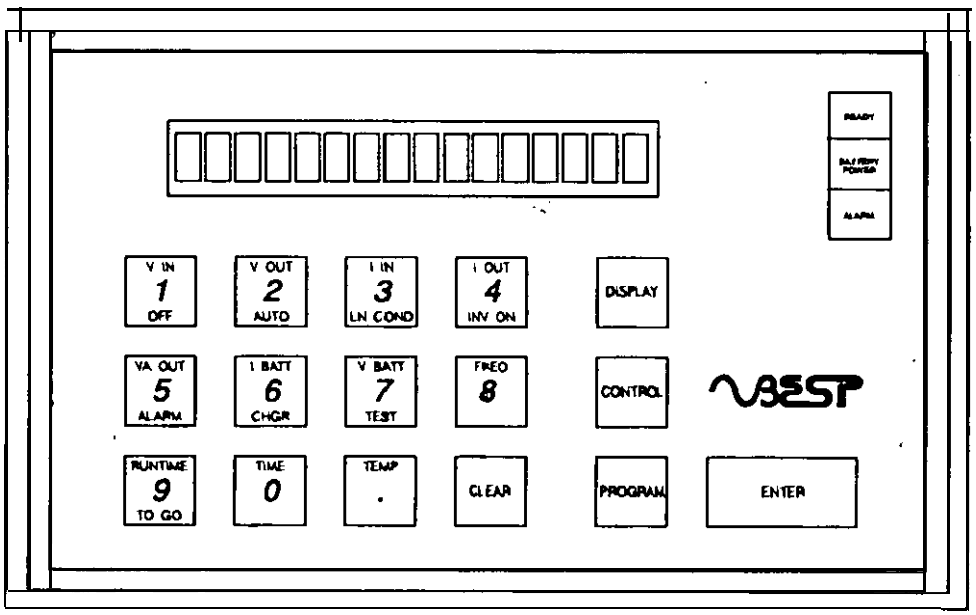


Figure 1 - Handheld Control Panel with Vacuum-Fluorescent Display and LEDs

305-l Definition of the Buttons

DISPLAY (GREEN) - This is used before entering a parameter number you wish to display. Some passwords are required for certain parameters to allow you to either display or change them. These are:

Password Level	Parameters Accessed
None	O-63, 67-69, 71-82, 84-99
USER	O-63, 67-69, 71-82, 84-99
SERVICE	O-63, 67-69.71-82. 84-99
FACTORY	0 - 99

NOTE: The USER password is 377. The origin of this password is from the date that the company was founded (March 1977). The SERVICE password seven times the USER password (2639 = 377 x 7). The FACTORY password is seven times the SERVICE password (18473 = 2639 x 7).

The green lettering above each number (and decimal point) on the keypad indicates the first eleven (and most common) parameters displayed by pressing DISPLAY and the corresponding pad.

CONTROL (RED) - This button is used to change the operating modes of the unit. Notice that underneath each of the first seven digits on the keypad, there is lettering to designate the CONTROL functions performed by pressing the corresponding pad. Any time you enter a command using the CONTROL key, the system will respond with “Enter to Confirm”.

[CONTROL][1], [2], or [3] performs SMODE changes to OFF, AUTO and LN COND, respectively.

[CONTROL][4] manually starts the inverter. Turn it off by selecting an appropriate SMODE.

[CONTROL][5] toggles the audible alarm to either off or on.

[CONTROL][6] is an invalid command.

[CONTROL][7] initiates an inverter test. [CONTROL][7][7] initiates the battery test. Once either of these tests are started, the display will show relevant parameters, to indicate how the test is doing. After the test is finished, the display will show whether or not the unit passed. If it does not pass, the unit will also alarm. To stop looking at the test parameters, press [CLEAR]. This requires a USER password.

[CONTROL][8] initiates an alarm test to verify that the audible alarm device(s) works. This requires a least a SERVICE password. Press this sequence again to clear the alarm test.

[CONTROL][9] clears both the inverter and alarm ‘logs. This requites at least a

FACTORY password.

[CONTROL][O] clears all alarms and resets all 16 alarm flags. If the alarm condition still exists, the alarms will reactivate, five seconds later. This requires at least a FACTORY password. If the alarm caused the unit to go into a NOT READY state, you must change system mode to ***get*** it back into READY.

[CONTROL][.] performs a system reset. This causes the unit to respond as if it were first turned on. ***It is possible to drop the load with this*** command. This requires at least a FACTORY password.

[CONTROL][DISPLAY] to display the status of the unit and the first 19 parameters. Press [CLEAR] to exit back to the normal scrolling display.

PROGRAM (ORANGE) - This pad is used to either initiate a password sequence, as explained above, or to enter a new value in a parameter.

ENTER (BLUE) - This is used in conjunction with the [DISPLAY], [CONTROL] and [PROGRAM] buttons, as described above. If a parameter is being displayed, pressing [ENTER] consecutively will step through the remaining parameters. This is especially useful in displaying the inverter or alarm logs.

CLEAR (BLUE) - This clears the last value or command entered. It is also used to return to the scrolling display after completion of a parameter inspection or change. Press this button twice to clear the password.

305-2 Additional Functions

There am three remote control panel commands that are used to affect the audible or visible response of the handheld ONLY. These are for the audible alarm, keyclick and display brightness. The sequence to affect these parameters is also printed on a sticker on the back of the handheld remote.

Simultaneously pressing [CONTROL] and [PROGRAM] will initiate the sequence. The first choice is "Audible 1>YES 2>NO". By choosing either [1] or [2], you can enable or disable the handheld alarm. If you press [ENTER], the previously set value is retained and the display goes to the next function.

This next function is "Key click 1>YES 2>NO". Again, select [1] or [2], or simply [ENTER] to retain the original setting. This brings up the last parameter, " D i m 1>YES 2>NO". The same choices are available: In this case, [1] dims the display and [2] brightens it.

At this point, there are two options. If [ENTER] is pressed, the above sequence is restarted. If you have made changes to any of the three parameters and want them to be permanent, press [PROGRAM] [ENTER].

306 LED Indicator Lights

The AC LINE (green LED on front panel) LED is on only when AC line is present.

The READY (green) LED is lit to indicate the MICRO-PERRUPS will support an outage.

The CHARGING (green LED on front panel) Lit whenever system is charging batteries. Off when batteries are charged.

The BATTERY POWER (yellow) LED is lit whenever the inverter is running and the unit is on battery power.

The ALARM (red) LED is lit whenever an alarm condition exists. **See Alarms, this chapter.**

307 Alarm Conditions

A red indicator LED lit on the front panel indicates an alarm condition. A Morse coded letter will indicate which alarm is active. The audible portion of the alarm can be silenced by using the switch on the back of the MICRO-PERRUPS. Alarm conditions vary in severity. Certain alarms are only warnings; others indicate a shutdown condition and some will force a System Mode change. Certain alarms clear when the offending condition abates. Other alarms "latch" and have to be manually cleared even though the offending condition no longer exists. All alarms require attention from site personnel because of the possibility of system failure. If a system has shutdown due to an alarm condition that no longer exists, resetting the ON/OFF switch will clear the alarm. The following table lists all **alarms,** their **severity** and action to be taken. **If an alarm. cannot be cleared or corrected, proceed to the troubleshooting section.**

307-l Table of Alarm Conditions

NOTE: To continue with the procedure you will need to set-up communication.

ALARM	Letter/Code	Latching	Mode-Change To	PROCEDURE
Low Battery	A/• -	YES	Auto Not Ready (Lin-Cond.)	Batteries have discharged to 41 volts or less. With AC restored, do a system reset ([CONTROL][2]). Display battery voltage, parameter#7.
Near Low Battery	B/- • • •	NO	No Change	Battery voltage has fallen to 44 volts or less. Will clear when voltage rises over 44.
High Battery	C/- · - ·	YES	Not Ready	See troubleshooting procedures.

ALARM	Letter/Code	Latching	Mode-Change To	PROCEDURE
Low Runtime	D/- • •	NO	No Change	Inverter only-warning
Low AC Out	E/•	Both	Sys Mode Off	Output AC too low - See Troubleshooting
Hi AC Out	F/• • - •	NO	No Change	See troubleshooting procedures.
Output Overload	G/- - •	Both	Sys Mode Off	VA out (parameter #5) exceeds VALimit (#19). On AC Line MICRO-FERRUPS will continue to run for 10 minutes with 101-125% overload. (Inverter, 101-110%). After this, the unit will shutdown. Small, short overloads will self-clear. Reduce load, do a system reset.
High Am. Temp.	H/• • • •	Both	Sys Mode Off	Temp. exceeds the A Otemp set point (#33). Non-latching until temp. exceeds ATShdn set point (#34). To restart do a system reset. If I temp. does not decrease, go to troubleshooting.
Heatsink Overtemp	I/• •	YES	Sys Mode Off	Heatsink temperature probe rises to within 10 degrees of S Otemp set point (#35). (Alarm-only) If temperature exceeds #35, unit shuts down. To correct - See Troubleshooting.
User Test	J/• - - -	NO	No Change	User Test only ([CONTROL][8]). Clear ([CONTROL][8]).
Check Cooling	L/• - • •	YES	Sys Mode Off	Cabinet temperature exceeds 60C (Alarm). Cabinet temperature exceeds 65C (Shuts down). See Troubleshooting.
Check Battery	M/- -	YES	No Change	Automatic battery test has failed. Check calibrations and batteries. Clear with a reset or [CONTROL][0].
Check Inverter	N/- •	YES	No Change	Inverter has failed. Check calibrations and batteries. Clear with a reset or [CONTROL][0].
Memory Check	O/- - -	NO	Any Possible	Calibration factors in unit have changed. See Troubleshooting.
Shutdown Activated	P/• - - .	YES	Sys Mode Off	Pin 21 of RS232 (Panic Button) has been activated. Open pin 21 and manually restart.

308 Communication via Terminal

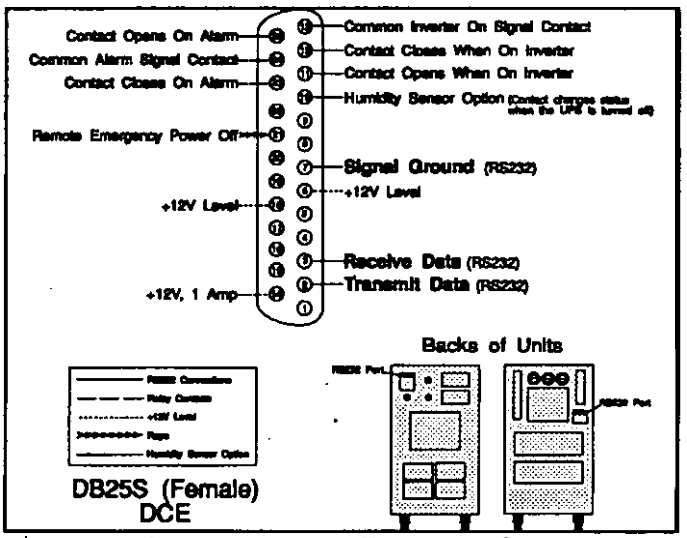
NOTE: This section describes communication with the MICRO-FERRUPS by a computer or a terminal only.

308-1 Hardware Connection

A DB25S (female) connector is provided on the back panel of the MICRO-FERRUPS cabinet. Using this connector the user can communicate directly with the MICRO-FERRUPS microprocessor to access information or control operation. To communicate directly, a terminal is required. A computer that can emulate a terminal can also be used. The MICRO-FERRUPS

DB25 is wired DCE (Data Communications Equipment) as opposed to most terminals which are wired DTE (Data Terminal Equipment). Therefore a DTE can plug directly into a DCE. If your computer has a DB25. style serial port, it is typically wired DTE like a terminal. However, if it uses a DB9-style service port, it is wired DCE. If this is the case, a null-modem cable or a cable that has transmit and receive (pins 2 and 3) reversed will have to be. used. Refer to **Figure 2.**

CAUTION: Pin 1, chassis ground, should never be connected between the MICRO-FERRUPS and the terminal if there is the possibility of pin 1 and pin 7 (signal ground) being connected together in the terminal device. To do so might cause damage to the interface electronics.



igure 2 - The FERRUPS Intelligent Interface Connector

If the terminal device has no handshaking requirements, it may only be necessary to connect the TD, RD, and SG PINS between the communication line and the MICRO-FERRUPS. (Consult your device's operations manual if handshaking is required.)

The connection between the MICRO-FERRUPS and the console device should be through a high- quality shielded cable.

308-2 Communications Protocol

The data format is ASCII, 8 Data Bits, 1 Stop Bit. Baud Rate is 1200. Baud rate can be changed. (See Baud Rate end of this chapter.) Parity is set to none and operation is full duplex.

With the MICRO-FERRUPS powered up and the serial ports connected, the MICRO-FERRUPS will echo all characters it receives. It will terminate all responses with a "=>" prompt indicating the MICRO-FERRUPS is ready to accept command input from the console.

308-3 Using a Terminal Connected to the RS232 Port

All of the operations that can be performed from the remote can also be performed from a serial ASCII device connected to the RS232 port. In addition, a terminal (or a computer emulating a terminal) can perform functions the remote cannot. This is related to the limitations of the remote (limited alphabetic characters) and the display (limited display area).

The following is a menu of functions that can be performed from a terminal and the password level required.

No password needed to do this command.

* User password required. (377)
@ Service password required. (2639)
\# Factory password required. (18473)

A or ALARM	-	Lists the currently active alarm(s).
ALOG		Displays the alarm log.
AHELP		Lists all alarm messages, along with status and letter code and **Morse** code for each. (See detailed description that follows). The format is:

* Alarm	Ltr	Morse Code
* Low Battery	A	• -

(Alarm codes A thru P are listed)

The asterisk in the first column is present only if the alarm is currently active.

ATEST(C)	@	Invokes (or cancels) the user test alarm (alarm code I). [ATEST C] cancels the user test alarm. [ATEST] invokes it. If optional **CheckUPS** software is in use, the UPS may shutdown after two minutes on this alarm when running on inverter. Check **CheckUPS** software documentation.
BTEST	*	Perform battery test.
CLRLOG	#	Clears the inverter and alarm logs.
CLRPW		Removes any active password.
DATA _		Generic 64 point ASCII output for use with external plot programs.

NOTE: See the explanation of this command at the end of this section.

DATA X Outputs AC line and reference table at the time of last inverter turn on.
DATA R Output of present reference table.
DATA L Output of present AC line samples.

DATA _ _ - Generic 32 point ASCII output for use with external plot programs. Input voltage must be executed alone. Other plots can be executed individually or together. (Up to three plots can be' specified.)

DATA 1 Output of present AC output voltage.

DATA 2 Output of present AC input voltage.
DATA 3 Output of present AC **output current.**
DATA 4 Output of present DC input current.

D or Display	-	Displays one or a range of parameters. The format is: D <start #> <end #>
DATE or TIME	-	Displays the system date or time.
F		Returns 80 characters of fixed-field status information for use with programs that monitor the UPS state.
H or HELP		Displays a list of console commands requiring a SERVICE password or less.
I or IDENTIFY	-	Displays copyright message, software version and model number.
ID [<idstr>]	@	Display (no parameter number needed) or change unit ID.
ILOG		Displays inverter log.
ITEST	*	Initiates an inverter test. Test will end automatically.
L or LOG		Displays both inverter log and alarm logs.
MEM		Displays a memory location in hex code.
OFF	*	Displays the off time.
OFF <time>	*	Timed shutdown facility (time in seconds). For a shutdown of 60 seconds, type [OFF 60].
OFF <time> A	*	Timed shutdown with automatic restart when power returns.
OFF C		Cancels timed shutdown.

NOTE: Although the commands SHUTDN and SHUTDN C do not appear in the HELP menu, they exist to allow compatibility with previous versions of PowerWatch software. These commands actually invoke or cancel the OFF command.

P or PARAM	*	Displays a list of parameters up through 99.
PLOT _	*	64 point ASCII plot for use with terminals.

NOTE: See the explanation of this command at the end of this section.

PLOT X Outputs AC line and reference table at time of last invert& tumon.
PLOT R Output of present reference table.
PLOT L Output of present AC line samples.

PLOT _ _	*	32 point ASCII plot for **use with terminals.** Two can be executed at the same time except **#2.**

PLOT 1 Output of present reference table.
PLOT 2 Output of present AC input voltage.
PLOT 3 Output of present AC output current.
PLOT 4 Output of present DC input **current.**

PORTS	#	Displays the values at ports **A,B,C,D** and F of the processor. This is a programmer's diagnostic tool.
PR **<param> <value>@**		Enters "program" mode, where parameters can be displayed and/or set if password permits. Format: PR **<par#>** <value>. For example, to change the time (parameter 0) to **8:15** am, type [PR 0 **815].**
PROGRAM	#	Works the same as PR.
PW<#>	#	To enter a password, PW should be immediately followed (without a space) by the appropriate three to six digit number. If the number matches one of the internally stored passwords, that password level will be activated. It can be removed with the CLRPW command or by entering PW without a number.
RESET	%	Resets the unit as if it were initially powered up. Equivalent to a **[CONTROL][.].**
SHUTUP	*	Disables the audible alarm.
SMODE		Displays the system mode.
SMODE A		Changes the SMODE to AUTO.
SMODE **F**		Changes the **SMODE** to OFF.
SMODE I		Manually starts the **inverter.**
SMODE L		Changes the SMODE to LN COND.

S or STATUS - Displays date, time, and system status. The system mode, alarm condition and inverter status are also shown. In addition, parameters 0 through 9 and 11 are then displayed.

TIME Displays the system time and date.

UNSHUTUP * Enables the audible alarm. Here am some additional details on the available terminal commands:

AHELP - This command will print the list:

Reason for Alarm:					
A	• -	Low Battery	I	• •	Heat Sink Overtemp
B	- • • •	Near Low Battery	J	• - - -	User Test Alarm
C	- • - •	High Battery	K	- • -	Check Cooling
D	- • •	Low Run Time Left	L	• - • •	Reserved Alarm
E	•	Low AC Out	M	- -	Check Battery
F	• • - •	High AC Out	N	- •	Check Inverter
G	- - •	Output Overload	O	- - -	Memory Check
H	. . . .	High Ambient Temp	P	• - - •	Shutdown Activated

ALOG - This command displays the **entire** alarm log. See the section on parameters for a description of the entries.

ILOG - This command displays the **entire** inverter log. See the section on parameters for a description of the entries.

CLRPW, or **PW<> -** Clears the current password in effect,

PW<value> - Enters the password at <value>.

D **<#>** or DISPLAY **<#> -** Displays the parameter requested at #. A range of parameters can be requested by separating starting and ending parameters with a space.

PR <parameter> <value> - Allows a parameter to be. changed, providing you have the proper password and the parameter can be changed.

ID **<value> -** Allows programming the unit's serial number into parameter **#14.** This could also

be accomplished using the PR command. A service password is requited.

I and **IDENTIFY** - Responds with the unit model number, software version, address and phone number of BEST and a copyright notice. An example would be:

MICRO-PERRUPS BY BEST.
Model # **ME3.1KVA** - Unit ID "ME3.1K00000"
Software version **ME7.00** dated **05/12/90**
Copyright **(C)** 1990
Best Power Technology, Inc.
Necedah, WI. 54646 USA
Tel. (608) **565-7200**
Patents Pending

OFF - Displays the time before the unit will shut off.

OFF C - Cancels the **OFF** command and resets the counter back to 0. Changing the SMODE or setting parameter 38 to zero will also cancel the **OFF** command.

OFF <time> - Sets the parameter, in minutes, when the unit should shutdown.

OFF <time> A - A stands for **auto** restart. This means that after the off timer (parameter #38) has counted down to **zero,** another counter is started for one minute. Afteithat **minute** is up, the unit will restart in AUTO Not Ready. The unit will go back'to ready when criteria stated in the low battery routine are met. While the **OFF** command is active, the beeper will sound once every 5 seconds until the off command is in the Auto Not Ready state.

SHUTUP and **UNSHUTUP** - [SHUTUP] silences the audible alarm and [UNSHUTUP] will enables it. Any **mode** change or DC reset also enables the audible alarm.

MEM &cation> - Displays the value at memory locations **FF00-FFFF** in hex.

ITEST - Performs the inverter test. The inverter will be tumed'on for a half cycle on each side., It will adjust the test phase, to try to get the proper DC peak current for the unit. If the proper values are not reached, the unit will alarm "Check **Inverter**". Before doing this test, the unit must be calibrated and the battery charged continuously for at least eight hours.

BTEST - Performs the battery test. When entered the inverter test will start first. After the inverter test is passed, the battery test will turn on the inverter for one minute and check, the calculated runtime. If the runtime goes below 80% of the unit's expected runtime with three year old batteries, the unit will alarm "Check Battery". Before doing this test the unit should be calibrated and the battery charged continuously for 24 hours.

308-4 Explanation of DATA and PLOT Commands

The DATA and the PLOT commands differ only in what is actually displayed on the terminal's screen. The DATA command will return a table of data points. This is useful if these data are captured on a disk file and later manipulated and displayed using some form of plotting software.

The PLOT command will return an actual plot to the terminal's screen. Since the typical terminal only has 80 fixed horizontal and 25 fixed vertical locations, the plot has been slightly modified to provide maximum horizontal resolution to the viewer. Each plot is "folded", i.e. the negative half cycle is displayed as going in the same direction as the Positive half cycle. This way each half cycle is given the full screen width for better resolution.

There are two forms of the DATA command: DATA _ and DATA _ _ _. The first form takes "X", "R" or "L" as a single argument. "X" will return both the AC line and the reference table at the time of last transfer to inverter. This is useful to give some indication of what the last cycle of commercial AC power looked like before the system transferred to inverter. "R" will return the current reference table data. "L" will return the current line sample table.

The responses to all DATA commands will return the sample number in the left column (from 00 to 64) and one or more numbers next to these, depending on the form of the command.

The second form of the DATA command (DATA _ _ _) can have one, two, or three arguments. The are four choices for the arguments. These are:

1	Present AC output voltage
2	Present AC input voltage
3	Present AC output current
4	Present AC input current

There are some restrictions on which combinations are valid. For a two-argument command, only l-3, 1-4, and 3-4 are valid as DATA arguments. For a three-argument command, only l-3-4 is valid.

There are two forms of the PLOT command: PLOT _ and PLOT _ _. The first form, like its associated DATA command, takes "X", "R" or "L" as its single argument. The meanings are the same as in the DATA command.

The plot will list the sample number in the left column (from 00 to 63) and the x-axis at the end of the plot.

The second form of the PLOT command is analogous to the second form of the DATA command except that no more than two arguments are allowed. These arc the same DATA command.

308-5 Examples of Responses to The Status and Parameter Commands

(Note that some parameters arc model-dependent.)

The STATUS Command

Fact =>s
Status - Model # ME1.8KVA - Jun 12, 16:45:43

SysMode: Auto
Status: Ready
Aud Alm: Enabled
Inverter: Off

Alarm(s) - None

1 V In 203
2 v out 120
3 I In 003.1
4 I out 000.0
5 VA Out 00010
6 I Batt 000
7 V Batt 053.3
8 Freq 59.95 Hz
9 RnTm 0242 Min
. Amb Temp 020C

The Parameters

Fact =>p
Parameters -Jun 12, 16:45:46

12 HS Temp 023C
13 Reserved
14 ID Number:

15 Model Number
FD4.3KVA
16 FullLoad% 000
17 Watts 00015
18 PF 1.00 ----
19 VALimit 03000
20 #Pwr Out 0065
21 #Ovr Lds 0009
22 Sys Hrs 00027
23 InvMin 0092.0
24 Inverter Log
25 Alarm Log
26 Reserved
27 Low Vout 108
28 Hi Vout 130
29 LowBat 041.0
30 NLBatt 044.0
31 HiBatt 059.6
32 L RnTm 05 Min
33 A Otemp 060C
34 AT Shdn 070C
35 S Otemp 095C
36 Low Humid 30
37 Hi Humid 75
38 Off Cnt 0000
39 Reserved
40 NVVers 06.00
41 Model Indx 09
42 Reserved
43 XferDly 20Sec
44 AutoRst l)Yes
45 AC ShDn 2)No
46 ExBnOut l)Yes
47 AltSetup 0
48 Reserved
49 VinNom 208
50 VoutNom 120
51 BrownoutV 164
52 Lo Freq 59.50
53 Hi Freq 60.50
54 Reserved
55 Reserved
56 Freq Delay 2
57 Glitch Cnt 2 -- ---
58 Reserved
59 Line Deltl 12
60 Line Delt2 16
61 V Reftbl 200
62 EBrownotV 125

63 Reserved
64 Overlap 0
65 66 **PhsDly** Reserved 0040

67 Reserved
68 **InvTest** l)Yes
69 **TestRate** 1440
70 **IPk** 300

71 72 **TestPhas** I Batt Pk 0100 000
73 Peak 1 0000
74 Peak 2 0000
75 Reserved
76 Reserved
77 Reserved
78 Baud **4)9600**
79 **ConMde 1)Norm**
80 **CtlPswd 2)No**
81 # Bad PW 0002
82 Reserved
83 **RnTm** K 19
84 **BatCap** 0031
85 BTT 0 6 0
86 **BattTst** 1)Yes
87 **IntrvlDavs** 30
88 89 **FctrAlRnTAlm** 00000 0005

90 BTRT 0000 Min

91 CFACVI **Reserved** 06534
93 CFACVO 03437

94 95 CFACAO CFACAI 15872 13797
96 CFDCV 11258
97 98 CFDCA CFREF 07460 00001

99 Reserved

Maintenance and Component Replacement

400 Maintenance

In order to obtain years of built-in reliability from your MICRO-FRRRUPS, proper maintenance procedures must be followed. Scheduled maintenance is the only way to insure continued reliability. Unscheduled maintenance procedures may have to be followed when batteries, parts or components have to be replaced

401 Scheduled Maintenance

In or&r to insure satisfactory operation of your MICRO-PERRUPS, regularly-scheduled preventive maintenance procedures must be followed The most basic of these procedures consists of an outage test to see that the unit is functional. This augments the internal operational tests that are automatically performed on a regular basis by the MICRO-FERRUPS. Any irregular results are logged by the system and generate an alarm condition to alert the operator of a possible malfunction. An outage test should be performed monthly.

A system load test is more comprehensive than a simple outage test. This test should be performed biannually and should also include an inspection of the system and battery bank. It should be performed if the outage test is failed.

401-l Outage T&t

This test should be performed when operations are not critical. Usually scheduled for after-hours or weekends, it may have to be conducted "off line" when critical operations are conducted on a 24-hour basis. When conducted "off line" the load equipment would be operating on "bypass mode" and the results of this test would only indicate whether the MICRO-FJXRUPS will or will not come on in case of an outage. It will **not** indicate whether it will successfully carry the required load equipment. The same procedure is used for both models coveted in this manual and for all operating voltages.

NOTE: If no communication exisits proceed with 401-4 to ensure that the batteries are working and that the inverter is functioning properly.

Step 1. The MICRO-PERRUPS should be running on AC line in the Auto Mode. Loads that are normally supported by the UPS should be up and running, if at all possible.

Step 2. Do a battery test first. ([CONTROL][7][7][ENTER][ENTER]) This will assure you of properly charged batteries, and also to assure you that the inverter is working properly.

Step 3. Find the AC breaker for the FERRUPS and open it.

step 4. Verify the MICRO-FERRUPS has switched to battery power and the loads are running normally. There should be no alarms; a short beep will sound every 20 seconds.

Step 5. Using the keypad, press [DISPLAY][9][ENTER]. The number displayed will be the calculated runtime remaining. After about two minutes on batteries, record this number. to compare with results from future tests. At some point this number will decrease, indicating a failing or weakening battery string. This will require a complete system performance check and battery load test. If the number obtained is acceptable, continue running the FERRUPS on battery power until a significant portion of the DC has been run off.

Step 6. Restore AC line from the breaker; in 20 seconds the FERRUPS will switch back to Auto Mode. Check to see that the CHARGING LED comes on.

401-Z **System** Load **Test**

This test is performed as part of a six-month routine or in response to questionable numbers obtained during the outage test. When performed as part of a six month routine, the system and battery physical inspections are also performed. When performing this test, fill out the Scheduled Maintenance Checklist to keep a record of the test results.

NOTE: If no communication exisits proceed with 402-2.2 Load test with out communications to ensure that the batteries are working and that the inverter is functioning properly.

Caution: Portions of the following procedure are conducted with the system AC and DC powered up, the side panels removed and internal components exposed. The following procedure, should be attempted by BEST factory authorized technicians only. Dangerous AC and DC voltages are present.

401-2.1 With Communications

Step 1. With the system operating in Auto Mode and load equipment powered by the FERRUPS; fill out steps #3 through #10 in TIP 605. Using the keypad,. display and record the first 20 parameters in step #12 column A. Then display and record the most recent five entries in the invener log (parameter #24) and the alarm log (parameter #25) in step #8 of TIP 605.

Step 2. Enter the factory password by pressing [PROGRAM]; the display should read Password?. Press [18473][ENTER]. The display should read Factory Password.

Step 3. Disable the battery charger. Press [DISPLAY][31]. The display should read "Hi Batt 059.6". Push [PROGRAM] on the keypad; the display will change to New Value?. Push [48][ENTER] on the keypad and the display will confii Hi Batt 048. The Hi Batt Alarm will now come on. Silence it by pushing [CONTROL][5]

[ENTER][ENTER]. The remaining steps will be performed with the red alarm light on.

Step 4. Using a calibrated DC voltmeter, measure the individual battery voltage readings (read each individual battery plus to minus). Record these readings under battery information, "No Load Voltage". If any battery in the string is under 11 volts, and after a recharge continues to read under 11 volts. it should be replaced See the battery replacement procedure at the end of this chapter.

Step 5. Perform a system test by switching off the AC **breaker** to the FERRUPS. After two minutes of battery power operation, display and record the first 23 parameters in step #13, INV. on with LOAD column in TIP 605. Using the DC voltmeter, measure the individual battery voltage readings again and record under battery information, "With Load Voltage". Any battery more than .4 volts lower than others in the string should be. replaced. If all batteries arc nearly equal and the system runtime is still insufficient, the entire string should be replaced.

Step 6. Reset Hi Batt Alarm (parameter 31) to 59.6 and push [CONTROL][2][ENTER] [ENTER]. The alarm light should go out.

Step 7. Restore AC Line and wait 20 seconds. Verify the battery charging light comes on. After a 24-hour charge all batteries should read at least 13 volts and the system should have a string voltage of at least 52 volts. Clear the password by pressing [CLEAR][CLEAR] twice.

401-2.2 Without Communications

This procedure describes the way to check the condition of the batteries in your MICRO-FERRUPS when no communication exist. This procedure was written for batteries with a nominal 12 volt per/battery container. For other voltages i.e.: 2v, 4v, 6v, etc. contact Best's Service Department or the appropriate battery manufacturer, for battery voltage specifications.

WARNING: Any battery has the potential to cause bums or even explode. Standard safety procedures should be observed, including safety glasses and insulated tools. **Remove** conductive **watches/rings/bracelets/etc., and wear eye protection and protective clothing when working with batteries.** All lead-acid batteries (including sealed no maintenance) contain sulfuric acid. Baking soda (sodium bicarbonate) and water solution should be. readily available to neutralize electrolyte if necessary. A mixture of one pound baking soda to one gallon of water should be used. The covets of sealed, no-maintenance batteries should not be removed.

WARNING: If replacing batteries or repairing battery connections, follow the Turn off and Shutdown procedure in the MICRO-FERRUPS user's manual to shut off your UPS and remove both AC and DC input power.

WARNING: Any battery that has catastrophically failed must be replaced. Please insure that

equipment that could be damaged by a sudden loss of power has been shut down prior to removing AC input **to the FERRUPS.** If a computer is used, insure that critical data is saved.

step 1. Remove the cover by loosening the Phillips screw located **just** below the LED indicators.

Step 2. Make certain the UPS is turned off and AC input and output power is removed. Replace batteries that have physical damage such as leakage, cracks or broken battery connections. Disassemble, clean and neutralize any connections displaying corrosion (typically the positive terminal). Torque all connections to 55 inch/pounds.

Step 3. If your system has parallel battery strings each string should be tested individually.

Step 4. Use a digital voltmeter and carefully check each of the batteries in the string for open circuit voltage readings. Record the readings **and** if a battery displays a voltage of less than 11.0 volts DC or greater than 14.0 volts DC call Best Power Technology at (800)356-5737.

Step 5. Connect your digital voltmeter across the battery string (bank). Simulate an AC power failure by turning off the circuit breaker feeding the MICRO-FERRUPS.

Step 6. Run the inverter until **the total battery** suing voltage indicates 11.5 VDC per battery or 46 VDC per string.

Step 7. Measure the individual batteries while the inverter is running. Use a .5 volt variance per 12 volt battery to indicate a weak battery at this point. If some readings are borderline, or questionable, a twenty-four hour equalize cycle should **be** initiated and another load test performed. Any battery with greater than a .5 volt variance from the average voltage of the other batteries should be replaced.

Step 8. Reapply AC line to the UPS and place the unit back on line with your load equipment.

401-3 Final System Check and Inspection

To complete the biannual routine, a final system check and inspection should be performed. These first three steps are performed with the system powered down and the covers off. The last step is performed with the cover off, but with the system operating in Auto Mode.

Tools and Material Required:

Hand vacuum cleaner or compressed air outlet.
Wire Brush, Petroleum jelly
7/16" insulated open end wrench

step 1. With system **AC** and DC powered down, cover off, inspect the interior of unit. If excessive dust and dirt have accumulated inside use a vacuum cleaner to remove or use compressed air to blow it out.

Step 2. Locate the fan. Refer to Section 800 to locate. Using a pen or pencil, spin the rotor of the fan to see if it spins freely. Check all connectors and cables, looking for loose or bad connections. Look for any unusual discolorations on circuit boards for evidence of hot spots or leaking capacitors.

Note: Before proceeding, follow battery safety precautions. Remove rings, watches, bracelets and wear safety glasses.

Step 3. Inspect the battery compartment. Look for leaking, swollen, or cracked batteries. Check battery cables for tight connections and corrosion on terminals. Use an insulated wrench to tighten terminals and a wire brush to remove corrosion. Coat terminals and connections lightly with petroleum jelly. If leaking electrolyte is found, neutralize with a baking soda solution and replace the battery. If external batteries are being used, follow the same procedures for additional strings.

Step 4. Power the unit up on DC and set the time and date. Apply AC and verify the system is running in the Auto mode. Check operation of fan. Apply the load and if a load test has not been performed previously, perform it now. Close the cabinet and return the system to service.

402 Unscheduled Maintenance

402-l Battery Replacement

Preparation: Make certain that there are no external voltages applied to the unit. Power the unit down (turn key switch to OFF.) Turn off the input AC by turning off the supply circuit breaker or removing the input line cord from the outlet. Turn off the DC circuit breaker behind the front panel.

NOTE: Before replacing batteries, observe all safety precautions. Remove rings, watches, bracelets and wear safety glasses. Use insulated tools.

Tools and Material Required:

(2) 7/16" open end wrenches (Tape length of wrench to avoid shorting battery)
Wire brush, Electrical tape
Baking soda, Petroleum jelly
Small brush
DC Voltmeter

NOTE: When replacing the batteries, the batteries should all be the same type to ensure proper charging.

Removal Procedure:

step 1. Remove the cover by locating the Phillips screw. This screw is located just below the LED indicators.

Step 2. Locate the positive battery cable (attached to fuse on battery) and remove and tape the connector end to prevent accidental contact.,

step 3. If replacing the entire suing of batseries, remove the most positive battery and replace it first. Continue replacing batteries on a one-for-one basis until the entire suing is replaced. If replacing only one or two batteries, remove only those and replace on a one-for-one basis. Before installing a new battery, wire brush terminals to remove any corrosion. After tightening terminals, brush on a light coating of petroleum jelly. If any of the replaced batteries have leaked electrolyte, use baking soda and water to neutralize before wiping it up. Reinstall the fuse on the most positive terminal.

Step 4. After the entire string has been replaced, measure across the string (from the negative cable to the positive terminal with fuse attached) with-a DC voltmeter. Voltage should read at least 48 volts. Make certain the polarity is correct before turning on the unit.

Step 5. Do a system load test as described in Section 400, Scheduled Maintenance, verify the integrity of the new batteries.

Step 6. Replace the outer cover.

Requited System Calibration:

Recalibrate the system using the procedure at the end of this section.
MICRO-PERRUPS Battery Load Test Procedure

402-t Logic Board Removal and Replacement

Preparation: Make certain that there are no external voltages applied to the unit. Power the unit down by turning the on/off switch to the off position. This switch is located on the back of the unit to the left of the output receptacles. Turn off the input AC by turning off the supply circuit breaker or-removing the input line cord from the outlet depending. on how the unit is installed. If the unit has external batteries be sure to turn off the DC switch located on the battery cabinet.

TOOLS AND MATERIAL REQUIRED:

#2 Phillips Screwdriver
7/16" Box End Wrench
7/16" Nut Driver

Reference Dmwings: Refer to the diagrams in Section 800 to find location of the Logic board.

Removal Procedure:

Step 1. Remove the outer shell from the unit. To complete this locate the Phillips screw on the front panel just below the LED indicators. The outer cover will pull towards you when the screw is loose.

Step 2. If you have a external cabinet you must turn off the DC disconnect switch and continue. If the batteries are located inside of the unit you must disconnect the suing. To accomplish this use a 7/16" wrench and a 7/16" nutdriver and disconnect the most positive battery.

Step 3. Remove the following connectors:
J6 Ribbon cable from the logic board
J10 Ribbon cable to the RS232 port
J2 AS400 connection
TR1 Ambient temperature probe
J11 Cabinet temperature probe

Step 4. Remove the four Phillips screws that hold the logic board down.

Step 5. Remove the logic board.

Replacement Procedure:

Step 1. Replace the four Phillips screws that hold the logic board in.

Step 2. Remove the following connectors:
J6 Ribbon cable from the logic board
J10 Ribbon cable to the RS232 port
J2 AS400 connection
TR1 Ambient temperature probe
J1 1 Cabinet temperature probe

Step 3. If you have a external cabinet you may turn on the DC disconnect switch. If the batteries are located inside of the unit you must reconnect the string. To accomplish this use a 7/16" wrench and a 7/16" nutdriver and reconnect the battery.

Step 4. Replace the outer shell on the unit.

Required System Calibration:

Recalibrate the system using the procedure found at the end of this section.

402-3 Heatsink Assembly Removal and Replacement

Preparation: Make certain that there are no external voltages applied to the unit. Power the unit down by turning the on/off switch to the off position. This switch is located on the back of the unit just below the output receptacles. Turn off the input AC by turning off the supply circuit breaker or removing the input line cord from the outlet depending on how the unit is installed. If the unit has external batteries be sure to turn off the DC switch located on the battery cabinet.

TOOLS AND MATERIAL REQUIRED:

#2 Phillips Screwdriver
7/16" Box End Wrench
7/16" Nut Driver

Reference Drawings: Refer to the diagrams in Section 800 to find location of the Heaisink Assembly.

Removal Procedure:.

Step 1. Remove the outer shell from the unit. To complete this locate the Phillips screw on the front panel- just below' the LED indicators. The outer cover will pull towards you when the screw is loose.

Step 2. If you have a external cabinet you may skip to step 3. If the batteries are located inside of the unit you must disconnect the sting. To accomplish this use a 7/16" wrench and a 7/16" nutdriver and disconnect the most positive battery.

Step 3. Remove the following wires:
Positive battery (orange wire) from El5
Negative battery (orange wire) from El 1
Lead #2 (black wire) from El7
Lead #1 (black wire) from E9 (For a 1.8KVA remove from E6)
Lead #4 (black wire) from E4
Lead #5 (black wire) from El
L1 (black wire) from E3

Step 4. Remove the following connectors:
J3 ribbon cable to logic board
Jl monitor wires from terminal strip

Step 5. Remove the Phillips screw located on the side of the unit. If you have problems locating this screw refer to Section 800, pictorial of ME units.

Step 6. Remove heatsink assembly from unit.

Replacement Procedure:

Step 1. Replace the Phillips screw located on the side of the unit. This will secure the heatsink assembly.

Step 2. Replace the following wires:
Positive battery (orange wire) to El5
Negative battery (orange wire) to El 1
Lead #2 (black wire) to El7
Lead #1 (black wire) to E9 (For a 1.8KVA remove from E6)
Lead #4 (black wire) to E4
Lead #5 (black wire) to El
L1 (black wire) to E3

Step 3. Replace the following connectors:
J3 ribbon cable to logic. board
J1 monitor wires from terminal strip

Step 4. If you have a external cabinet you may turn the DC switch to on. If the batteries are located inside of the unit you must reconnect the string. To accomplish this use a 7/16" wrench and a 7/16" nutdriver and reconnect the battery.

Step 5. Replace outer cover.

Required System Calibration:

Recalibrate the system using the procedure found at the end of this section.

403 Calibration Check

The logic board and or parts you receive should be calibrated. After installation, a check to insure the calibrations are correct must be performed. To do this you will need a true RMS meter and a clamp-on current probe. We recommend the Fluke 87 true RMS multimeter and the Fluke 80i-400 AC current probe.

Step 1. Remove the outer shell of the unit. To complete this, locate the philips head screw on the front panel just below the LED indicators. The outer cover will pull towards you when the screw is loose.

Step 2. Power up the unit by applying DC and AC. Turn the ON/OFF switch to on.

Step 3. Apply the load to the UPS.

Step 4. With your digital multimeter @MM) measure AC volts in and program this into parameter #1.

Step 5. With your DMM measure AC volts out and program this into parameter #2.

Step 6. With your clamp-on current probe measure current out and program this into parameter #4.

Step 7. With your DMM measure battery voltage and program this into parameter #7.

Step 8. Drop AC line to the unit so that it is running on inverter. The next two measurements will be done while running on inverter. Allow the unit to run for 1 minute before taking measurements.

Step 9. With your DMM measure battery voltage and program this into parameter #7.

Step 10. With your DMM set to mVDC, measure across the shunt on the heatsink assembly. One mV = one amp. Program the Amp reading into parameter #6.

Troubleshooting

500 Getting Started

Finding and resolving problems inside the MICRO-FERRUPS system cabinet is a very easy process. However, the problem may not be "inside" the MICRO-FERRUPS cabinet, but instead 'may be caused by improper sizing, reactive loads, poor installation wiring practices, or neglected maintenance. Statistical analysis performed by BEST's Service Departmdnt reveals that about 80% of all customer problems with MICRO-FERRUPS systems are installation-related.

Keep in mind that interactions between the line, the MICRO-FERRUPS, and the protected loads can create a tangled web of symptoms that are difficult to resolve. Combine this with poor installation wiring methods, and you have an extremely difficult troubleshooting job in front of you.

Troubleshooting the entire MICRO-FERRUPS protected system can be simplified by dividing the system into smaller subsystems. By dividing it into smaller systems, you can quickly eliminate subsystems that could not cause the problem. This is called the "divide and conquer" method of troubleshooting.'.

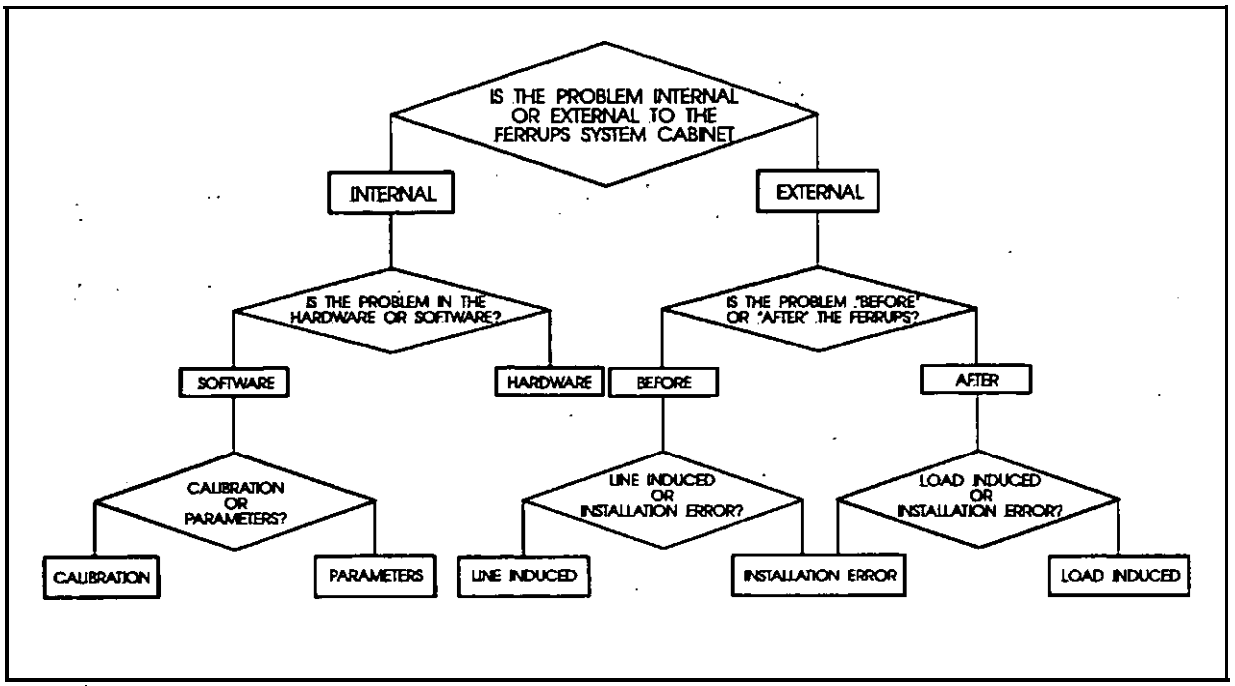
When applying the "divide and conquer" troubleshooting method to the MICRO-FERRUPS system, you should begin with the question "is the problem internal or external to the MICRO-FERRUPS system cabinet?" In other words, is the MICRO-FERRUPS broken, or is the problem caused by external factors such as installation wiring, grounding, load interaction, and so on. If the problem only occurs when a complete blackout happens and the MICRO-FERRUPS does not have any alarms logged in it's alarm log for that time, the problem is probably external. If the problem only occurs during an actual power disturbance, but not when we simulate one, check for equipment that is connected to the computer with a data cable, but is not protected by the MICRO-FERRUPS.

Figure 1 is a general **"divide** and conquer" troubleshooting flowchart that encompasses the entire system. These are common questions that you can ask yourself and use to break the system into subsystems. You should use this flowchart early in the troubleshooting process to orient your thinking and locate the cause of the problem.

501 Troubleshootine Internal Problems

Normally, the first indication of a problem with the MICRO-FERRUPS will be one of the system alarms. To simplify the troubleshooting procedure. associated with the alarm conditions, a troubleshooting flowchart for each alarm condition is located within this section. These flowcharts should help you locate faults that are internal to the MICRO-FERRUPS system cabinet, and may indicate some external faults as well.

If after trying to start the UPS properly, the keypad and display are inactive, refer to the Dead



gure 1 - FERRUPS and MICRO-FERRUPS Troubleshooting

Unit Diagnostic Procedure in this section.

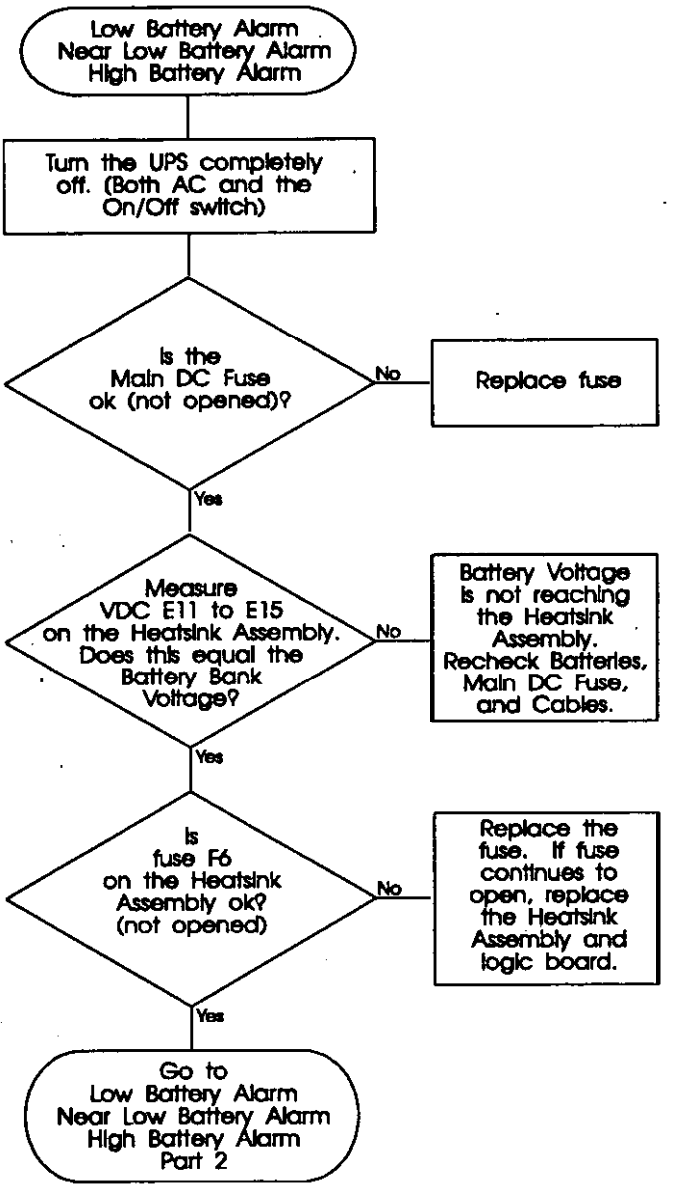
If you can properly start the UPS but it will not operate properly on either AC Line or Inverter, you may want to follow the AC Line Diagnostic Procedure or the Inverter Diagnostic Procedure flowchart in this section.

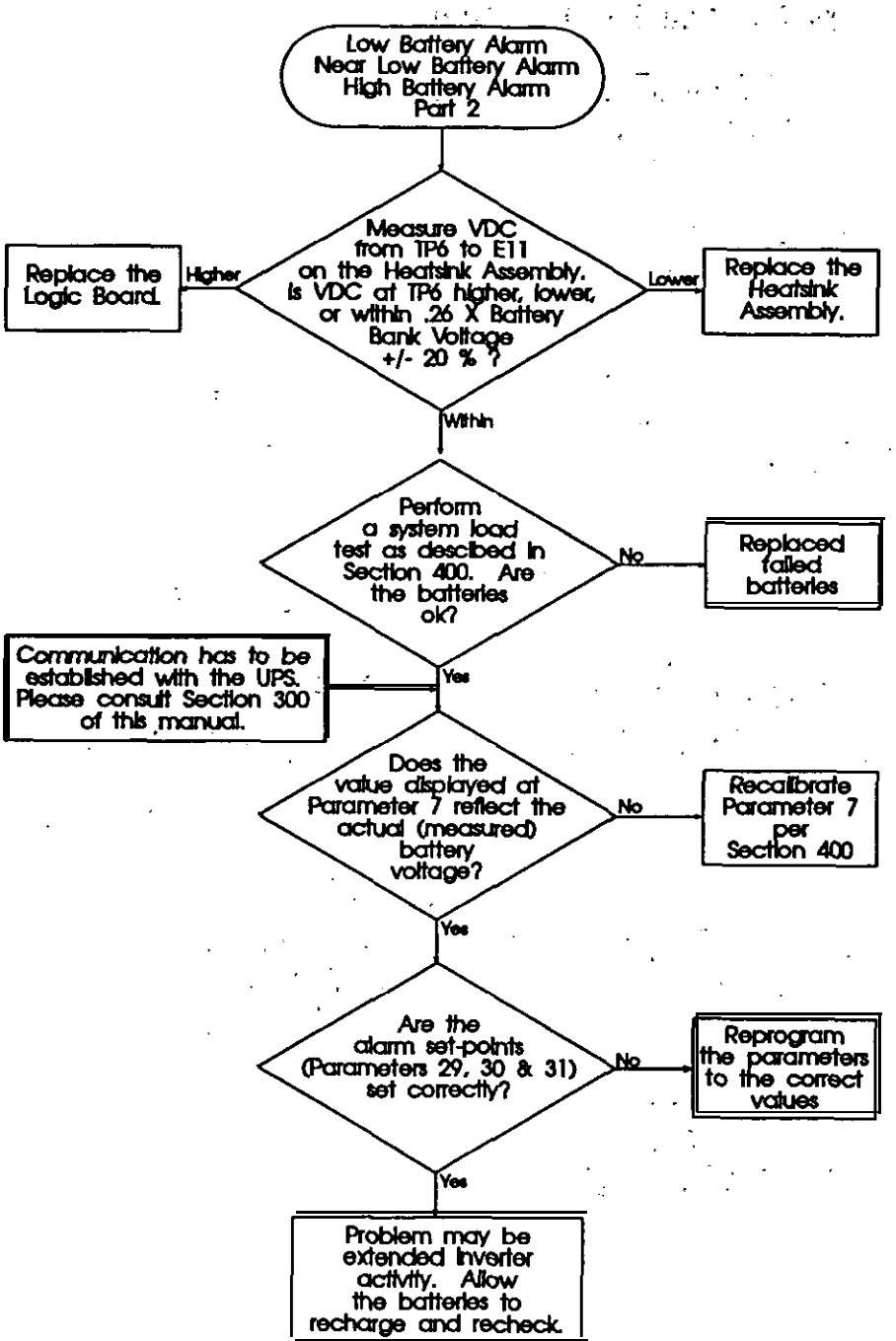
Assistance in identifying the fuses in the system can be found after the troubleshooting flowcharts in this section.

For help in identifying boards, modules, or components, refer to the pictorial layouts and schematics in section 800.

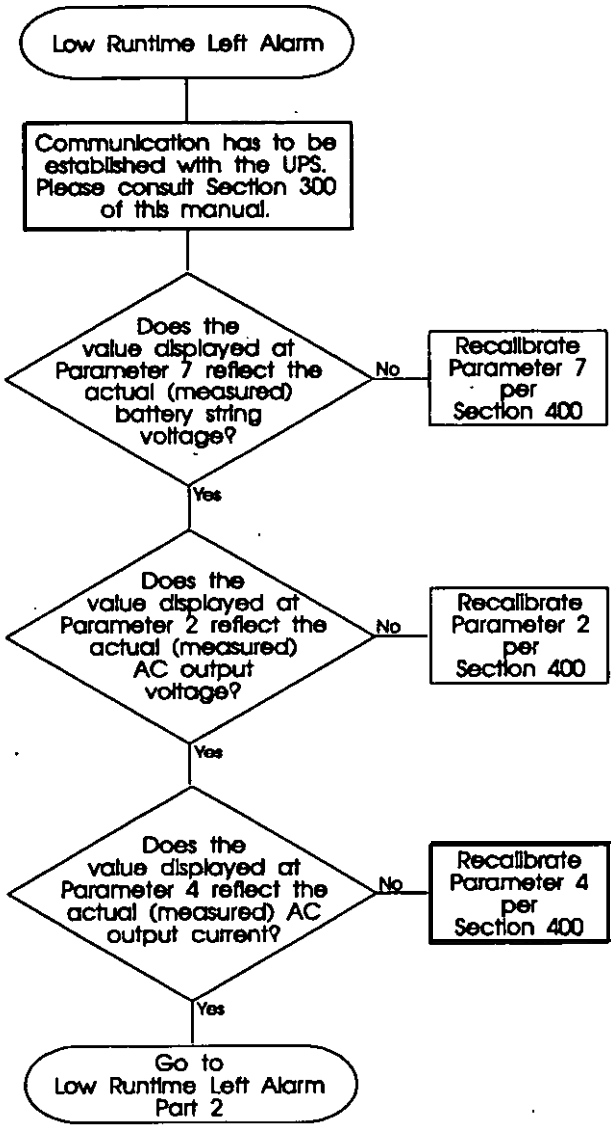
501-l Diagnostic Flowcharts

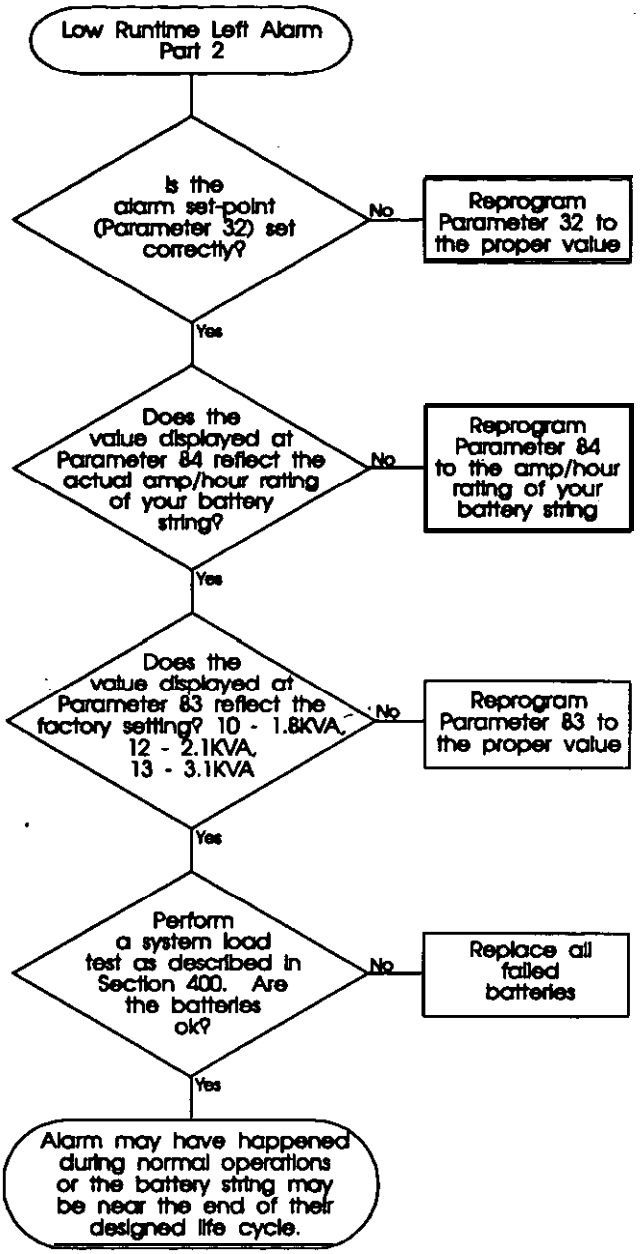
-Low/Near Low/High Battery Alarm



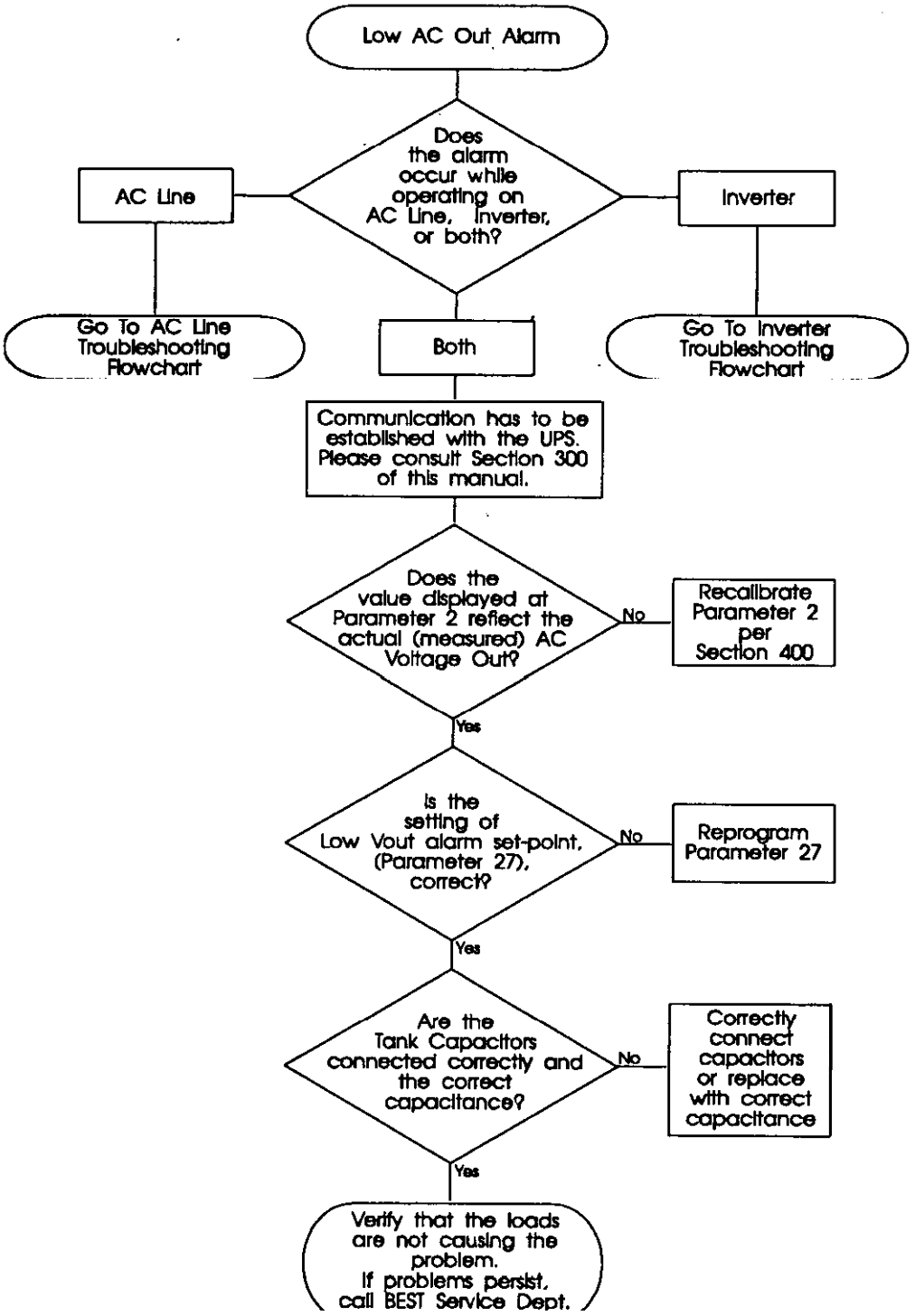

Low Battery Alarm
Near Low Battery Alarm
High Battery Alarm
Part 2
Measure VDC from TP6 to E11 on the Heatsink Assembly. Is VDC at TP6 higher, lower, or within .26 X Battery Bank Voltage +/- 20 % ?
Higher
Replace the Logic Board.
Lower
Replace the Heatsink Assembly.
Within
Perform a system load test as described in Section 400. Are the batteries ok?
No
Replaced failed batteries
Yes
Communication has to be established with the UPS. Please consult Section 300 of this manual.
Does the value displayed at Parameter 7 reflect the actual (measured) battery voltage?
No
Recalibrate Parameter 7 per Section 400
Yes
Are the alarm set-points (Parameters 29, 30 & 31) set correctly?
No
Reprogram the parameters to the correct values
Yes
Problem may be extended inverter activity. Allow the batteries to recharge and recheck.

-Low **Runtime Left** Alarm

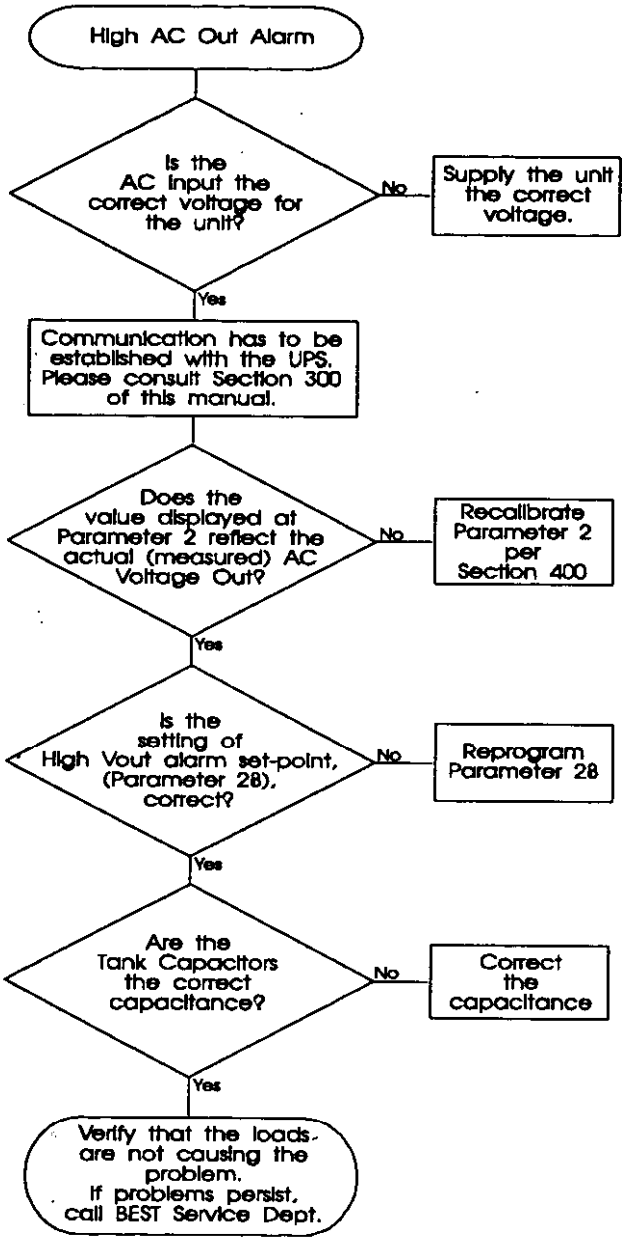



Low Runtime Left Alarm Part 2
Is the alarm set-point (Parameter 32) set correctly?
No
Reprogram Parameter 32 to the proper value
Yes
Does the value displayed at Parameter 84 reflect the actual amp/hour rating of your battery string?
No
Reprogram Parameter 84 to the amp/hour rating of your battery string
Yes
Does the value displayed at Parameter 83 reflect the factory setting? 10 - 1.8KVA, 12 - 2.1KVA, 13 - 3.1KVA
No
Reprogram Parameter 83 to the proper value
Yes
Perform a system load test as described in Section 400. Are the batteries ok?
No
Replace all failed batteries
Yes
Alarm may have happened during normal operations or the battery string may be near the end of their designed life cycle.

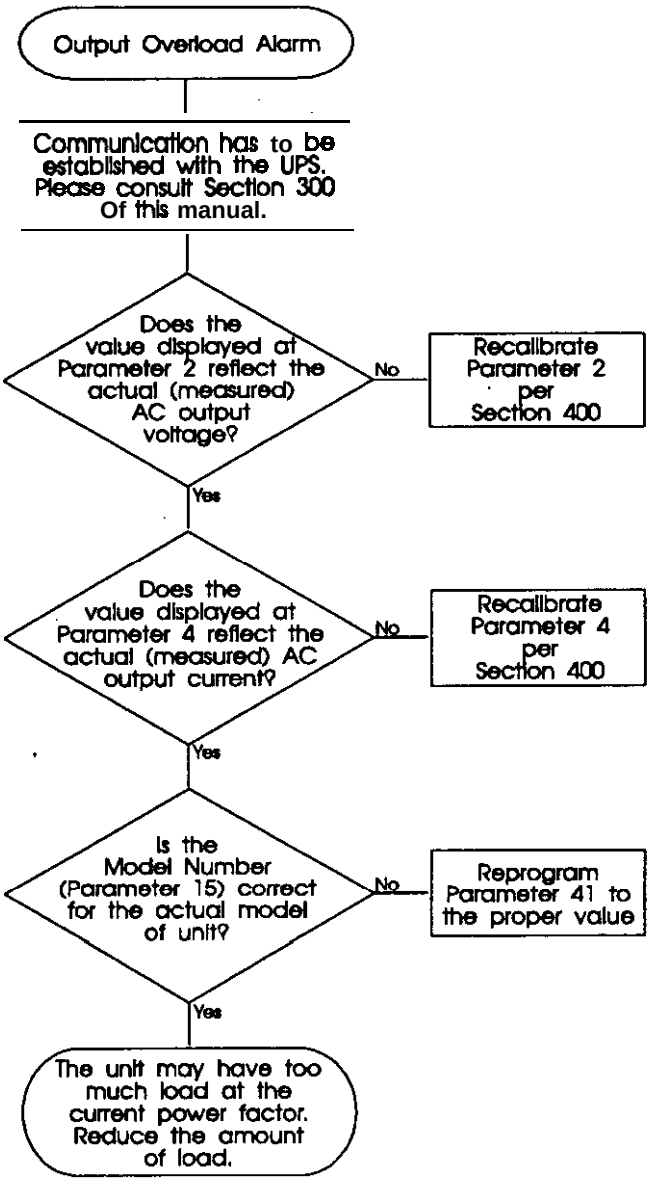
-Low AC Out Alarm



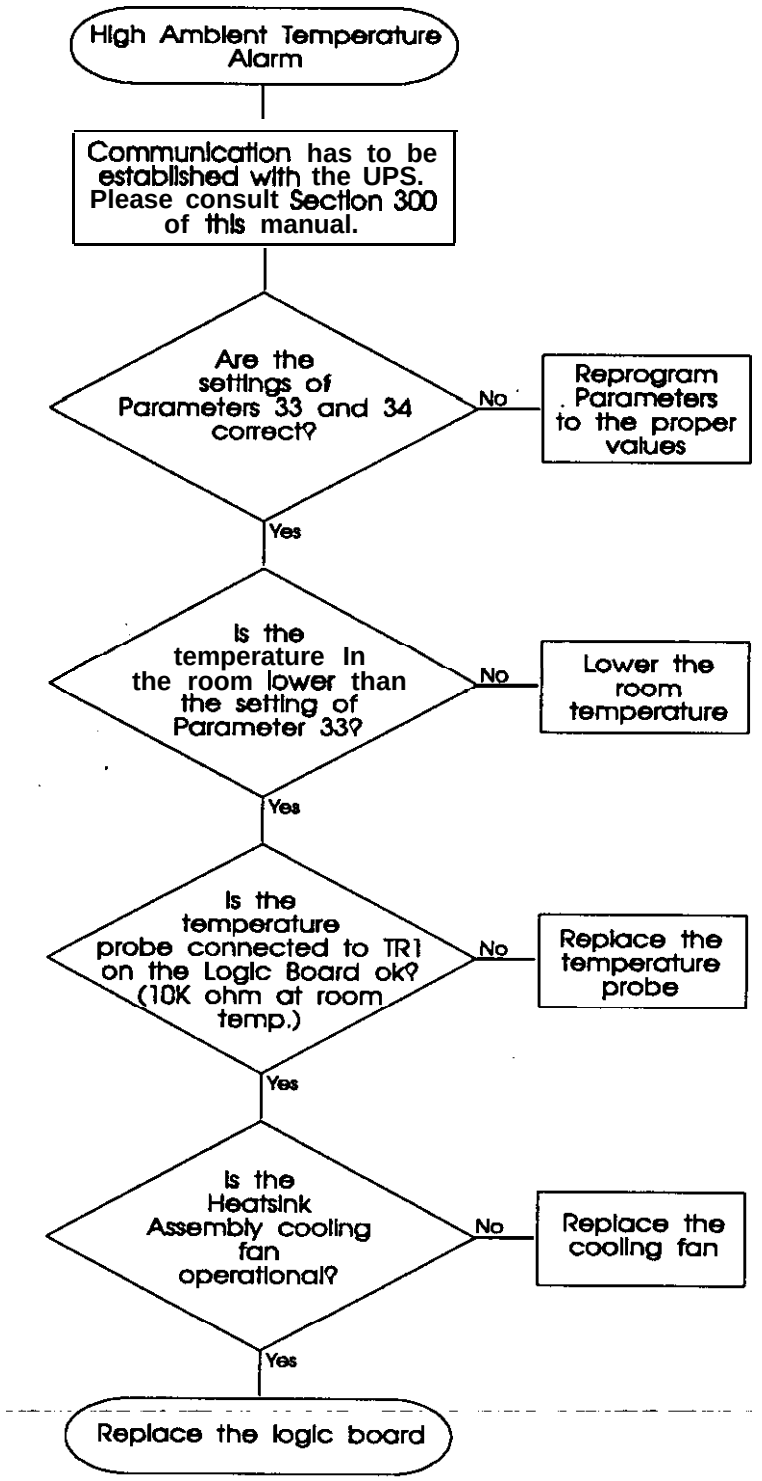
—High AC Out Alarm



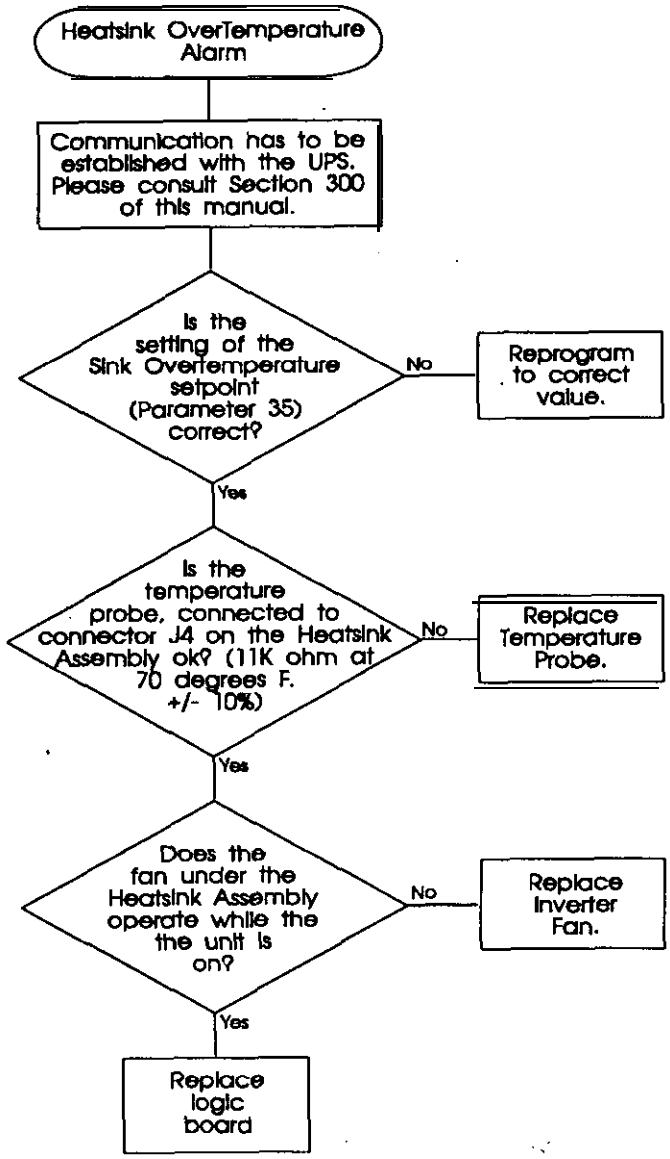
-Output Overload Alarm



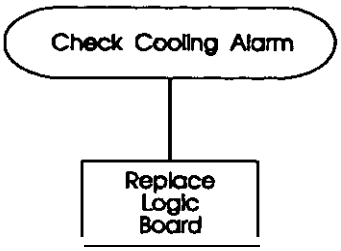
—High Ambient Temperature Alarm



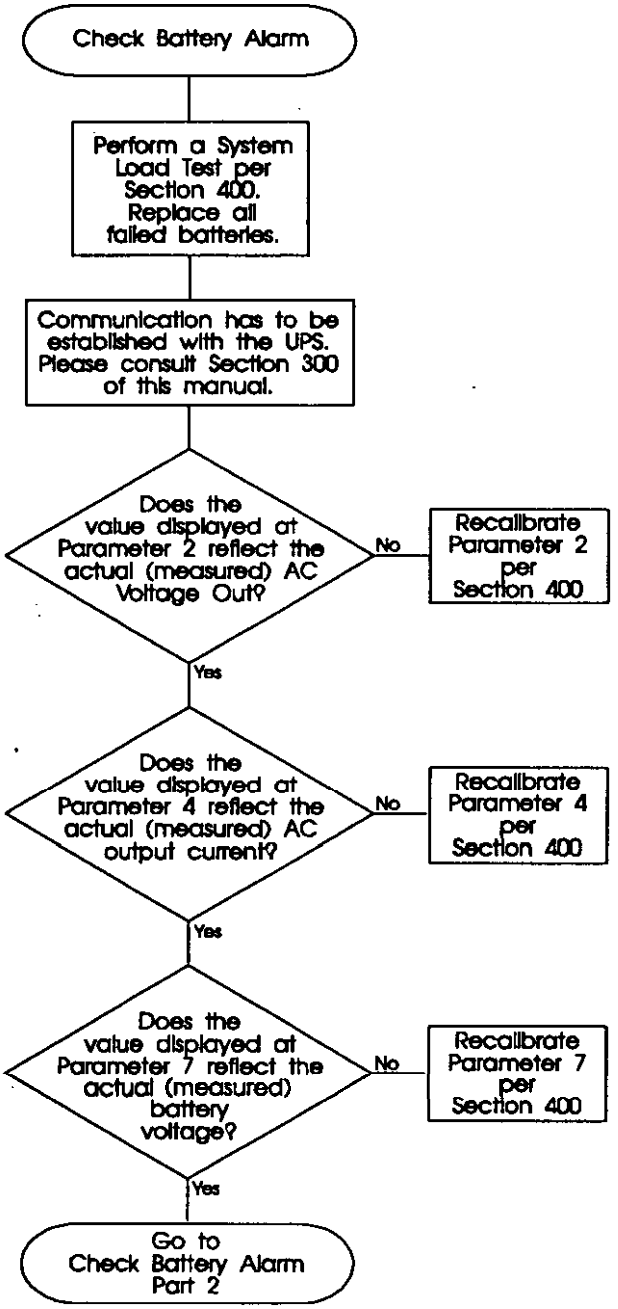
-Heatsink Overtemperature Alarm

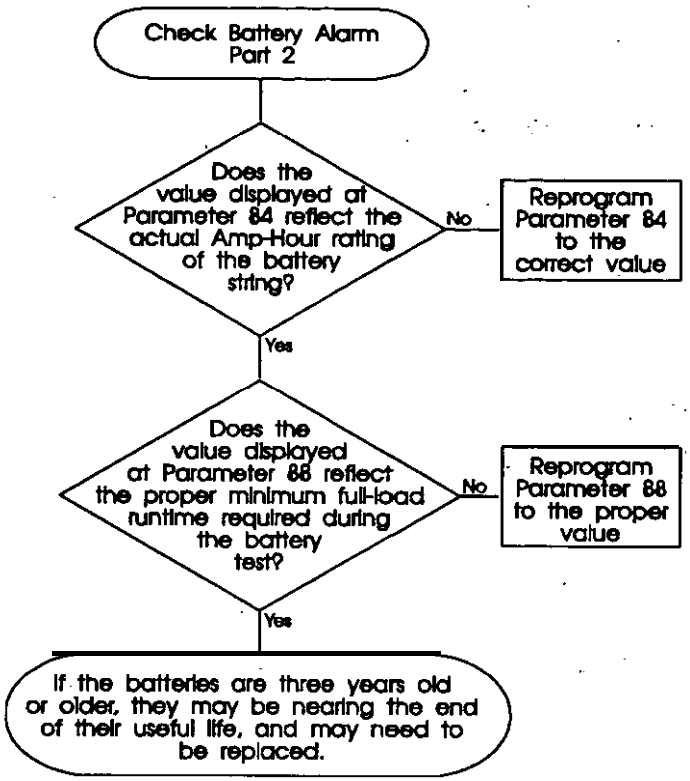


-Check Cooling Alarm

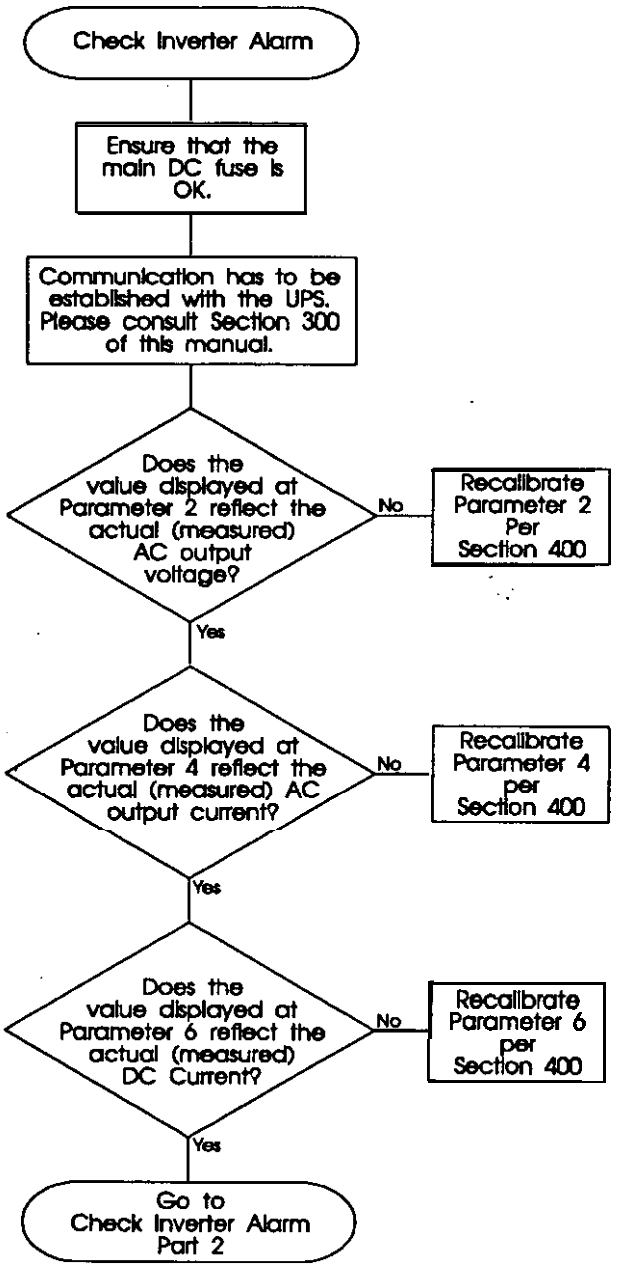


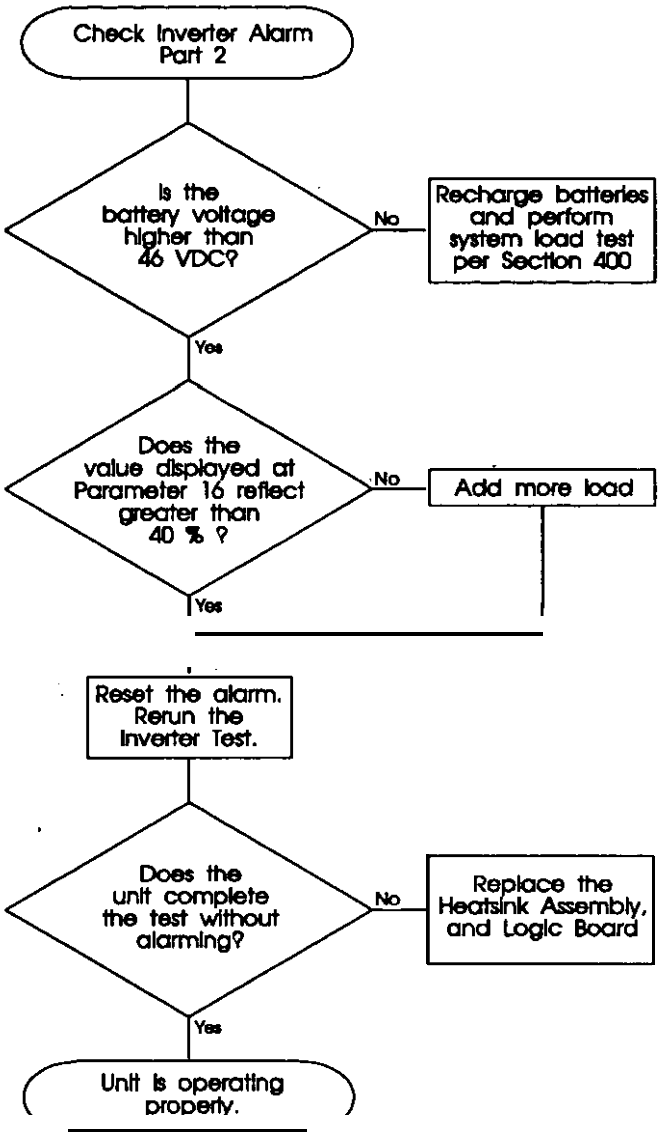
-Check Batterv Alarm



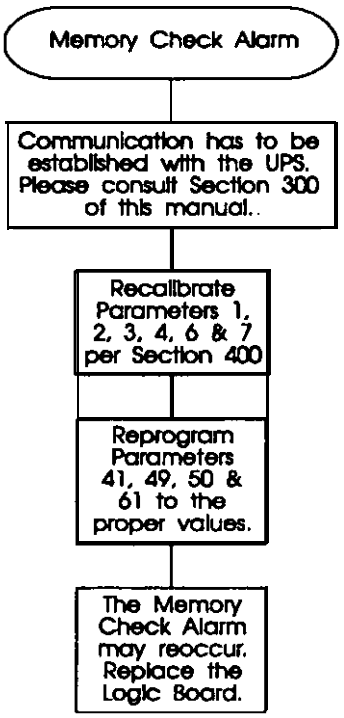

Check Battery Alarm Part 2
Does the value displayed at Parameter 84 reflect the actual Amp-Hour rating of the battery string?
No
Reprogram Parameter 84 to the correct value
Yes
Does the value displayed at Parameter 88 reflect the proper minimum full-load runtime required during the battery test?
No
Reprogram Parameter 88 to the proper value
Yes
If the batteries are three years old or older, they may be nearing the end of their useful life, and may need to be replaced.

-Check Inverter Alarm

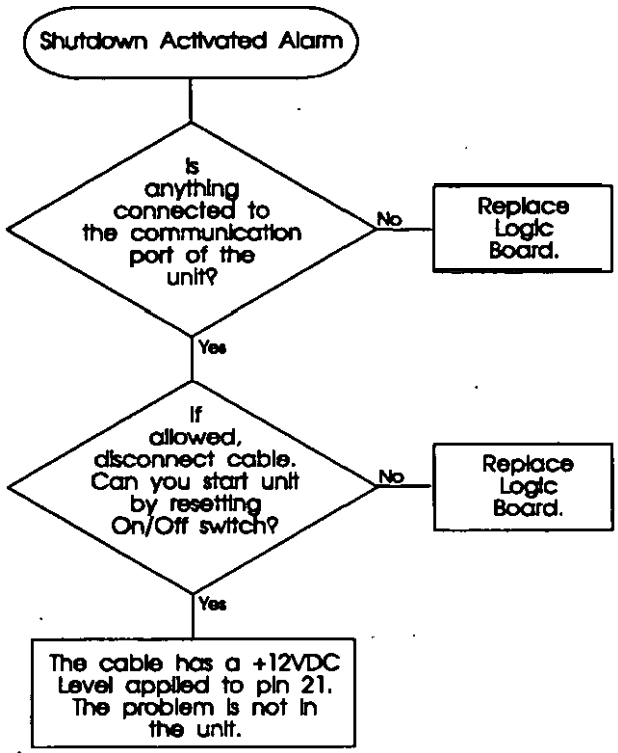



Check Inverter Alarm Part 2
Is the battery voltage higher than 46 VDC?
No
Recharge batteries and perform system load test per Section 400
Yes
Does the value displayed at Parameter 16 reflect greater than 40 % ?
No
Add more load
Yes
Reset the alarm. Rerun the Inverter Test.
Does the unit complete the test without alarming?
No
Replace the Heatsink Assembly, and Logic Board
Yes
Unit is operating properly.

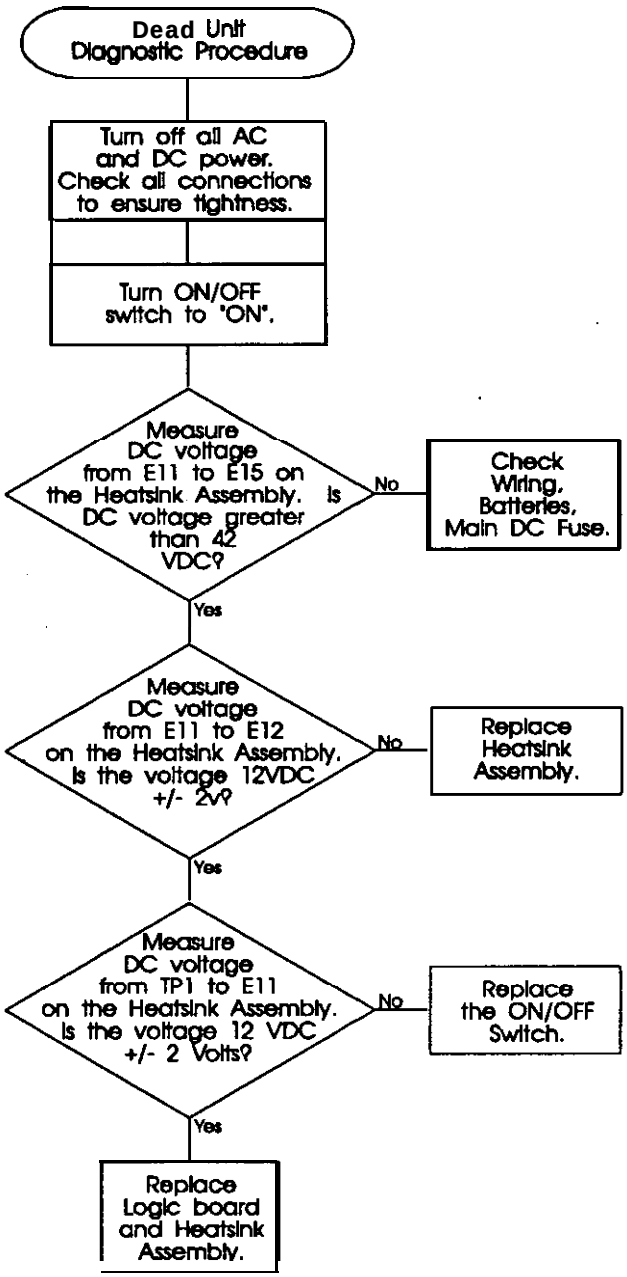
—Memory Check Alarm



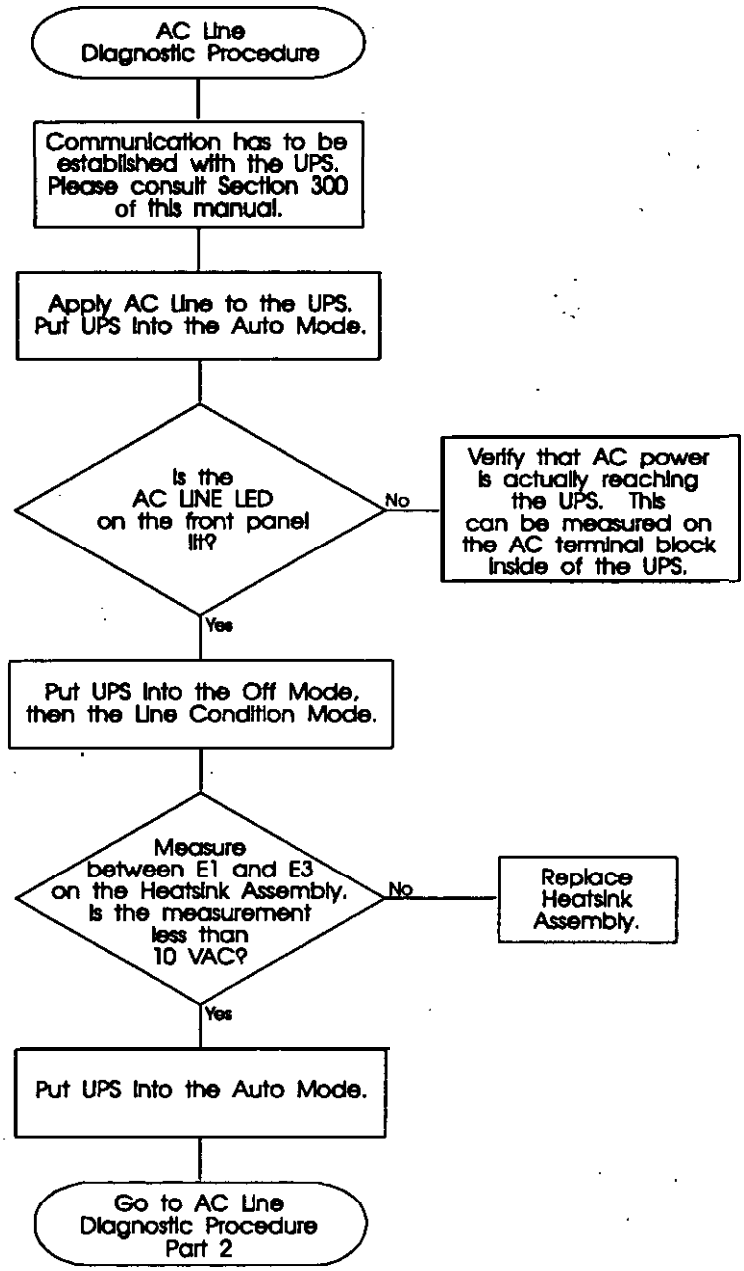
-Shutdown Activated Alarm

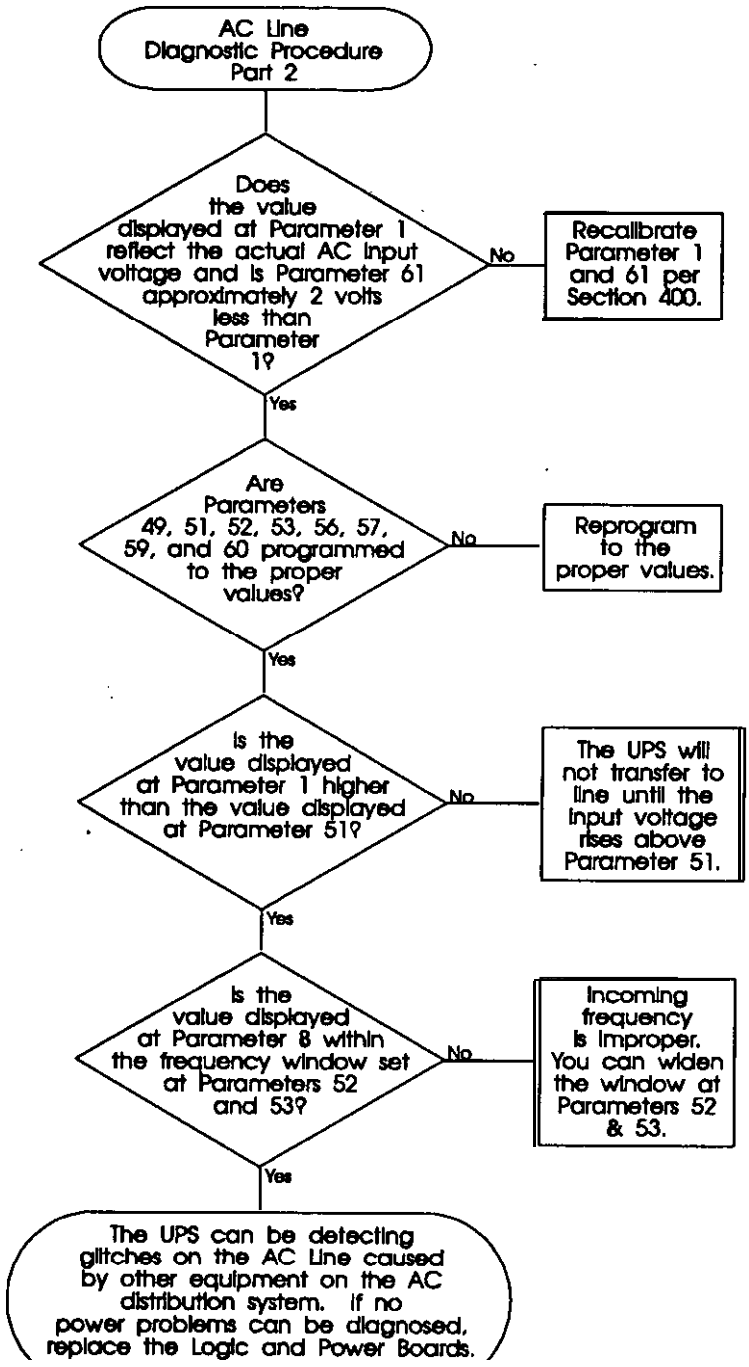


-Dead Unit Diagnostic Procedure

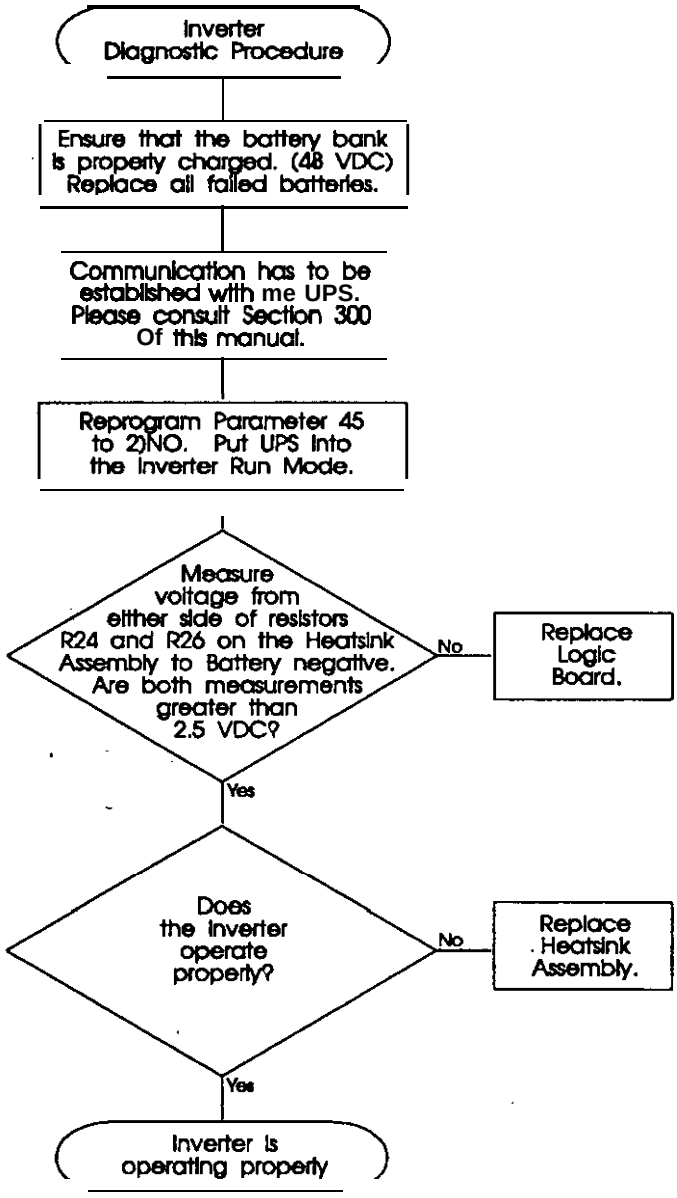


-AC Line Diagnostic Procedure




AC Line Diagnostic Procedure Part 2
Does the value displayed at Parameter 1 reflect the actual AC input voltage and is Parameter 61 approximately 2 volts less than Parameter 1?
No
Recalibrate Parameter 1 and 61 per Section 400.
Yes
Are Parameters 49, 51, 52, 53, 56, 57, 59, and 60 programmed to the proper values?
No
Reprogram to the proper values.
Yes
Is the value displayed at Parameter 1 higher than the value displayed at Parameter 51?
No
The UPS will not transfer to line until the input voltage rises above Parameter 51.
Yes
Is the value displayed at Parameter 8 within the frequency window set at Parameters 52 and 53?
No
Incoming frequency is improper. You can widen the window at Parameters 52 & 53.
Yes
The UPS can be detecting glitches on the AC Line caused by other equipment on the AC distribution system. If no power problems can be diagnosed, replace the Logic and Power Boards.

—Inverter Diagnostic Procedure



501-2 Fuses and Locations

The fuses and locations charts are set up to aid in the identification of the fuses in the MICRO-FERRUPS system. The charts are separated into five columns. The first column lists what the fuse is used for. The second column lists the BEST part number for ordering replacement fuses. The third column lists the voltage and current rating of the fuse, and the type of fuse. The fourth column lists the location of the fuse in reference to the schematics in section 800. The fifth column lists the physical location of the fuse within the actual unit.

FUSES and LOCATIONS (1.8-2.1 KVA)

Fuse Use	BEST Part Number	Fuse Size	Location (Schematic)	Location (Physical)
Main DC Fuse	FUSA-025 (1.8 and 2.1KVA)	70 Amp 150 V	F1 DRWG# #D2721 3 of 3	On Battery Bank
	FUSA-165 (3.1KVA ONLY)	150 Amp 130 V	F1 DRWG# #D2721 3 of 3	On Battery Bank
AC Input Monitor Fuse	FUSA-154	5 Amp 250 VAC MSL	Not Listed	On Heatsink Assy.
Standard Charger AC Fuse	FUSA-	MSL 10 Amp, 125V	Not Listed	Heatsink Assy.
Spike Protection	FUSA-154	5 Amp 250 VAC MSL	F2 DRWG# D2721 3 of 3	Right side of Terminal Block
AC Output Monitor Fuse	FUSA-154	5 Amp 250 VAC MSL	Not Listed	F1 on Power Board
DC Protection Fuse	FUSA-002	MSL 10 Amp, 125V	Not Listed	F5 on Power Board
Output Protection	FUSA-155	20 Amp 250 V	Not Listed	Receptacle Panel

502 Troubleshooting External Problems

Once you have completed the tests indicated above, you may still find that the MICRO-FERRUPS system does not perform properly. If you are able to turn-on and test the MICRO-FERRUPS when it is not connected to the line or load, but have problems once you reconnect

it to 'the "real world", then the problem is almost certainly external in nature.

MICRO-FERRUPS is a separately-derived power system,! and as such: must be installed differently than a simple step-up transformer. The role that grounding plays in the proper installation of this system is of critical importance. Improperly installed MICRO-FERRUPS grounding can contribute to what are colloquially referred to as "back door" problems.

"Back door" problems are generally intermittent in nature, and include such things as 'CPU halts, data errors and parity errors. In the worst case, peripherals that amnotpowered by the UPS will allow transient or lightning energy to reach the CPU via the "back door", or I/O ports; hence the moniker.

Although 100% absolute lightning arid transient protection is not reasonable to attain, using the proper installation methods can certainly afford you a very high degree of protection from these kinds of problems. Refer to the previous section entitled "Installation Wiring and Grounding" for general information.

502-1 Installation Wiring and Grounding

As stated at the beginning of this chapter, statistical analysis performed by Best's Service Department reveals that about 80% of' all problems with MICRO-FERRUPS systems are installation related. Most of these problems result from simply NOT using the correct wiring diagram provided by BEST. Tbe National Electrical Code requires that listed equipment be installed in accordance with the instructions-furnished by the manufacture. Failure to comply with this is a violation of NEC Article 110-3(b).

installation, from the service entrance. panel, through the MICRO-FERRUPS connection panel, through the bypass switch, and out to the receptacle outlets that the load equipment plugs into. Compare the installation to the wiring diagram in the Installation Manual shipped with the unit and make note of any discrepancies.

600 50 Hertz Models

600-l **QME1.8KVA**

ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-053	(S) 31 A.H. AGM TYPE, 4 Required
Battery		BATA-046	(O) 55 A.H. AGM TYPE. 4 Reouired
Battery Charger		BCAA-023E	(O) 10 amp Battery Charger
Battery Charger		BCAA-024E	(0) 20 amp Batttery Charger
Fan		FANA-005	(S) 220/230/240 VAC
HeatSink		HSAA-025	(S) High Voltage
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-025	(S) 70 amp
Logic Board		PCLA-115	(S) Control Board

600-2 **QME2.1KVA**

QME2.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-053	(S) 31 A.H. AGM TYPE, 4 Required

QME2.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-046	(0) 55 A.H. AGM TYPE, 4 Required
Battery Charger		BCAA-023E	(0) 10 amp Battery Charger
Battery Charger		BCAA-024E	(O) 20 amp Batttery Charger
Fan		FANA-005	(S) 220/230/240 VAC
HeatSink		HSAA-027	(S) High Voltage
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-025	(S) 70 amp
Logic Board		PCLA-115	(S) Control Board

600-3 QME3.1KVA

QME3.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT Batttery
Battery			
Battery			
			Charger
			(S) 220/230/240 VAC

QME3.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Heatsink		HSAA-027	(S) High Voltage
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-165	(S) 70 amp
Logic Board		PCLA-115	(S) Control Board
Receptacle Fuse		FUSA-144	(S) 20 amp

601 60 Hertz Models

601-l **ME1.8KVA**

ME1.8KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-053	(S) 31 A.H. AGM TYPE, 4 Required
Battery		BATA-046	(0) 55 A.H. AGM TYPE. 4 Reauired
Battery Charger		BCAA-027E	(O) 10 amp Battery Charger
Battery Charger		BCAA-020E	(0) 20 amp Batttery Charger
Fan		FANA-003	(S) 120 VAC
HEATSINK		HSAA-024	(S) Low Voltage
		HSAA-025	(0) High Voltage

ME1.8KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-025	(S) 70 amp
Logic Board		PCLA-114	(S) Control Board

601-2 **ME2.1KVA**

ME2.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-053	(S) 31 A.H. AGM TYPE, 4 Required
Batten,		BATA-046	(O) 55 A.H. AGM TYPE. 4 Required
Battery Charger		BCAA-027E	(O) 10 amp Battery Charger
Battery Charger		BCAA-020E	(0) 20 amp Batttety Charger
Fan		FANA-003	(S) 120 VAC
HEATSINK		HSAA-026	(S) Low Voltage
		HSAA-027	(0) High Voltage
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-025	(S) 70 amp
Logic Board		PCLA-114	(S) Control Board

ME3.1KVA			
ASSEMBLY	SUB-ASSY	BEST PART #	COMMENT (S)=Standard Model (O)=Op
Battery		BATA-053	(S) 31 A.H. AGM TYPE, 4 Required
Battery		BATA-046	(0) 55 A.H. AGM TYPE, 4 Required
Battery Charger		BCAA-027E	(O) 10 amp Battery Charger
Battery Charger		BCAA-020E	(0) 20 amp Batttety Charger
Fan		FANA-003	(S) 120 VAC
HEATSINK		HSAA-026	(S) Low Voltage
		HSAA-027	(0) High Voltage
Fuses, Power Bd.		FUSA-154	(S) 6 amp 250v MSL 4 Required
Main Fuse DC		FUSA-165	(S) 70 amp
Logic Board		PCLA-114	(S) Control Board
Receptacle Fuse		FUSA-144	(S) 20 amp

Technical Information Publications

This section of your service manual contains the following Technical Information Publications:

700 TIP's

TIP 302	MICRO-FERRUPS 60 Hz Installation with Line Cord
TIP 303	MICRO-FERRUPS 60 Hz Hardwire Installation
TIP 365	Bypass Switch Installation
TIP 604	Written Procedure
TIP605	Schedule Maintenance and Service Call Report Form

701 QTIP's

QTIP 302	MICRO-FERRUPS 50 Hz Installation
QTIP 303	MICRO-FERRUPS 50 Hz Hardwire Installation
QTIP 365	Bypass Switch Installation
QTIP 615	50 Hz Voltage Change

MICRO-FERRUPS® 60 Hz AC Installation with Line Cord

TIP302
3
October 15, 1990

Best Power Technology, Inc

This Technical Information Publication for ME units includes AC input service requirements, output receptacles and installation instructions for units with a line cord (softwired).

Contents Index

WARNING:

Input and output AC voltages used in this unit are hazardous. Do not use uninsulated tools or touch wires or terminals. AC may be present at the output with no AC line input.

DC batteries are high-current sources; accidental short circuits can cause severe arcing, equipment damage, battery explosion and personal injury. Do not turn the UPS on at this time.

RESTRICTED

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. (608) 565-7200 Toll-Free 800-356-5794 Service Toll-Free 800-338-1610 (U.S.A. & Canada) Telex No. 701934 (Best Power UD)
Fax (608) 565-2221 Service Fax (608) 565-2509
"All products made in the U.S.A. with quality and pride."

INSTALLATION

100: AC Input Service and Receptacle Requirements

101: Standard Charger Units: Input Service Specifications

101-l. AC Input Service

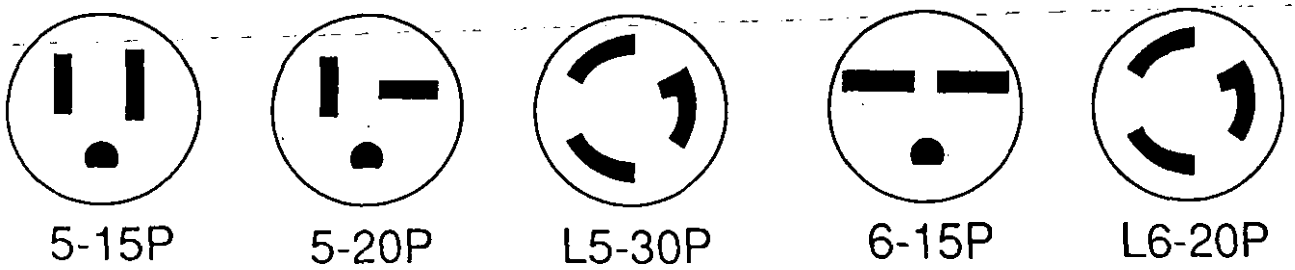
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Model: / Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10amp	10 amp	10 amp	15 amp	20 amp	25 amp	30 amp	35 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	25 amp	30 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
120VAC	10 amp	10 amp	10 amp	1.5 amp	15 amp	20 amp	20 amp	30 amp
200 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
220 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp.

101-2. Input Receptacles for Units with Line Cord (Softwired Units)

Model	¥120A C	208 VAC	¥240A C
ME500VA	5-15R	6-15R	6-15R
ME700VA	5-15R	6-15R	6-15R
ME850VA	5-15R	6-15R	6-15R
ME1.15KVA	5-15R	6-15R	6-15R
ME1.4KVA	5-15R	6-15R	6-15R
ME1.8KVA	5-20R	6-15R	6-15R
ME2.1KVA	5-20R	6-15R	6-15R
ME3.1KVA	L5-30R	L6-20R	6-15R

101-3. Plug Configurations (for units with line cord)



102: 10 Amp Charger Units: Input Service Specifications

102-l. AC Input Service

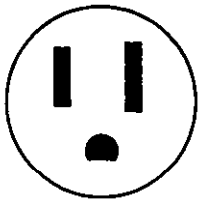
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

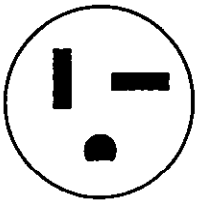
Model: Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	15 amp	15 amp	20 amp	30 amp	35amp	40 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
115VAC	10 amp	10 amp	10amp	15 amp	15 amp	25 amp	25 amp	35 amp
120 VAC	10 amp	10 amp	10 amp	1.5 amp	15 amp	25 amp	25 amp	30 amp
200 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
220 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	15 amp

102-Z. Input Receptacles for Units with Line Cord (Softwired Units)

Model	120VAC.	208 VAC	240 VAC
ME500VA	5-15R	6-15R	6-15R
ME700VA	5-15R	6-15R	6-15R
ME850VA	5-15R	6-15R	6-15R
ME1.15KVA	5-15R	6-15R	6-15R
ME1.4KVA	5-20R	6-15R	6-15R
ME1.8KVA	L5-30R	6-15R	6-15R
ME2.1KVA	L5-30R	6-15R	6-15R
ME3.1KVA	5-50R	L6-20R	6-15R

102-3. Plug Configurations (for units with line cord)


5-15P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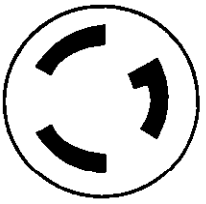
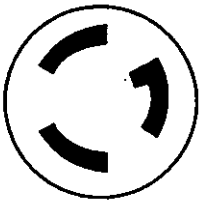

L5-30P


5-50P


6-15P


L6-20P

103: 20 Amp Charger Units: Input Service Specifications

103-l. AC Input Service

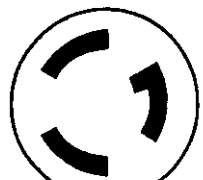
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot

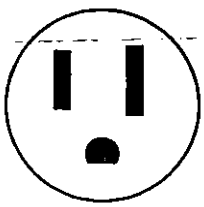
Model: Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	15amp	15amp	20 amp	20 amp	40 amp	45 amp	50 amp
110 VAC	10 amp	15 amp	15amp	15 amp	15 amp	35 amp	40 amp	45 amp
115 VAC	10 amp	10 amp	15 amp	15 amp	15 amp	30 amp	35 amp	40 amp
120 VAC	10 amp	10amp	15amp	15 amp	15 amp	30 amp	30 amp	40 amp
200 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
208 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
210 VAC	5 amp	10amp	10amp	10 amp	10 amp	20 amp	2oamp	25 amp
220 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
230 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
240 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp

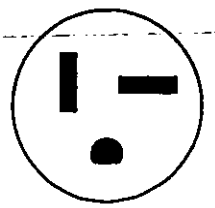
103-2. Input Receptacles for Units with Line Cord (Softwired Units)

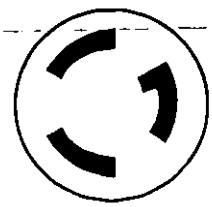
Model	120 VAC	208 VAC	240 VAC
ME500VA	5-15R	6-15R	6-15R
ME700VA	5-15R	6-15R	6-15R
ME850VA	5-15R	6-15R	6-15R
ME1.15KVA	5-15R	6-15R	6-15R
ME1.4KVA	5-20R	6-15R	6-15R
ME1.8KVA	L5-30R	6-15R	6-15R
ME2.1KVA	5-50R	L6-20R	L6-20R
ME3.1KVA	5-50R	L6-30R	L6-30R

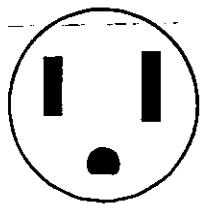
103-3. Plug Configurations (for units with line cord)


L6-30P

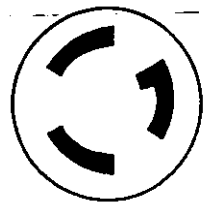

5-15P


5-20P


L5-30P


5-50P


6-15P

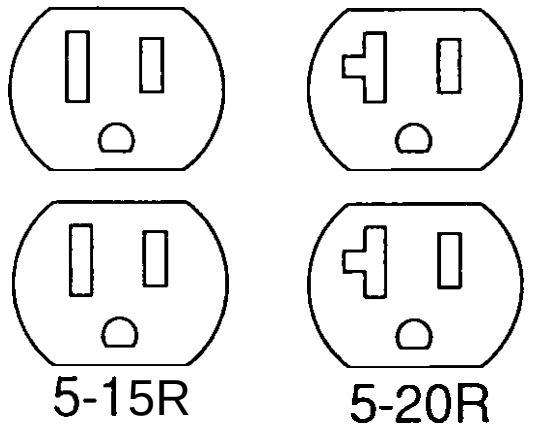

L6-20P

200: Output Receptacles (Receptacle Panels)

Model	Type	Quantity
ME500VA	5-15R	4
ME700VA	5-15R	4
ME850VA	5-15R	4
ME1.15KVA	5-15R	4
ME1.4KVA	5-15R	4
ME1.8KVA	5-20R	4
ME2.1KVA	5-20R	4
ME3.1KVA	5-20R	4

4=2 duplex receptacles

Standard Output Receptacles



TIP303
3
October 23, 1990

MICRO-FERRUPS® 60 Hz Hard-wire AC Installation

Best Power Technology, Inc.

This Technical Information Publication for ME units includes AC input service requirements, output receptacles, wiring diagrams and installation instructions for units without a line cord (hard-wired).

Contents Index

WARNING:

Installation of this UPS should be completed by a qualified electrician.

Input and output AC voltages used in this unit are hazardous. Do not use uninsulated tools or touch wires or terminals. AC may be present at the output with no AC line input.

DC batteries are high-current sources; accidental short circuits can cause severe arcing, equipment damage, battery explosion and personal injury. Do not turn the UPS on at this time.

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. (608) 565-7200 Toll-Free 800-356-5794 Service Toll-Free 800-338-1610 (U.S.A. & Canada) Telex No. 701934 (Best Power UD)
Fax (608) 565-2221 Service Fax (608) 565-2509

100: AC Input Service

101: Standard Charger Units: Input Service Specifications

NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Model: / Input Voltage.	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp	30 amp	35 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	25 amp	30 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
120VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
200 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
220 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp-
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp.

102: 10 Amp Charger Units: Input Service Specifications

NOTE: Circuit breaker a fuse size should correspond to service requirement. Use nut largest available circuit breaker or fuse rating if exact match cannot be found.

Model: / Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	15 amp	15 amp	20 amp	30 amp	35amp	40 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
120 VAC	10 amp	10 amp	10 amp	1.5 amp	15 amp	25 amp	25 amp	30 amp
200 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10amp	10 amp	15 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
220 VAC	5 amp	5 amp	5	10	10 amp	15 amp	15 amp	20 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	15 amp
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	15 amp

103: 20 Amp Charger Units: Input Service Specifications

NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

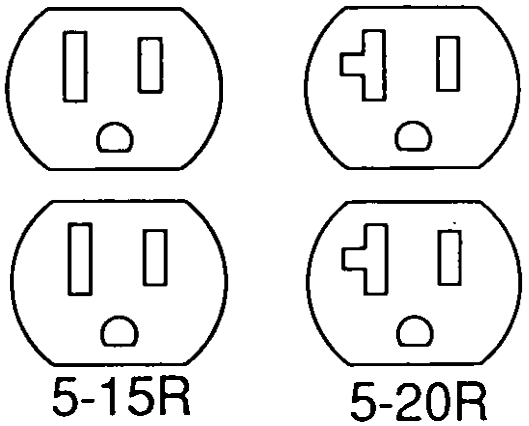
Model: / Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	15 amp	15 amp	20 amp	20 amp	40 amp	45 amp	50 amp
110 VAC	10 amp	15 amp	15 amp	15 amp	15 amp	35 amp	40 amp	45 amp
115 VAC	10 amp	10 amp	15 amp	15 amp	15 amp	30 amp	35 amp	40 amp
120 VAC	10 amp	10 amp	15 amp	15 amp	15 amp	30 amp	30 amp	40 amp
200 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
208 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
210 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
220 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
230 VAC'	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
240 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp

200: Output Receptacles (Receptacle Panels)

Model	Type	Quantity	Model	Type	Quantity
ME500VA	5-15R	4	ME1.4KVA	5-15R	4
ME700VA	5-15R	4	ME1.8KVA	5-20R	4
ME850VA	5 - m	4	ME2.1KVA	5-20R	4
ME1.15KVA	5-15R	4	ME3.1KVA	5-20R	4

4=2 duplex receptacles

Standard Output Receptacles



ME500VA - ME3.1 KVA INSTALLATION WIRING 'DIAGRAM

120 VAC Input - 120 VAC Output

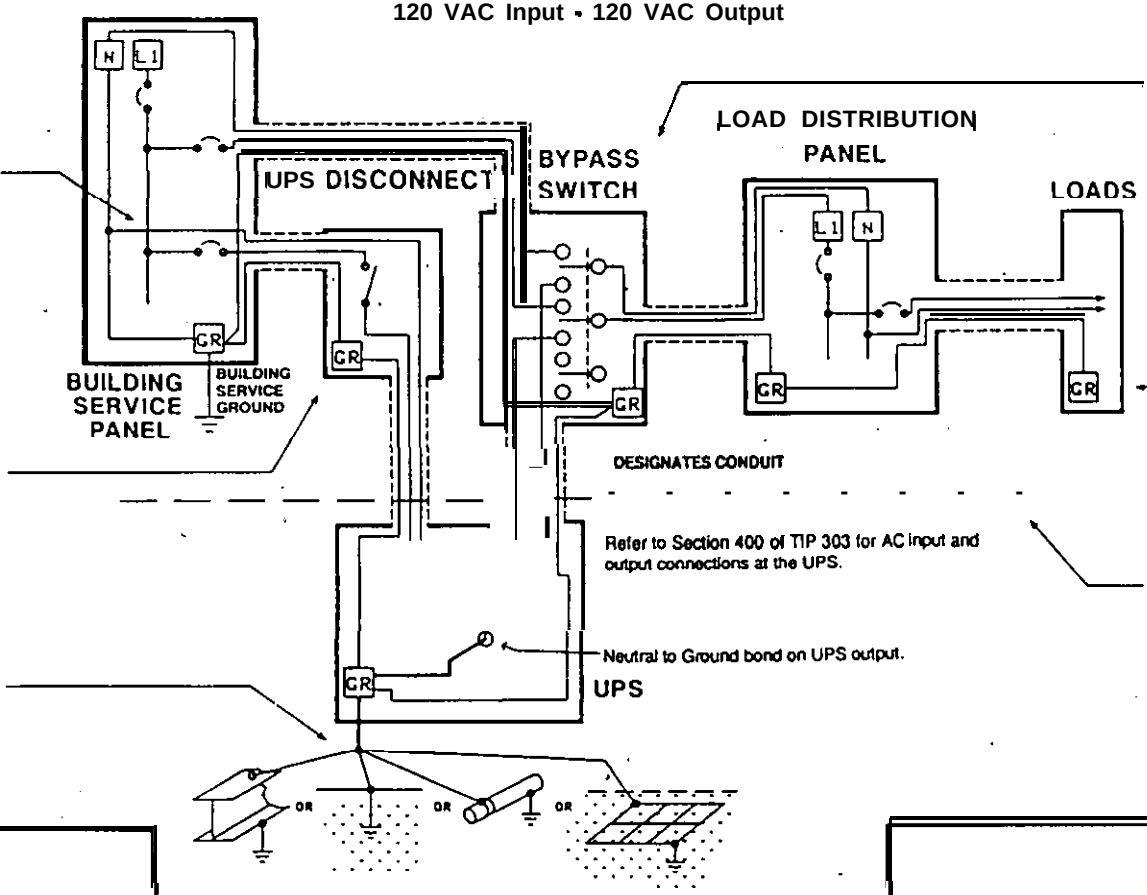


FIGURE 301
120 VAC Input - 120 VAC Output

NOTE #1

FERRUPS and the External Service Bypass Switch must be assigned separate circuit breakers (or fuses) at the Building Service Panel. The UPS service specifications are in Section 100 of TIP 303.

If the appropriate circuit breaker cannot be found, contact BEST's Service Department at 800-356-5737 [or (608) 565-7200]. Or, refer to NEC article 240-21, exception #2, and install a UPS fuse disconnect.

NOTE #3

If the Building Service Panel or UPS Fuse Disconnect is some distance from the UPS, a disconnect will have to be installed within sight of the UPS. BEST Service Bypass Switches are available with an optional disconnect switch or circuit breaker for the UPS AC input.

NOTE #5

The customer must provide local ground according to NEC article 250-5d and 250-26. For maximum protection use all of the methods shown for the local ground on the UPS.

NOTE #2

The bypass switch must be within sight of the UPS.

NOTE #4

For maximum protection against ground noise, use isolated ground receptacles. See NEC article 250-74, exception #4.

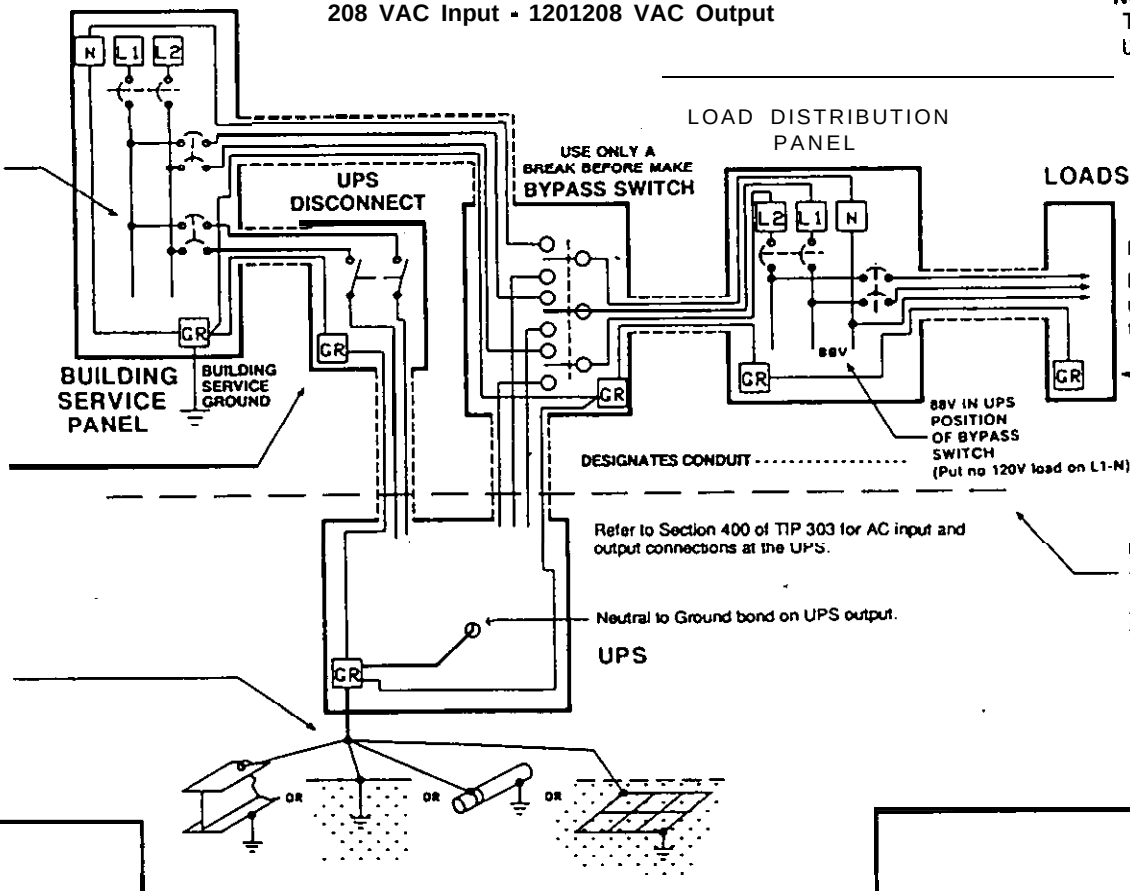
NOTE #6

FACILITIES AND WIRING SHOWN ABOVE THIS LINE ARE PROVIDED BY THE CUSTOMER IN ACCORDANCE WITH NEC AND LOCAL BUILDING CODES. SEE NOTE 5 ALSO.

ME500VA - ME3.1 KVA INSTALLATION WIRING DIAGRAM

FIGURE 302
208 VAC Input - 120/208 VAC Output

208 VAC Input - 1201208 VAC Output



NOTE #1

FERRUPS and the External Service Bypass Switch must be assigned separate circuit breakers (or fuses) at the Building Service Panel. The UPS service specifications are in Section 100 of TIP 303.

If the appropriate circuit breaker cannot be found, contact BEST's Service Department at 800-356-5737 [or (608) 565-7200]. Or, refer to NEC article 240-21, exception #2, and install a UPS fuse disconnect.

NOTE #3

If the Building Service Panel or UPS Fuse Disconnect is some distance from the UPS, a disconnect will have to be installed within sight of the UPS. BEST Service Bypass Switches are available with an optional disconnect switch or circuit breaker for the UPS AC input.

NOTE #5

The customer must provide local ground according to NEC article 250-5d and 250-26. For maximum protection use all of the methods shown for the local ground on the UPS.

NOTE #2

The bypass switch must be within sight of the UPS.

NOTE #4

For maximum protection against ground noise, use isolated ground receptacles. See NEC article 250-74, exception #4.

NOTE #6

FACILITIES AND WIRING SHOWN ABOVE THIS LINE ARE PROVIDED BY THE CUSTOMER IN ACCORDANCE WITH NEC AND LOCAL BUILDING CODES. SEE NOTE 5 ALSO.

E3.1 KVA INSTALLATION WIRING DIAGRAM

FIGURE 303
240VAC Input - 120/240 VAC Output

VOTE #1

FERRUPS and the External Service Bypass Switch must be assigned separate circuit breakers (or fuses) at the Building Service Panel. The UPS service specifications are in Section 100 of TIP 303.

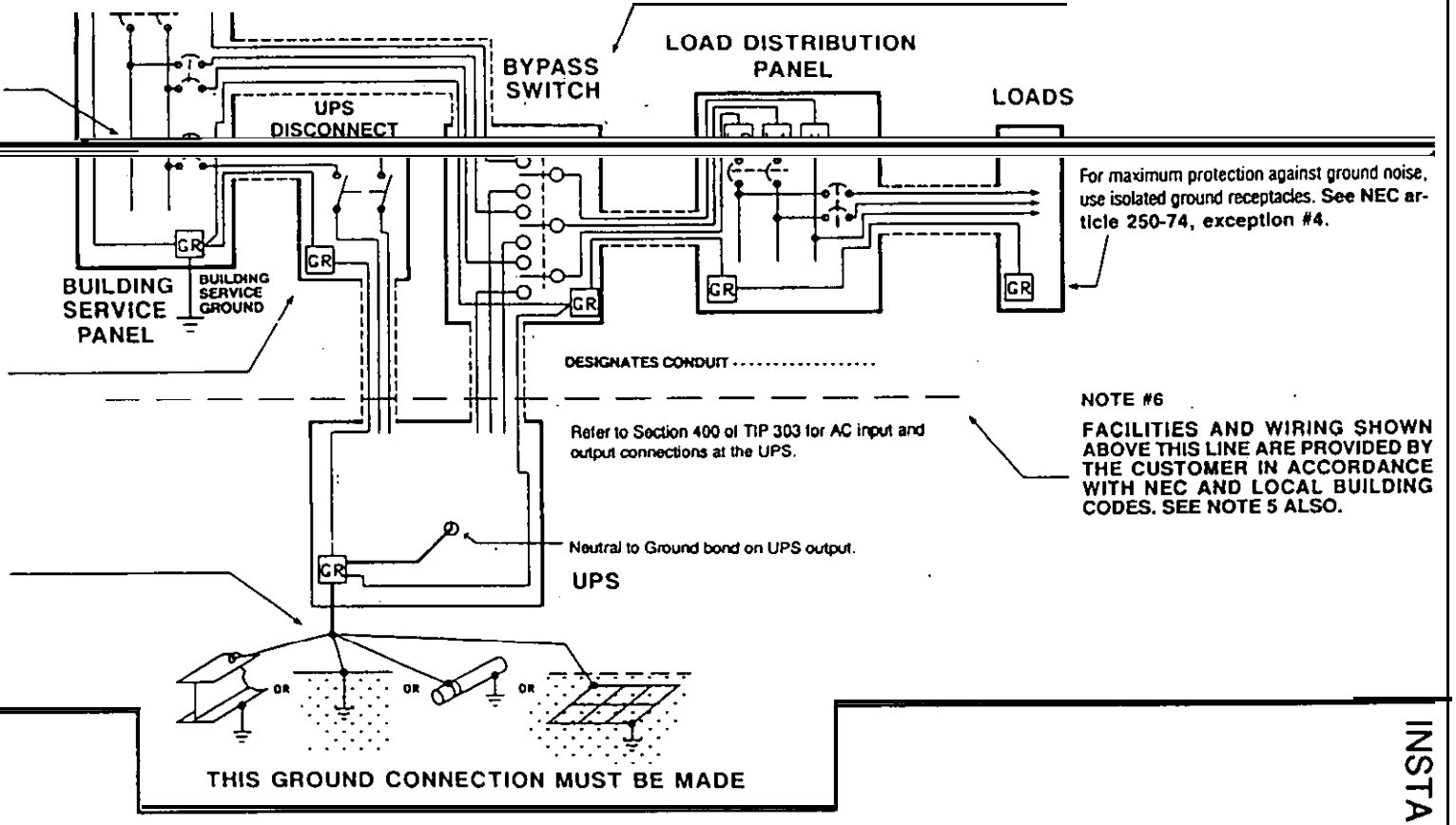
If the appropriate circuit breaker cannot be found, contact BEST's Service Department at 800-356-5737 [or (608) 565-7200]. Or, refer to NEC article 240-21, exception #2, and install a UPS fuse disconnect.

NOTE #3

If the Building Service Panel or UPS Fuse Disconnect is some distance from the UPS, a disconnect will have to be installed within sight of the UPS. BEST Service Bypass Switches are available with an optional disconnect switch or circuit breaker for the UPS AC input.

NOTE #5

The customer must provide local ground according to NEC article 250-5d and 250-26. For maximum protection use all of the methods shown for the local ground on the UPS.



NOTE #2

The bypass switch must be within sight of the UPS.

For maximum protection against ground noise, use isolated ground receptacles. See NEC article 250-74, exception #4.

NOTE #6

FACILITIES AND WIRING SHOWN ABOVE THIS LINE ARE PROVIDED BY THE CUSTOMER IN ACCORDANCE WITH NEC AND LOCAL BUILDING CODES. SEE NOTE 5 ALSO.

400: AC Input/Output Unit Connections

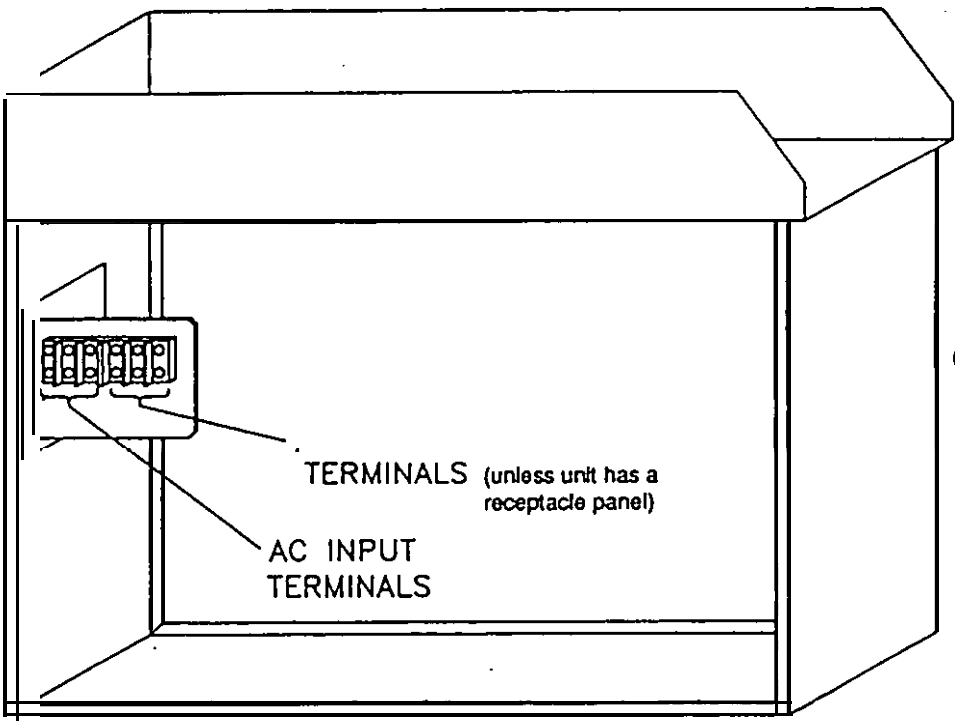
1. Make certain the ON-OFF (1-O) switch on the back of the UPS is turned to OFF (0). Turn off the circuit breaker or disconnect switch at the AC input service panel.

2. Find the screw access hole in the lower right comer of the black plastic front panel. The screw access hole may be covered by a round piece of black tape. Save the piece of tape so it can be replaced when the UPS is reassembled. Use a #2 Phillips screwdriver to loosen (but not remove) the screw on the front panel. Loosen and remove the screw on the top at the back of the UPS. Slide the cover forward.

3. Place the UPS in position in the location where it will be operating. Make certain the cover can be removed and reinstalled when the UPS is in position.

4. Refer to Figure 400-l (below) for the location of theterminal block in the UPS where AC line input and UPS output♣ AC connections will be made. Local or NRC regulations may require using conduit which may limit the movement of the UPS once the AC input service and output wiring to the loads are connected. If you are using optional external batteries with your UPS, you must allow about six inches of clearance behind the UPS (minimum), to plug the battery connector into the UPS.

♣ If the UPS has AC receptacles on the back panel, there will not be any *AC output* wiring



a

6. For standard 120 VAC Input and Output (and optional 120 VAC Input and 208 or 240 VAC Output), connect "N" (or"NIN"), "L1" (or "LIN"), and "GR" to the "AC INPUT" terminals on the left side of the terminal block.

   For optional 208 or 240 VAC Input and Output, connect "Ll", "L2" and "GR" to the "AC INPUT" terminals on the left side of the temunal block.

   Refer to Figure 401 below for standard 120 VAC applications.

   Refer to Figure 402 below for optional 120 VAC Input and 208 or 240 VAC Output applications.

   Refer to Figure 403 on the next page for optional 208 VAC applications.

   Refer to Figure 404 on the next page for optional 240 VAC applications.

Figure 401: 120 VAC Input and 120 Output

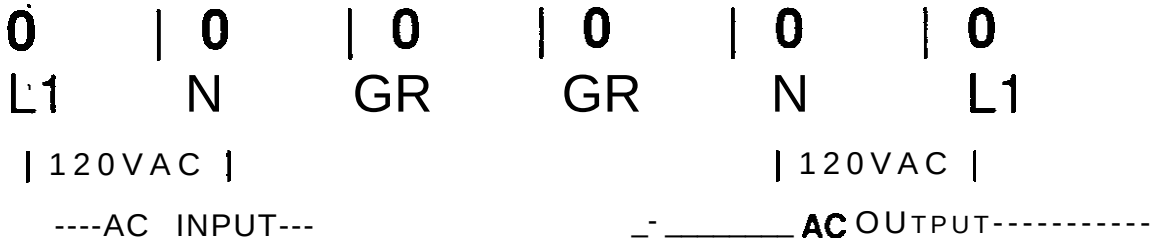
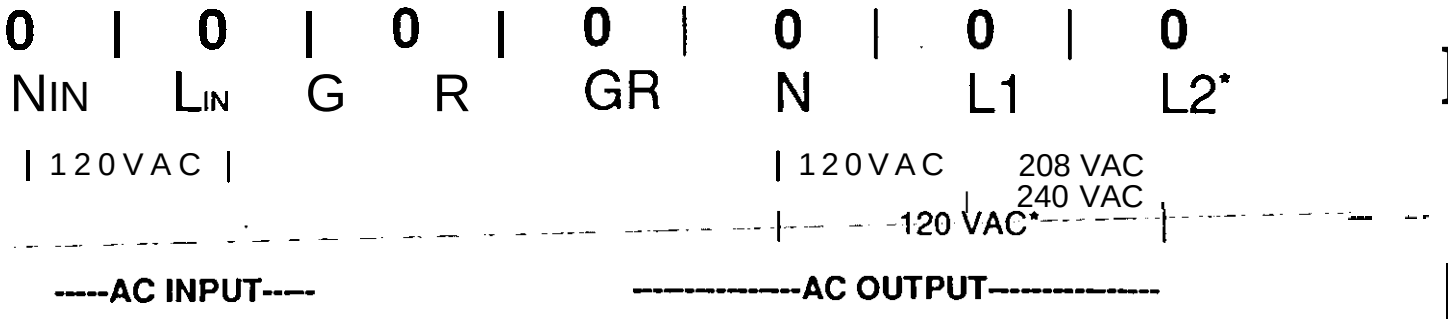
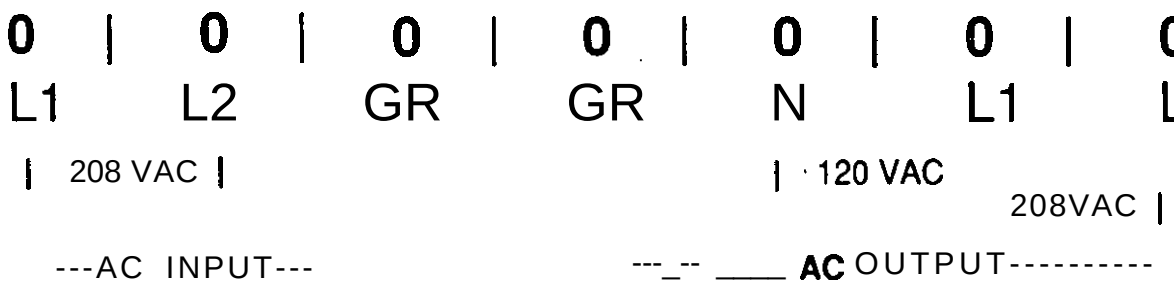


Figure 402: Optional 120 VAC Input and 208 or 240 VAC Output



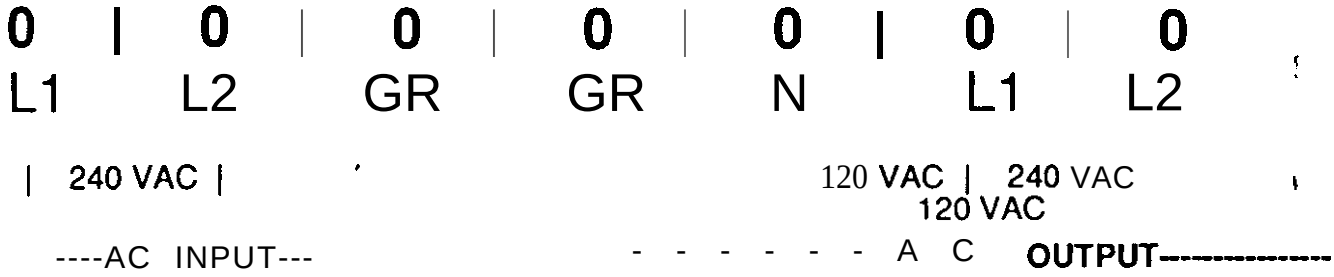
* Caution: for 208 VAC applications, there is only 88 VAC between N and L2.

Figure **403: Optional 208 VAC Input and 208 VAC Output**



* Caution: for 208 VAC applications, there is only.88 VAC between N and L2.

Figure 404: **Optional 240 VAC Input and 240 VAC Output**



[Disregard the following step if your UPS has receptacles on the back panel for connecting rhe load.]

7. Run the AC output wiring to the loads through the conduit/adaptor and connect "L1", "N" and "GR" to the "AC OUTPUT" terminals on the right side of the terminal block. Refer to Figure 400-1, for information.

8. If your UPS was ordered with its batteries removed, or with optional external batteries, refer to the "Battery Installation" information that came with the UPS.

9. Once you have completed any optional battery wiring, replace the cover on the UPS. Replace the screw in the top at the back of the UPS. Tighten the Phillips head screw on the front pane1 that holds the cover in place. Place the round piece of tape over the screw access hole on the front of the UPS.

Bypass Switch Installation

TIP365
2345
November 15, 1990

Best Power Technology, Inc.

This installation procedure describes how to install the bypass switch that you have received.

The bypass switch should be installed on all UPS systems which do not have an AC input line cord and output receptacles. The purpose of the bypass switch is to provide a way of routing utility power to the protected loads if the UPS has to be shut down for scheduled maintenance or service. It can also be used simultaneously to provide isolation with an optional UPS AC Line Disconnect switch or circuit breaker.

This installation procedure. must be completed by a qualified electrician familiar with applicable building and electrical codes.

****

DANGER: This UPS uses and produces dangerously high AC and DC voltages. Use extreme caution to prevent electrical shock by checking wires and connections with a meter before handling. Being a UPS system, disconnecting input AC alone does not eliminate output AC. This is a highly automatic uninterruptible power supply designed to provide power under a variety of conditions. To ensure the unit is off and will not come on unexpectedly, input AC and DC must be off or disconnected.

****

Determine which type of bypass switch you have received by looking at the two figures on the following page. Figure 1 shows the front panel of the Break-Before Make bypass switch. Figure 2 shows the front panel of the Make-Before-Break bypass switch. Determine which switch you have received and then refer to Section 1 or Section 2. Note that the UPS AC disconnect switch is optional.

Section 1 is for Break-Before-Make Bypass Switch Installation Instructions.

Section 2 is for Make-Before-Break Bypass Switch Installation Instructions.

Remember that if the UPS is out of sight or some distance from the UPS AC input service panel, the UPS must have an input service disconnect installed near (within sight of) the UPS. The BEST bypass can be provided with an input service disconnect switch or circuit breaker installed in the bypass switch enclosure.

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. (608) 565-7200 Toll-Free 800-356-5794 Service Toll-Free 800-338-1610 (U.S.A. & Canada) Telex No. 701934 (Best Power UD)
Fax (608) 565-2221 Service Fax (608) 565-2509

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BREAK-BEFORE-MAKE UPS BYPASS

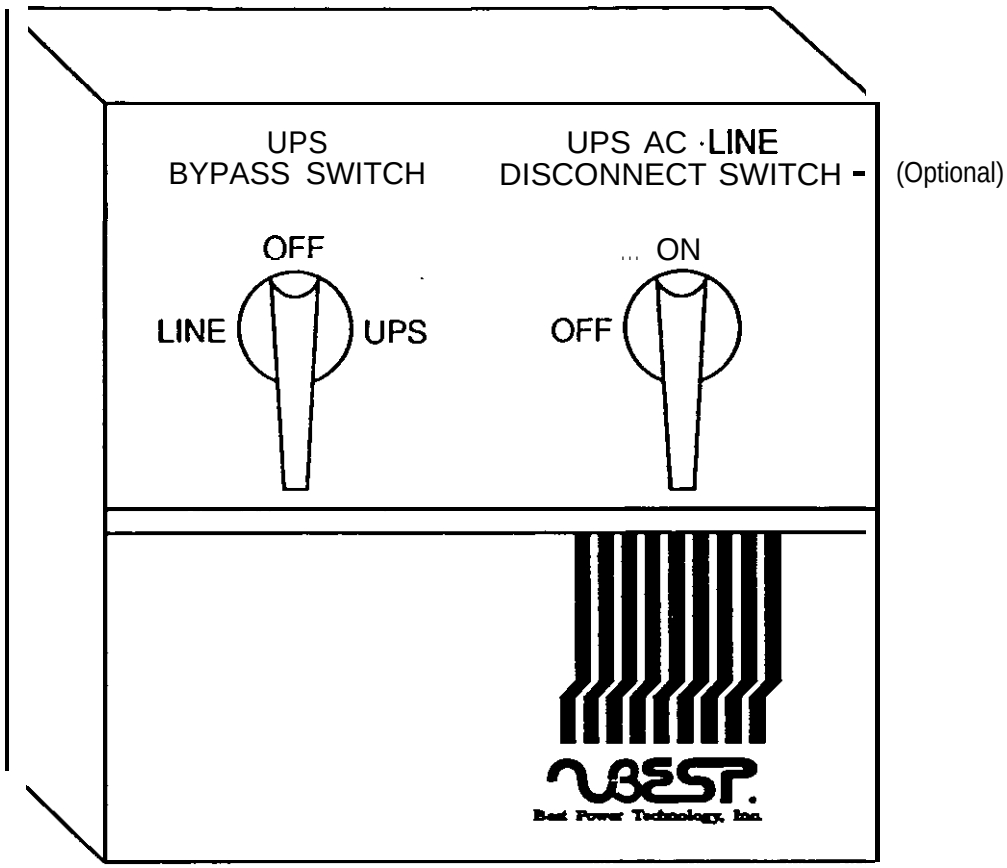

Figure 1

MAKE-BEFORE-BREAK UPS BYPASS

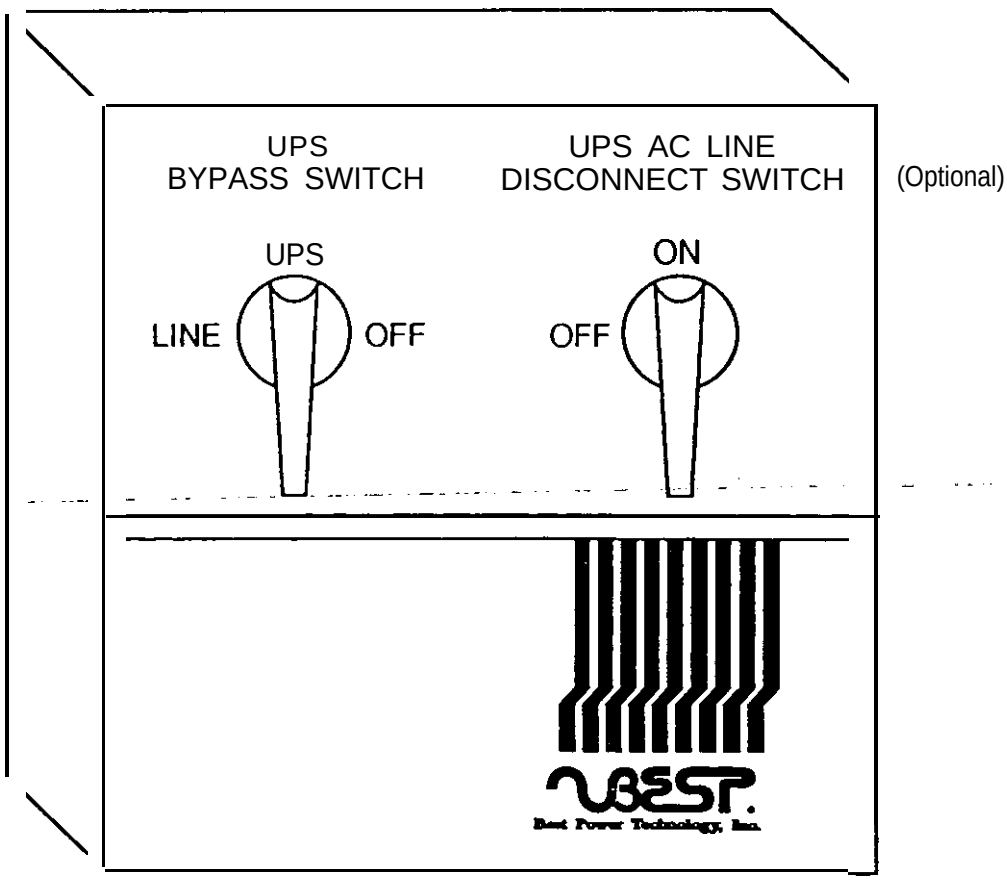

Figure 2

Section 1 Break-Before-Make Bypass Switch Installation

Refer to the wiring diagram that corresponds to your voltage and bypass configuration in the Installation Manual.

Best sells five sizes of **break - before - make** bypass switches. These bypass switches arc:

Model #	Ampere	Wire Size
SWE42-BBM -	42 ampere	up to 8GA (1-12) 4GA (13-20)
SWE80-BBM -	80 ampere	up to 4GA (1-12) 1/O (13-20)
SWE125-BBM -	125 ampere	up to l/O all
SWE150-BBM -	150 ampere	up to l/O all
SWE200-BBM -	200 ampere	up to 2/O all

Table 1

There is a "UPS BYPASS SWITCH" on the left side of the enclosure. (It is in the center of the enclosure if there is no optional AC disconnect).

The addition of the optional "UPS AC LINE DISCONNECT SWITCH" on the right side of the enclosure permits AC input line to the UPS to be shut off during maintenance and service.

UPS BYPASS SWITCH POSITION

1 (LINE) connects AC line to the load.

2 (OFF) disconnects UPS output and AC line from the load.

3 (UPS) connects UPS **output** to the load.

Important: Note that regardless of switch position, AC line is present at the UPS input terminals inside the UPS, except as noted in the following paragraphs.

INSTALLATION

1. Install the enclosure.

Remove the screws in the lower part of the switch enclosure cover and lift it off. Then knockout or punch holes for input AC service, UPS output AC and load AC wiring.

****

WARNING: To prevent the danger of electrical shock or equipment damage, be sure AC line input is off and FERRUPS is off before attempting to connect any wires to the terminal strip already wired to the switch.
****

Begin the switch enclosure terminal strip wiring. Use THHN 90 degree Celsius copper wire to connect to the terminal strip. The terminal will accept the wire size shown in **Table 1** (in the first column on this page).

Terminals 1 through 12 are used for the "UPS BYPASS SWITCH' connections. Terminals 13 through 20 are used for the "UPS AC LINE DISCONNECT SWITCH" if one is provided.

2. Insert the wire and tighten all connections securely to the appropriate terminal on the DIN rail. There is a label on the back of the lower cover of the switch. The label is also shown in Figure 3 on page 5.

Terminal #	Function
1, 2, 3, & 4	Load to Bypass
5, 6, 7 & 8	UPS output to Bypass
9, 10, 11, & 12	AC Line input to Bypass
13, 14, 15 & 16	Disconnect AC Line Input (optional)
17, 18, 19 & 20	Disconnect to UPS AC Input (optional)

IMPORTANT: Good ground connections are necessary to prevent noise and ensure safe operation of UPS and loads.

3. Be sure to complete the following phase check before using the UPS Bypass Switch.

a********&

Caution: Before using the UPS Bypass Switch to switch from UPS to AC line it is necessary to check for the proper phase relationship between AC LINE input and UPS **output.**
****

Complete the following phase check.

STEP 1: Place the bypass switch in the "OFF" position and then perform steps A through 0 in the START-UP Section of the User's Manual. (In FC models follow Section 4, Operation).

STEP 2: Turn on the power that supplies the bypass AC line input.

STEP 3: To assure the voltages feeding the bypass switch are compatible, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal block. Record voltages in the space shown below.

AC From UPS Output	Bypass AC Line Input
A. 7 to 8_____VAC	11 to 12_____VAC
B. 6 to 7_____VAC	10 to 11_____VAC
C. 6 to 8_____VAC	10 to 12_____VAC

Compare the readings taken in lines A, B, and C. The values recorded for "AC From UPS Output" should match the values recorded on the same line for "Bypass AC Line Input".

STEP 4: To assure that the AC from UPS output and the bypass AC line input are in phase, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal strip. Voltage measurements exceeding 100 VAC are unacceptable.

7 to 11_____VAC

8 to 12_____VAC

STEP 5: Using an AC voltmeter, measure the AC voltage between the following points on the bypass switch terminal snip. This reading should not exceed 1 VAC.

6to 10_____VAC

If any of the AC voltage measurements taken in Steps 3, 4, or 5 are unacceptable, contact Best Power Technology Sales Corp., Service Department at 800-356-5737 or (608) 565-7200.

STEP 6: Install the bypass switch cover and tighten screws securely.

STEP 7: Refer to the FERRUPS User's Manual, START-UP Section, and continue with Step P (in FC models see Section 4, Operation).

Switch Terminal Strip with AC Disconnect Switch

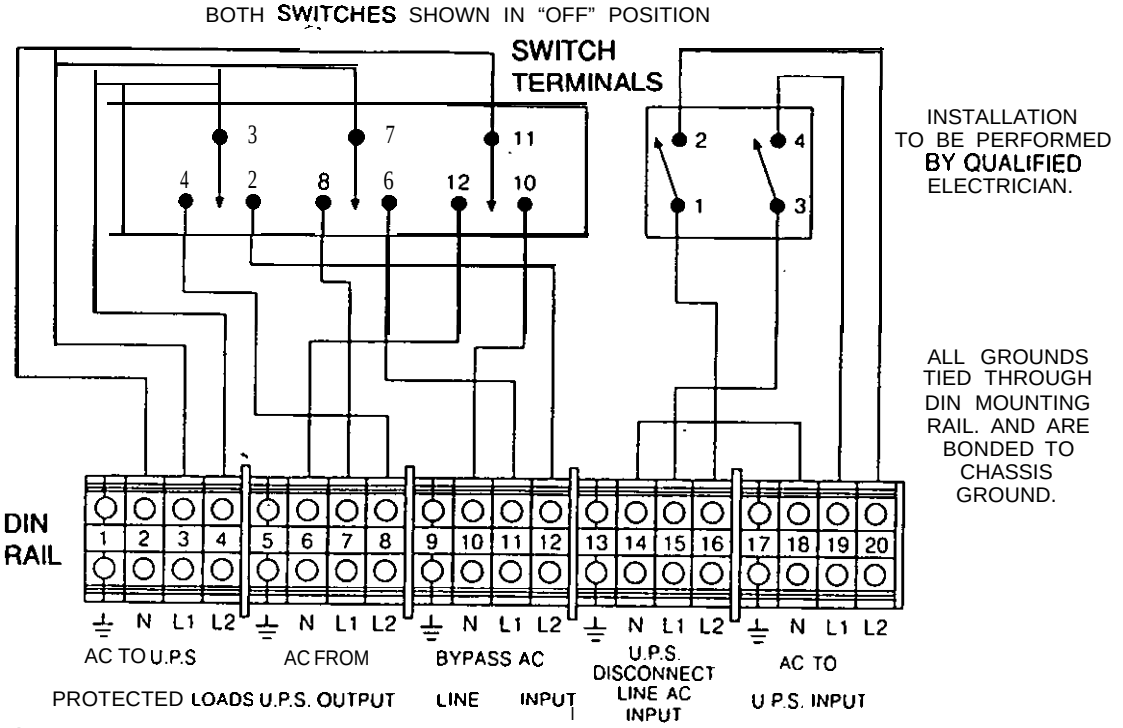

Figure 3

Note: L2 may not be used in some applications.

Switch Terminal Strip without AC Disconnect Switch

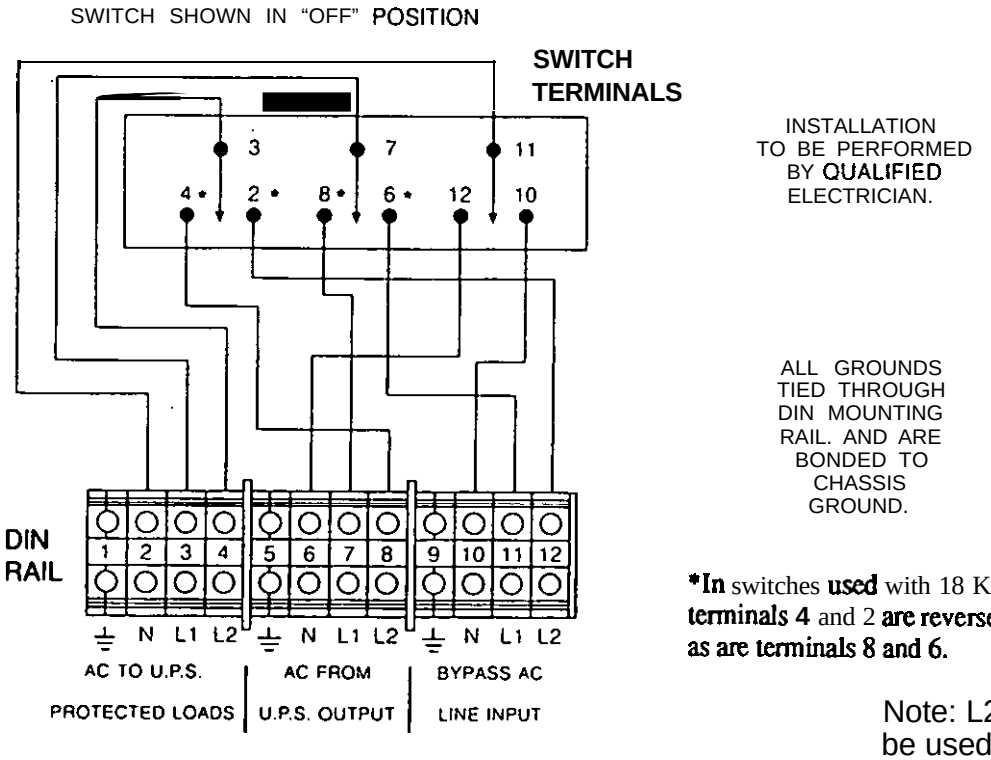

Figure 4

*In switches used with 18 KVA models, terminals 4 and 2 are reversed in position as are terminals 8 and 6.

Note: L2 may not be used in some applications.

Section 2 Make-Before-Break UPS Bypass Switch Installation

Refer to the wiring diagram that corresponds to your voltage and bypass configuration in the Installation Manual.

Best sells five sizes of **Make-Before-Break** bypass switches. These bypass switches are:

Model #	Amperes	Wire Size
SWE42-MBB -	42 ampere	up to 8GA (1-12) 4CA (13-20)
SWE80-MBB -	80 ampere	up to 4GA (1-12) 1/O (13-20)
SWE125-MBB -	125 ampere	up to 1/O all
SWE150-MBB -	150 ampere	up to 1/O all
SWE200-MBB -	200 ampere	up to l/O all

Table 2

There is a "UPS BYPASS SWITCH" on the left side of the enclosure. (It is in the center of the enclosure if there is no optional AC disconnect).

The addition of the optional "UPS AC LINE DISCONNECT SWITCH" on the right side of the enclosure permits AC input line to the UPS to be shut off during maintenance and service.

UPS BYPASS SWITCH POSITION

1 (LINE) connects AC line to the load.

2 (UPS) connects UPS output to the load.

3 (OFF) disconnects UPS output and AC line from the load.

Important: Note that regardless of switch position, AC line is present at the UPS input terminals inside the UPS, except as noted in the following paragraphs.

INSTALLATION

1. Install the enclosure.

Remove the screws in the lower part of the switch enclosure cover and lift it off. Then knockout or punch holes for input AC service, UPS output AC and load AC wiring.

****

WARNING: To prevent the danger of electrical shock or equipment damage, be sure AC line input is **off** and FERRUPS is **off** before attempting to connect any wires to the terminal strip already wired to the switch.

****

Begin the switch enclosure terminal strip wiring. Use THHN 90 degree Celsius copper wire to connect to the terminal strip. The terminal will accept the wire size shown in **Table 2** (in the first column on this page).

Terminals 1 through 12 are used for the "UPS BYPASS SWITCH" connections. Terminals 13 through 20 are used for the "UPS AC LINE DISCONNECT SWITCH" if one is provided.

2. Insert the wire and tighten all connections securely to the appropriate terminal on the DIN rail. There is a label on the back of the lower cover of the switch. The label is also shown in Figure 3 on page 5.

Terminal #	Function
1, 2, 3, & 4	Load to Bypass
5, 6, 7 & 8	UPS output to Bypass
9, 10, 11, & 12	AC Line input to Bypass
13, 14, 15 & 16	Disconnect AC Line Input (optional)
17, 18, 19 & 20	Disconnect to UPS AC Input (optional)

IMPORTANT: Good ground connections are necessary to prevent noise and insure safe operation of UPS and loads.

3. Be sure to complete the following phase check before using the UPS Bypass Switch.

****

Caution: Before using the UPS Bypass Switch to switch from UPS to AC line it is necessary to check for the proper phase relationship between AC LINE input and UPS output.

****

Complete the following phase. check.

STEP 1: Place the bypass switch in the "OFF" position and then perform steps A through 0 in the START-UP Section of the User's Manual. (In FC models follow Section 4, Operation).

STEP 2: Turn on the power that supplies the bypass AC line input.

STEP 3: To assure the voltages feeding the bypass switch are compatible, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal block. Record voltages in the space shown below.

AC From UPS Output	Bypass AC Line Input
A. 7 to 8_____VAC	11 to 12_____VAC
B. 6 to 7_____VAC	10 to 11_____VAC
C. 6 to 8_____VAC	10 to 12_____VAC

Compare the readings taken in lines A, B, and C. The values recorded for "AC From UPS Output" should match the values recorded on the same line for "Bypass AC Line Input".

STEP 4: To assure that the AC from UPS output and the bypass AC line input are in phase, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal strip. Voltage measurements exceeding 100 VAC are unacceptable.

7 to 11 _____VAC

8 to 12_____VAC

STEP 5: Using an AC voltmeter, measure the AC voltage between the following points on the bypass switch terminal strip. This reading should not exceed 1 VAC.

6 to 10_____VAC

If any of the AC voltage measurements taken in Steps 3, 4, or 5 are unacceptable, contact Best Power Technology Sales Corp., Service Department at 800-356-5737 or (608) 565-7200.

STEP 6: Install the bypass switch cover and tighten screws securely.

STEP 7: Refer to the FERRUPS User's Manual, START-UP Section, and continue with Step P (in FC models see Section 4, Operation).

TIP604
23
November 15, 1990

MICRO-FERRUPS® and FERRUPS®
Written Scheduled Maintenance Procedure
for ME and FD Models

Best Power Technology, Inc.

Use TIP 605 to record the responses to the steps in this procedure.

1. Who authorized you to perform maintenance on the UPS? Does the customer understand that during this procedure there is a chance of a power outage?

2. Record any comments ***or*** problems the UPS has had since the last scheduled maintenance was done.

3. The LED status indicators are located on the front panel. What should be noticed are any LEDs not working when they should be. You may want to press [CONTROL] [4] [ENTER], [ENTER] to force the inverter to 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 Technical support. (The CHARGING LED may or may not be lit.)

4. Press [CONTROL] [8] [ENTER], [ENTER] to determine if the alarm works. 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 Technical support. If the alarm did work, continue.

5. Make sure the surroundings are safe for the UPS and in a clean, dry area. If not, stop and call BEST Technical support. If it is, continue.

6. Remove all power and remove the covers by loosening the screw on the front and on the top at the back for ME models, and loosening the screws on the top and sides for FD models. Withcthe covers off, look for any damage on the boards or any marks on the inside. Check each terminal to make sure that the terminals are in good working order and free of corrosion. Check each battery connection to ensure that they are tight. We recommend that each connection is torqued to 55 inch/lbs. If you find damage, stop and call BEST Technical support. If there is no damage, continue.

7. On FD models only, check the 587 spike suppression board for any damage. This board is located in the back of unit by the DIN rail. If any damage is evident or fuses arc open, stop and call BEST Technical support. If there is no damage, continue. Close the unit up by replacing the sides.

8. To find the most recent inverter and alarm log activity, display parameters 24 and 25. Step through each entry by pressing the [ENTER] key. The first one listed is always the most recent.

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. (608) 565-7200 Toll-Free 800-356-5794 Service Toll-Free 800-338-1610 (U.S.A. & Canada) Telex No. 701934 (Best Power UD)
Fax (608) 565-2221 Service Fax (608) 565-2509
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9. Look at step 8 and determine if any battery alarms have occurred since the last scheduled maintenance was done, such as alarm A, (LOW BATTERY) B, (NEAR LOW BATTERY) or C (HIGH BATTERY). If so, stop and call BEST Technical support. If not, continue.

10. If the customer is using a communications link such as an AS/400 (for example), you must make sure of the default setting of the QUPSDLY prior to doing a battery test. Perform a battery test. Press [CONTROL] [7][7][ENTER] [ENTER]. NOTE: This test could take up to 30 minutes to perform.

11. Disable the charger by entering the service password. Next, display parameter 7 (VBATT) Note the value shown. Then display parameter 31 (HI BATT). This value must be programmed to a lower value then what was displayed in parameter 7. Press the [PROGRAM] key and program parameter 31 to a value lower then parameter 7 and then push the [ENTER] key. The UPS should sound an alarm at this point. To disable the alarm, push the [CONTROL] [5][5] [ENTER] [ENTER].

12a. While the UPS is in this mode, read each individal battery voltage from positive to negative and record each in the "INV.OFF CHG.OFF" column on page 2. The most positive battery will always be "BATT. #1"

12b. Remove AC from the UPS and let the inverter run for at least 10 minutes per battery string or until each battery is 11.5 volts DC. Record these figures in the "INV. ON WITH LOAD" column on page 2. While the UPS is running on inverter, display parameters 0 - 23 and record these values in the "ON INVENTER" column in step 13. After the test has been completed, answer the following questions and record them in step 13 on page 2. Length of load test ? Record how many minutes the test ran. Battery type? This is located on the top of each battery and should be a BATA number. If everything is good, continue. If not, stop and call BEST Technical support.

13. Reapply AC line to the UPS. After the UPS has transferred back to AC line, display parameters 0 - 23 and record the values in the "ON LINE" column in step 13.

14. If you have the original retest sheet that was shipped with the unit, compare the values that you have recorded with the values on the retest sheet to determine if anything has changed. If anything has changed, record these under step 15 and continue. If you do not have access to the retest sheet or a current list of parameters, stop and call BEST Technical support.

15. Did you change anything? Record your answer in step 15 and continue. If yes, you must completely describe what you found and what you did to correct the problem in detail.

16. List all replacement parts that were placed in the UPS to repair the system.

17. Reprogram parameter 31 back to the default setting you recorded in step 12.

18. At the bottom of page two answer the following questions: Travel Time? Time on the Site? BEST must call customer in reference to today's service? Answer yes or no and return this to BEST POWER TECHNOLOGY.

TIP605
2
Dec. 20, 1990

MICRO-FERRUPS® and FERRUPS® Scheduled Maintenance and Service Call Report Form for ME and FD Models

Best Power Technology, Inc.

Please check one: Maintenance __ Service ____ If service, RT/RMA #_____

_____/_____/_____Date T :i m e Company_____

Technician _____ Contact_____ Phone_____

FERRUPS Model #_____ Address_____

Serial #_____

1. Authorization to perform maintenance and test UPS (Contact Signature)_____

2. Comments or any problems regarding UPS_____

_____

3. Are all the LED status indicators normal? ____Yes ____No*

4. Is alarm operation normal when alarm test is performed? ____Yes ____No*

5. Is the UPS environment clean and free from dust and dirt? ____Yes ____No*

6. Perform a visual inspection of the UPS. Check battery terminal connections; are the connections tight, free of corrosion and in good condition? ____Yes ____No*

7. FD models only - check the Spike Suppression Board. Is there physical damage or open fuses? ____Yes* ____No

* Indicates that BEST's Service Department must be called immediately.

8. List the five (5) most recent inverter and alarm log events below:

Inverter Log	Alarm Log
1_____	1_____
2_____	2_____
3_____	3_____
4_____	4_____
5_____	5_____

9. 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 unhkely event of a problem, all equipment should be prepared for a power outage.

10. If customer is using UPS contacts for a communications link, take necessary precautions so that this contact closure will not cause a premature shutdown. Perform a battery test at this time. Press [CONTROL] [7] [7] [ENTER] [ENTER].

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. (608) 565-7200 Toll-Free 800-356-5794 Service Toll-Free 800-338-1610 (U.S.A. & Canada) Telex No. 701934 (Best Power UD)
Fax (608) 565-2221 Service Fax (608) 565-2509

11. Disable the Charger (on FD and ME models) - Program High Batt setpoint (par. # 3 1 FD and ME) below present V Batt. Alarm will sound; silence the alarm.

12. (A) Record voltage readings under "Inv.off/Chg.off" below.

B) Run inverter for 10 minutes per battery string or until each battery is 11.5 volts with load on. a ecord voltages below in the "Inv. on with load" column.

Batt. #	*Inv. off Chg. off*	*Inv. on with load*	*Batt. #*	*Inv. off Chg. off*	*Inv.OR with load*
1			6		
2			*7*		
3			*8*		
4			*9*		
5			*10*		

Length of load test- minutes. Battery Type_____

If battery bad, record battery date code _____

13. Fill in parameter list that applies to the model being tested.

FD and ME Models

Par. #	**On Line**	**On Inverter**	**Par. #**	**On Line**	**On Inverter**
0 Time			12 HS Temp		
1 Volts In			13 % Humid*		
2 Volts out			14 ID:		
3 I In (FD only)			15 Model		
4 1 0 u t			16 Full Ld%		
5 VA Out			17 Watts		
6 1 Batt			18 PF		
7 V Ban			19 VALimit		
8 Freq			20 #Pwr out		
9 Rn Tm			21 #OvrLds		
10 Date			22 sys Hrs		
11 Amb Temp			23 InvMin		

* Optional-FD only

14. List any parameters that have been changed to any value other than the default values:_____

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

16. List all parts used to repair the system: _____

17. *On* FD and ME models, program High Baa. back to its normal setting. Re-enable the alarm.

Site Representative Signature

Service Representative Signature

Travel Tie_____ Time on Site_____

BEST must contact customer in reference to today's service: _ Yes _No Phone800-356-5737.

MICRO-FERRUPS® 50 Hz AC Installation with Line Cord

(Q)TIP302
5
January 2, 1991

Best Power Technology, Inc.

This Technical Information Publication for QME units includes AC input service requirements, output receptacles and installation instructions for units with a line cord (softwired).

Contents Index

WARNING:

Input and output AC voltages used in this unit are hazardous. Do not use uninsulated tools or touch wires or terminals. AC may be present at the output with no AC line input.

DC batteries are high-current sources; accidental short circuits can cause severe arcing, equipment damage, battery explosion and personal injury. Do not turn the UPS on at this time.

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. Telephone (608) 565-7200 Fax (608) 565-2221 Telex No. 701934 (Best Power UD)

100: AC Input Service and Receptacle Requirements

101: Standard Charger Units: Input Service Specifications

101-L AC Input Service

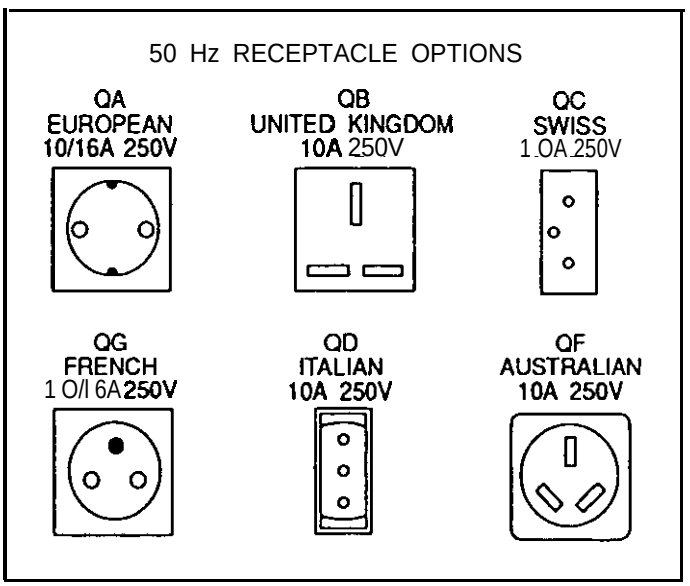
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker a fuse rating if exact match cannot be found.

Input Voltage	Model: 500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp	30 amp	35 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	25 amp	30 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
120 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
200 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp,
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
220 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp'
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp

101-2. Receptacles Required to fit Plug Configurations (for units with line cord)

The input plugs (which fit the receptacles shown) are readily available; the plug should be specified when ordering.

A variety of additional plugs may be ordered when required **for** particular applications.



102: 10 Amp Charger Units: Input Service Specifications

102-l. AC Input Service

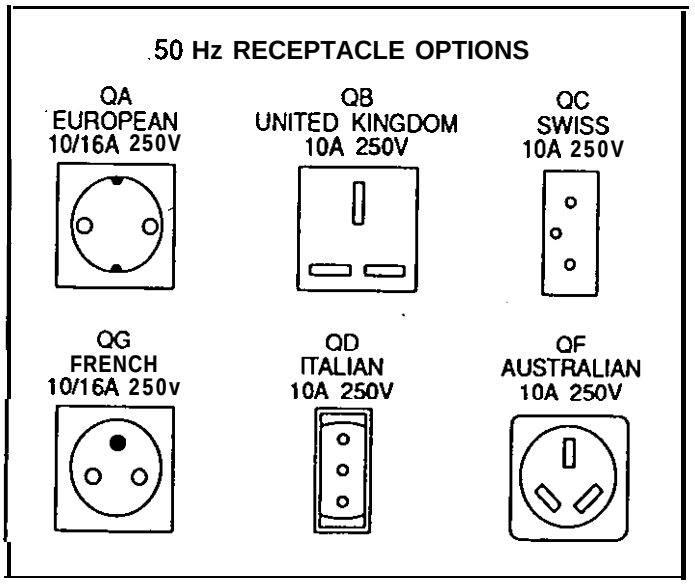
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Input Voltage	Model: 500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	15 amp	15 amp	20 amp	30 amp	35 amp	40 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
120 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	30 amp
200 VAC	5 amp	5 imp	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
220 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
230 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
240 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	15amp

102-2. Receptacles Required to tit Plug Configurations, (for units with line cord)

The input plugs (which fit the receptacles shown) are readily available; the plug should be specified when ordering.

A variety of additional plugs may be ordered when required for particular applications.



103: 20 Amp Charger Units: Input Service Specifications

103-l. AC Input Service

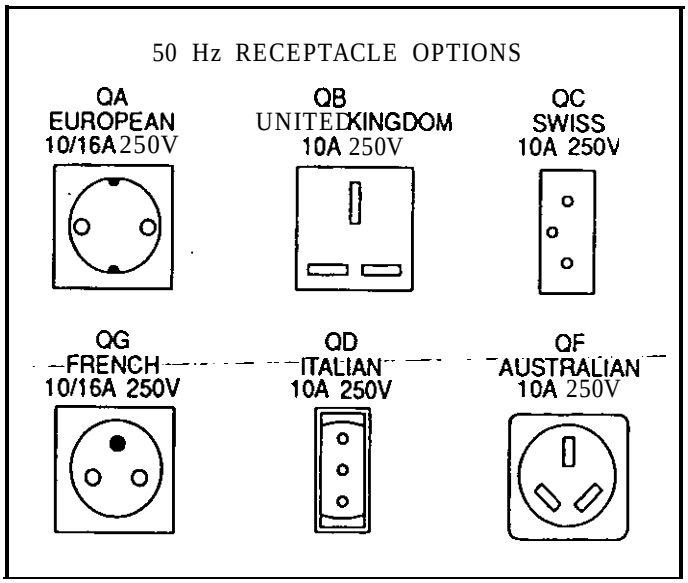
NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Input Voltage	Model: 5OOVA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	15 amp	15 amp	20 amp	20 amp	40 amp	45 amp	50 amp
110 VAC	10 amp	15 amp	15 amp	15 amp	15 amp	35 amp	40 amp	45 amp
115 VAC	10 amp	10 amp	15amp	15 amp	15 amp	30 amp	35 amp	40 amp
120 VAC	10 amp	10 amp	15 amp	15 amp	15 amp	30 amp	30 amp	40 amp
200 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
208 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
210 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
220 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
230 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
240 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp

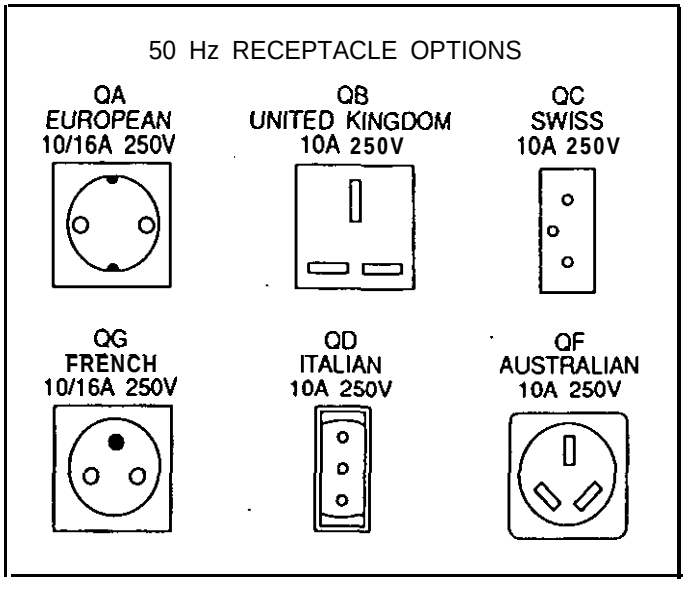
103-2. Receptacles required to fit Plug Configurations (for units with line cord)

The input plugs (which fit the receptacles shown) are readily available; the plug should be specified when ordering.

A variety of additional plugs may be ordered when required for particular applications.



200: Output Receptacles Available (Receptacle Panels).



(Q)TIP303
5
January 2, 1991

MICRO-FERRUPS® 50 Hz Hardwire AC Installation

Best Power Technology, Inc.

This Technical Information Publication for QME units includes AC input service requirements, output receptacles, wiring diagrams and installation instructions for units without a line cord (hardwired).

Contents Index

WARNING:

Installation of this UPS should be completed by a qualified electrician.

Input and output AC voltages used in this unit are hazardous. Do not use uninsulated tools or touch wires or terminals. AC may be present at the output with no AC line input.

DC batteries are high-current sources; accidental short circuits can cause severe arcing, equipment damage, battery explosion and personal injury. Do not turn the UPS on at this time.

Best Power Technology, Inc.
P.O. Box 280 Necedah, Wisconsin 54646 U.S.A. Telephone (608) 565-7200 Fax (608) 565-2221 Telex No. 701934 (Best Power UD)

100: AC Input Service

101: Standard Charger Units: Input Service Specifications

NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Model: 500VA Input Voltage	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp	30 amp	35 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	25 amp	30 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp	20 amp	30 amp
120 VAC	10 amp	10 amp	10 amp	15amp	15 amp	20 amp	20 amp	30 amp
200 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp
220 VAC	5 amp	5 amp	Samp	10 amp	10 amp	10 amp	1s amp	1s amp
230 VAC	5 amp	5 amp	s amp	10 amp	10 amp	10 amp	1s amp	1s amp
240 VAC	5 amp	5 amp	s amp	10 amp	10 amp	10 amp	1s amp	1s amp

102: 10 Amp Charger Units: Input Service Specifications

NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Model: 500VA Input Voltage	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	10 amp	15 amp	15 amp	20 amp	30 amp	35amp	40 amp
110 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
115 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	35 amp
120 VAC	10 amp	10 amp	10 amp	15 amp	15 amp	25 amp	25 amp	30 amp
200 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	15 amp	20 amp
208 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
210 VAC	5 amp	5 amp	5 amp	10 amp	10 amp	15 amp	15 amp	20 amp
220 VAC	s amp	5 amp	5 amp	10 amp	10 amp	1s amp	15 amp	20 amp
230 VAC	5 amp	Samp	5 amp	10 amp	10 amp	1s amp	1s amp	20 amp
240 VAC	5 amp	5 amp	s amp	10 amp	10 amp	1s amp	1s amp	1s amp

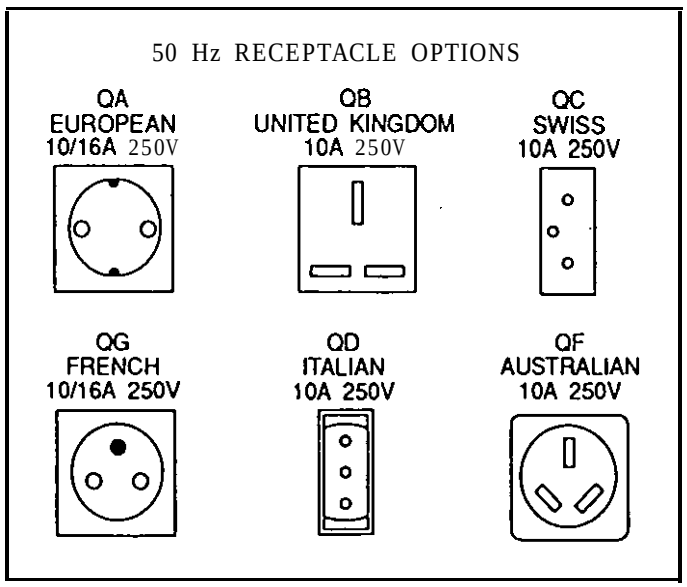
103: 20 Amp Charger Units: Input Service Specifications

NOTE: Circuit breaker or fuse size should correspond to service requirement. Use next largest available circuit breaker or fuse rating if exact match cannot be found.

Model: Input Voltage	500VA	700VA	850VA	1.15KVA	1.4KVA	1.8KVA	2.1KVA	3.1KVA
100 VAC	10 amp	15 amp	15 amp	20 amp	20 amp	40 amp	45 amp	50 amp
110 VAC	10 amp	15 amp	15amp	15amp	15 amp	35 amp	40 amp	45 amp
115 VAC	10 amp	10 amp	15 amp	15amp	15amp	30 amp	35 amp	40 amp
120 VAC	10 amp	10 amp	15 amp	15amp	15 amp	30 amp	30 amp	40 amp
200 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
208 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
210 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	20 amp	20 amp	25 amp
220 VAC	5 amp	10 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
230 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp
240 VAC	5 amp	5 amp	10 amp	10 amp	10 amp	15 amp	20 amp	25 amp

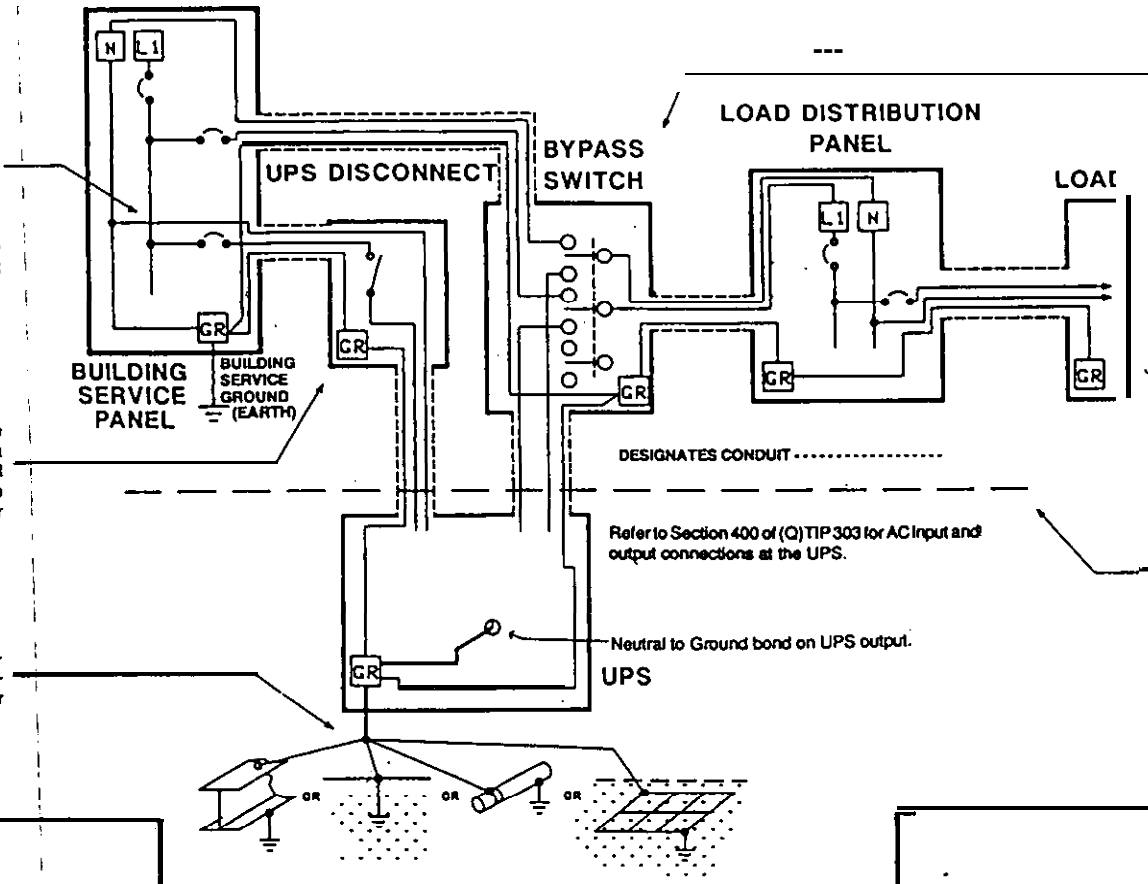
200: Output Receptacles Available (Receptacle Panels)

The following receptacles are available; choose the appropriate receptacle when ordering unit.



QME500VA - QME3.1 KVA INSTALLATION WIRING DIAGRAM

FIGURE 301.



NOTE #1

FERRUPS and the External Service Bypass Switch must be assigned separate circuit breakers (or fuses) at the Building Service Panel. The UPS service specifications are in Section 100 of (Q)TIP 303.

If the appropriate circuit breaker cannot be found, contact BEST's Service Department at 800-356-5737 [or (608) 565-7200].

NOTE #3

If the Building Service Panel or UPS Fuse Disconnect is some distance from the UPS, a disconnect will have to be installed within sight of the UPS. BEST Service Bypass Switches are available with an optional disconnect switch or circuit breaker for the UPS AC input.

NOTE #5

The customer must provide local earth according to national and local regulations. For maximum protection use all of the methods shown for the local earth on the UPS.

NOTE #2

The bypass switch must be within sight of the UPS.

NOTE #4

For maximum protection against ground noise, use isolated ground receptacles.

NOTE #6

FACILITIES AND WIRING SHOWN ABOVE THIS LINE ARE PROVIDED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL BUILDING/ELECTRICAL CODES. SEE NOTE 5 ALSO.

400: AC Input/Output Unit Connections

1. Make certain the ON-OFF (1-O) switch on the back of the UPS is turned to OFF (0). Turn off the circuit breaker or disconnect switch at the AC input service panel.

2. Find the screw access hole in the lower right comer of the black plastic front panel. The screw access hole may be covered by a round piece of black tape. Save the piece of tape so it can be replaced when the UPS is reassembled. Use a #2 Phillips screwdriver to loosen (but not remove) the screw on the front panel. Loosen and remove the screw on the top at the back of the UPS. Slide the cover forward.

3. Place the UPS in position in the location where it will be operating. Make certain the cover can be removed and reinstalled when the UPS is in position.

4. Refer to Figure 400-l (below) for the location of the. terminal block in the UPS where AC line input and UPS output+ AC connections will be made. Local or national regulations may require using conduit which may limit the movement of the UPS once the AC input service and output wiring to the loads are connected. If you are using optional external batteries with your UPS, you must allow about six inches of clearance behind the UPS (minimum), to plug the battery connector into the UPS.

♣ If the UPS has AC receptacles on the back panel, there will not be any AC *output* wiring connections made at the terminal block. The loads will be plugged into the receptacles.

5. Remove the knockouts in the panel on the back of the UPS. Install the conduit adaptor, and run the AC input service cable through the input conduit/adaptor.

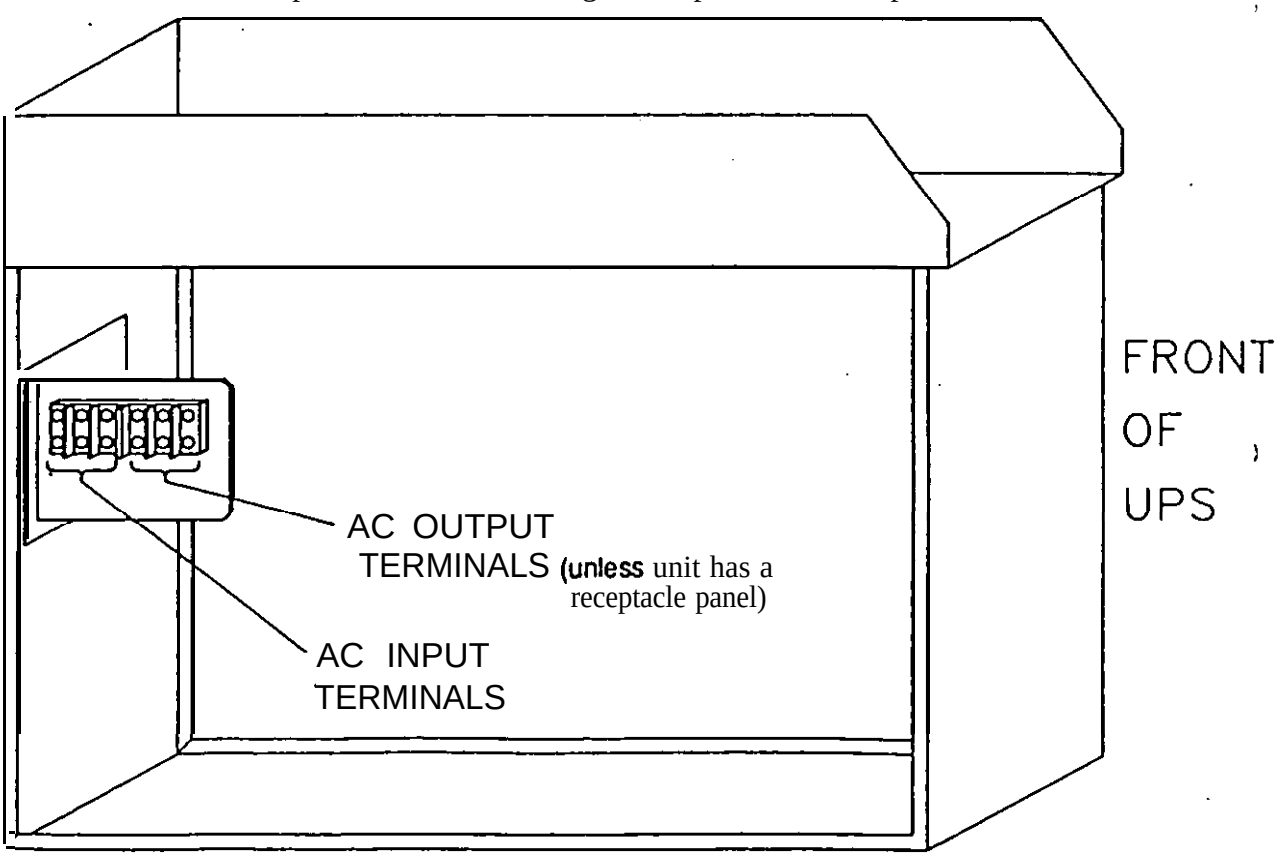
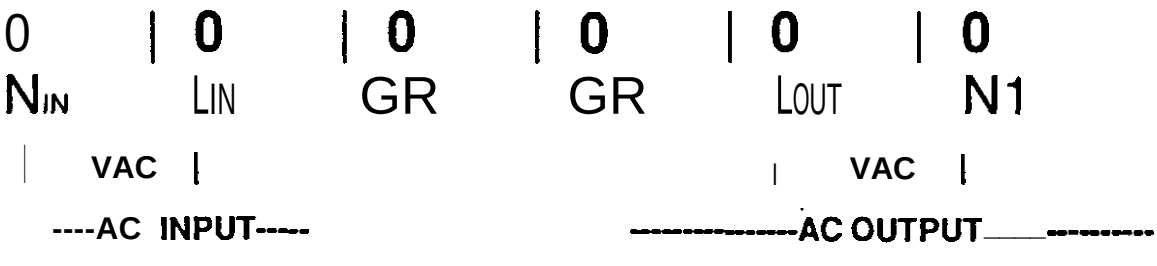


Figure 400-l

6. Connect "NIN", "LIN" and "GR" to the "AC INPUT" terminals on the left side of the terminal block.

   Refer to Figure 401 below.

Figure 401



[Disregard the following step if your UPS has receptacles on the back panel for connecting the load.]

7. Run the AC output wiring to the loads through the conduit/adaptor and connect "N1", "LOUT" and "GR" to the "AC OUTPUT" terminals on the right side of the terminal block. Refer to Figure 400-1, for information.

8. If your UPS was ordered with its batteries removed, or with optional external batteries, refer to the "Installation Manual" information that came with the UPS.

9. Once you have completed any optional battery wiring, replace the cover on the UPS. Replace the screw in the top at the back of the UPS. Tighten the Phillips head screw on the front panel that holds the cover in place. Place the round piece of tape over the screw access hole on the front of the UPS.

Bypass Switch Installation

(Q)TIP365
45
Aug. 15, 1990

Best Power Technology, Inc.

This installation procedure describes how to install the bypass switch that you have received.

The bypass switch should be installed on all UPS systems which **do not** have an AC input line cord and output receptacles. The purpose of the bypass switch **is** to provide a way of routing utility power to the protected loads if the UPS has to be shut down for scheduled maintenance or service. It can also be used simultaneously to provide isolation with an optional UPS AC Line Disconnect switch or circuit breaker.

This installation procedure must be completed by a qualified electrician familiar with applicable building and electrical codes.

****

DANGER: This UPS uses and produces dangerously high AC and DC voltages. Use extreme caution to prevent electrical shock by checking wires and connections with a meter before handling. Being a UPS system, disconnecting input AC alone does not eliminate output AC. This is a highly automatic uninterruptible power supply designed to provide power under a variety of conditions. To ensure the unit is off and will not come on unexpectedly, input AC and DC must be off or disconnected.

****

Determine which type of bypass switch you have received by looking at the two figures on the following page. Figure 1 shows the front panel of the Break-Before Make bypass switch. Figure 2 shows the front panel for the Make-Before-Break bypass switch. Determine which switch you have received and then refer to Section 1 or Section 2. Note that the UPS AC disconnect switch is optional.

Section 1 is for Break-Before-Make Bypass Switch Installation Instructions.

Section 2 is for Make-Before-Break Bypass Switch Installation Instructions.

Remember that if the UPS is out of sight or some distance from the UPS AC input service panel, the UPS must have an input service disconnect installed near (within sight of) the UPS. The BEST bypass can be provided with an input service disconnect switch or circuit breaker installed in the bypass switch enclosure.

Best Power Technology, Inc.
PO. Box 280 - Necedah, Wisconsin 54646 U.S.A. Telephone (608) 565-7200 Fax (608) 565-2221 Telex No. 701934 (Best Power UD)

Break-Before-Make UPS Bypass Front Panel

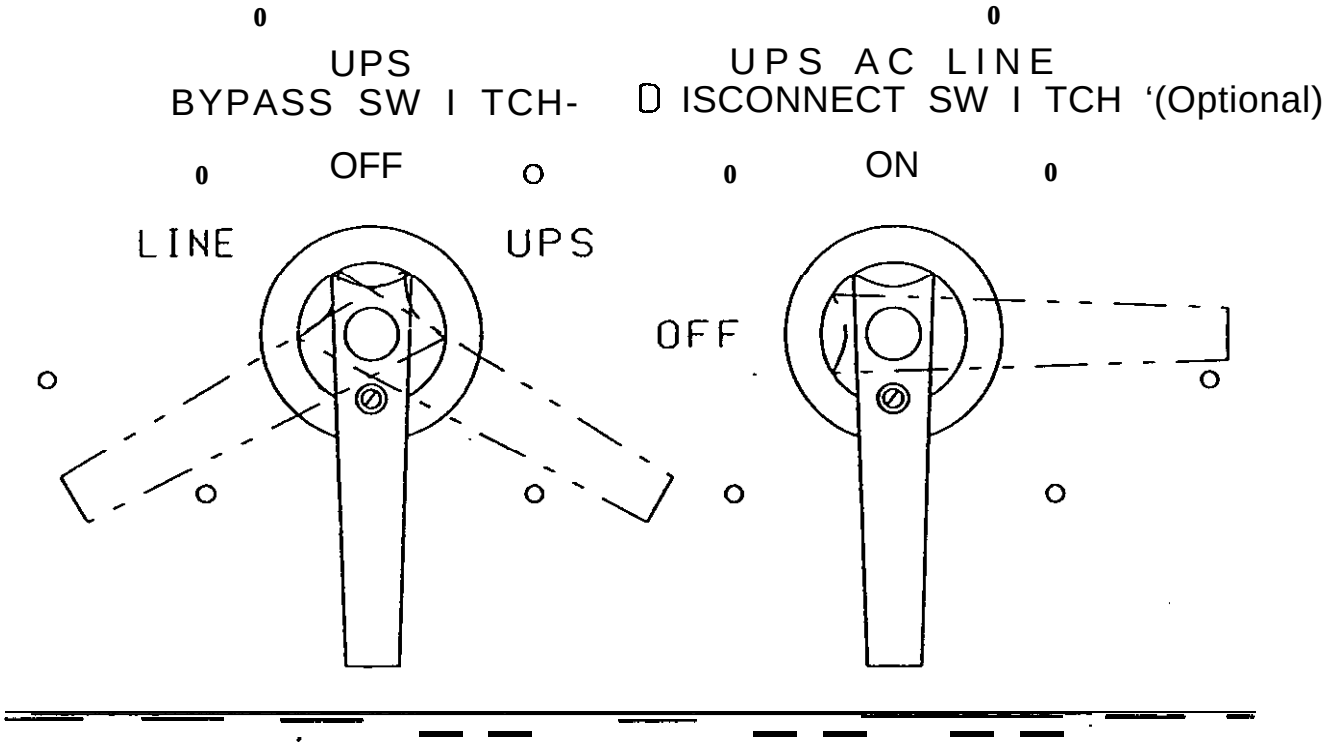


Figure 1

Make-Before-Break UPS Bypass Switdh Front Panel

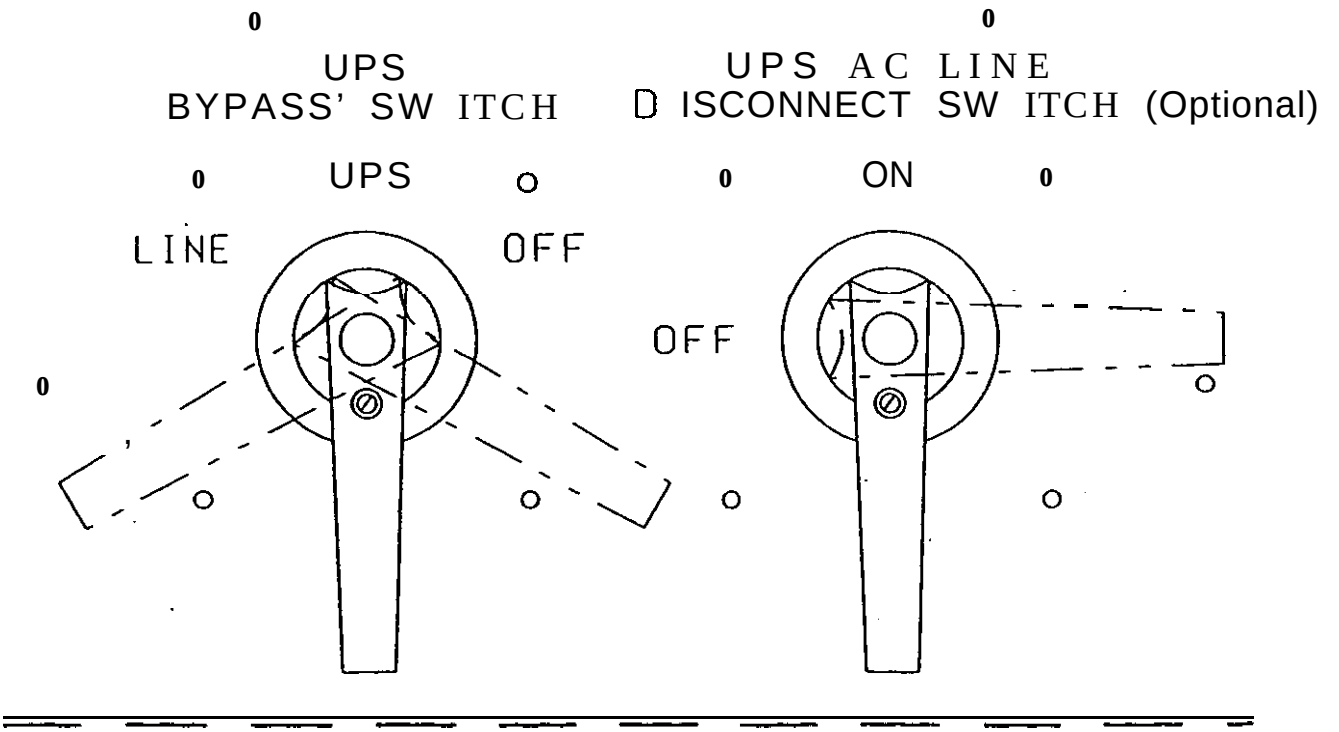


Figure 2

Section 1 Break-Before-Make Bypass Switch Installation

Refer to the wiring diagram that corresponds to your voltage and bypass configuration in the Installation Manual.

There is a "UPS BYPASS SWITCH" on the left side of the enclosure. (It is in the center of the enclosure if there is no optional AC disconnect).

The addition of the optional "UPS AC LINE DISCONNECT SWITCH" on the right side of the enclosure permits AC input line to the UPS to be shut off during maintenance and service.

UPS BYPASS SWITCH POSITION

1 (LINE) connects AC line to the load.

2 (OFF) disconnects UPS output and AC line from the load.

3 (UPS) connects UPS output to the load.

Important: Note that regardless of switch position, AC line is present at the UPS input terminals inside the UPS, except as noted in the following paragraph6

INSTALLATION

1. Install the enclosure.

Remove the screws in the lower part of the switch enclosure cover and lift it off. Then knockout or punch holes for input AC service, UPS output AC and load AC wiring.

****

WARNING: To prevent the danger of electrical shock or equipment damage, be sure AC line input is off and FERRUPS is off before attempting to connect any wires to the terminal strip already wired to the switch.

****

Begin the switch enclosure terminal strip wiring. Use THHN 90 degree Celsius copper wire to connect to the terminal strip.

Terminals 1 through 12 are used for the "UPS BYPASS SWITCH" connections. Terminals 13 through 20 are used for the "UPS AC LINE DISCONNECT SWITCH" if one is provided.

2. Insert the wire and tighten all connections securely to the appropriate terminal on the DIN rail. There is a label on the back of the lower cover of the switch. The label is also shown in Figure 3 on page 5.

Terminal #	Function
1, 2.3, & 4	Load to Bypass
5, 6, 7 & 8	UPS output to Bypass
9, 10, 11, & 12	AC Line input to Bypass
13, 14, 15 & 16	Disconnect AC Line Input (optional)
17, 18, 19 & 20	Disconnect to UPS AC Input (optional)

IMPORTANT: Good ground connections are necessary to prevent noise and insure safe operation of UPS and loads.

3. Be sure to complete the following phase check before using the UPS Bypass Switch.

****

Caution: Before using the UPS Bypass Switch to switch from UPS to AC line it is necessary to check for the proper phase relationship between AC LINE input and UPS output.

****

Complete the following phase check.

STEP 1: Place the bypass switch in the "OFF" position and then perform steps A through 0 in the START-UP Section of the User's Manual. (In QFC models follow Section 4, Operation).

STEP 2: Turn on the power that supplies the bypass AC line input.

Switch Terminal Strip with AC Disconnect Switch

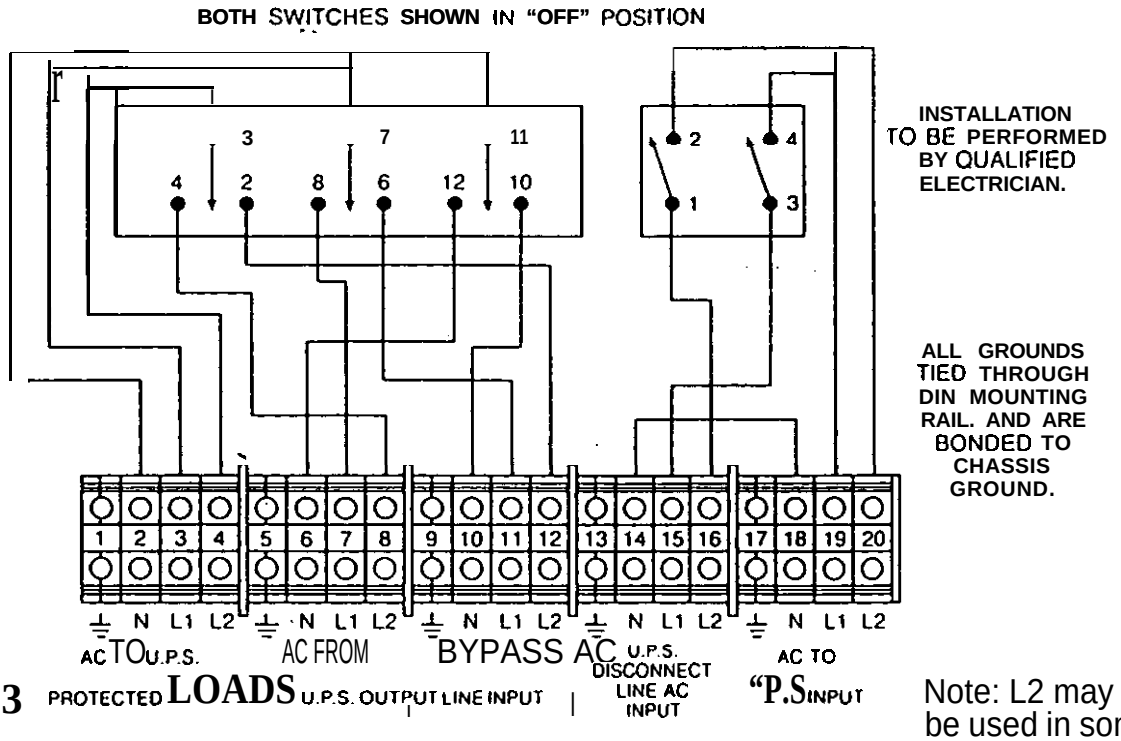


Figure 3

Note: L2 may not be used in some applications.

Switch Terminal Strip without AC Disconnect Switch

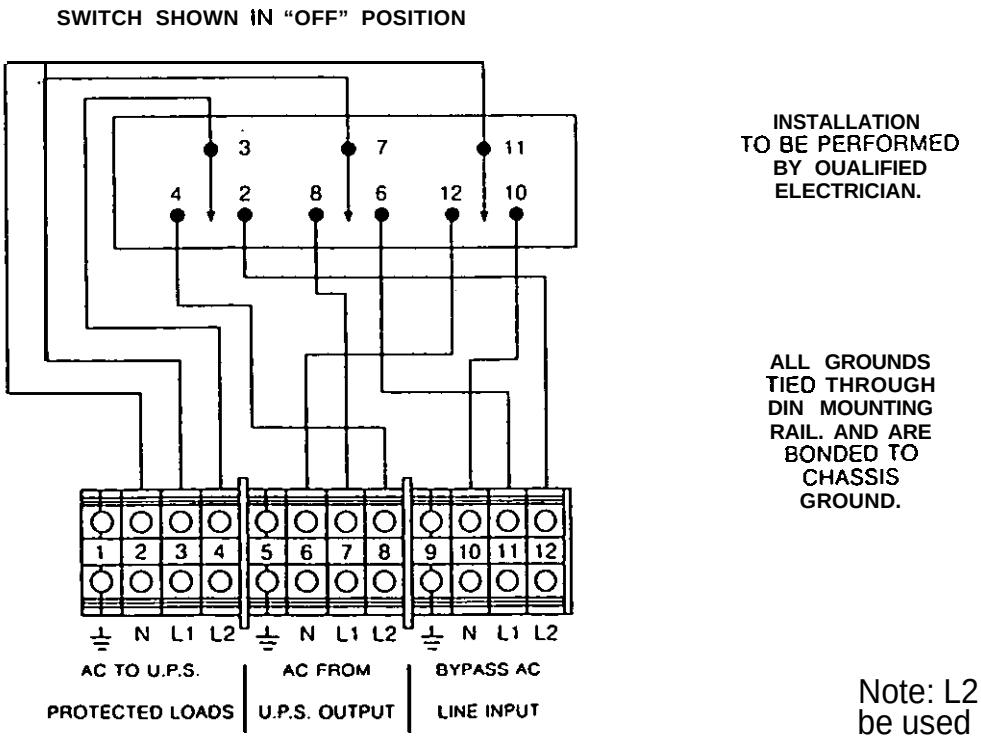


Figure 4

Note: L2 may not be used in some applications.

Section 2 Make-Before-Break UPS Bypass Switch Installation

Refer to the wiring diagram that corresponds to your voltage and bypass configuration in the Installation Manual.

There is a "UPS BYPASS SWITCH" on the left side of the enclosure. (It is in the center of the enclosure if there is no optional AC disconnect).

The addition of the optional "UPS AC LINE DISCONNECT SWITCH" on the right side of the enclosure permits AC input line to the UPS to be shut off during maintenance and service.

UPS BYPASS SWITCH POSITION

1 (LINE) connects AC line to the load.

2 (UPS) connects UPS output to the load.

3 (OFF) disconnects UPS output and AC line from the load.

Important: Note that regardless of switch position, AC line is present at the UPS input terminals inside the UPS, except as noted in the following paragraphs.

INSTALLATION

1. Install the enclosure

Remove the screws in the lower part of the switch enclosure cover and lift it off. Then knockout or punch holes for input AC service, UPS output AC and load AC wiring.

****

WARNING: To prevent the danger of electrical shock or equipment damage, be sure AC line input is **off** and FERRUPS is off before attempting to connect any wires to the terminal strip already wired to the switch.

****

Begin the switch enclosure terminal strip wiring. Use THHN 90 degree Celsius copper wire to connect to the terminal strip.

Terminals 1 through 12 are used for the "UPS BYPASS SWITCH" connections. Terminals 13 through 20 are used for the "UPS AC LINE DISCONNECT SWITCH" if one is provided.

2. Insert the wire and tighten all connections securely to the appropriate terminal on the DIN rail. There is a label on the back of the lower cover of the switch. The label is also shown in Figure 3 on page 5.

Terminal #	Function
1, 2, 3, & 4	Load to Bypass
5, 6, 7 & 8	UPS output to Bypass
9, 10, 11, & 12	AC Line input to Bypass
13, 14, 15 & 16	Disconnect AC Line Input (optional)
17, 18, 19 & 20	Disconnect to UPS AC Input (optional)

IMPORTANT: Good ground connections are necessary to prevent noise and insure safe operation of UPS and loads.

3. Be sure to complete the following phase check before using the UPS Bypass Switch.

****

Caution: Before using the UPS Bypass Switch to switch from UPS to AC line it is necessary to check for the proper phase relationship between AC LINE input and UPS output.

****

Complete the following phase check.

STEP 1: Place the bypass switch in the "OFF" position and then perform steps A through 0 in the START-UP Section of the User's Manual. (In QFC models follow Section 4, Operation).

STEP 2: Turn on the power that supplies the bypass AC line input.

STEP 3: To assure the voltages feeding the bypass switch are compatible, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal block. Record voltages in the space shown below.

	AC From UPS Output	Bypass AC Line Input
A.	7 to 8_____VAC	11 to 12_____VAC
B.	6 to 7_____VAC	10 to 11_____VAC
C.	6 to 8_____VAC	10 to 12_____VAC

Compare the readings taken in lines A, B, and C. The values recorded for "AC From UPS Output" should match the values recorded on the same line for "Bypass AC Line Input".

STEP 4: To assure that the AC from UPS output and the bypass AC line input are in phase, use an AC voltmeter to measure the AC voltage between the following points on the bypass switch terminal strip. Voltage measurements exceeding 100 VAC are unacceptable.

7 to 11_____VAC

8 to 12_____VAC

STEP 5: Using an AC voltmeter, measure the AC voltage between the following points on the bypass switch terminal strip. This reading should not exceed 1 VAC.

6 to 10_____VAC

If any of the AC voltage measurements taken in Steps 3, 4, or 5 are unacceptable, contact Best Power Technology Sales Corp., Service Department at 800-356-5737 or (608) 565-7200.

STEP 6: Install the bypass switch cover and tighten screws securely.

STEP 7: Refer to the FERRUPS User's Manual, START-UP Section, and continue with Step P (in QFC models see Section 4, Operation).

QME & QRE Operating Voltage Changes

January 10, 1991

Best Power Technology, Inc.

This Technical Information Publication describes the procedure to change the operating voltage in MICRO-FERRUPS QME and QRE models. **It is intended for use by a, qualified technician familiar with the MICRO-FERRUPS unit.** This procedure is intended to assist the BEST dealer or distributor in setting the operating voltage to the correct value before the UPS is placed in service.

The technician will need:

- Insulated tools
- Small diagonal wire cutter
- Needle-nose pliers
- True RMS reading digital voltmeter
- Factory Password information (Contact BEST'S Technical Support for Password at 800-356-5737.)
- Remote Control Panel or a terminal to communicate with the UPS
- Torque wrench calibrated to N/m or In/lb
- Black electrical tape
- Phillips head screwdriver
- Standard screwdriver
- True RMS reading AC and DC amp meter

!!! Warning !!!

UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line voltage is removed.

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.

Make certain that the UPS will comply with all applicable electric codes when the voltage change has been completed.

Contents

Best Power Technology, Inc.
P.O. Box 280 - Necedah, Wisconsin 54646 U.S.A. Telephone (608) 565-7200 Fax (608) 565-2221 Telex No. 701934 (Best Power UD)

QME500VA, QME700VA and QME850VA VOLTAGE CHANGES for 220V/230V/240V

1. Unpack the MICRO-FERRUPS unit and follow the Startup procedure in the user manual, Check the operating voltage and ensure the UPS is operating normally.

2. Turn off the MICRO-FERRUPS unit and remove the AC input plug from the receptacle, or turn off AC input to the UPS at the service panel or AC disconnect switch.

3. There is a round piece of tape covering the screw access hole in the black plastic panel (near its bottom edge) on the front of the MICRO-FERRUPS unit. Remove the tape to uncover the Phillips head screw. Save the tape so it can be used again.

3.A Loosen but do not remove the screw.

3.B Slide the cover forward to gain access to the MICRO-FBRRUPS unit.

4. Remember there are still hazardous voltages present in the UPS.

Changing the Input Voltage

5. Disconnect the + battery cable from the positive (+) battery terminal. Temporarily insulate the terminal with the black electrical tape and position the cable so it will not contact the terminal.

Refer to Figure l-1 below. Find the power board in the unit, and then refer to Table l-l on the next page.

Top View of a UPS

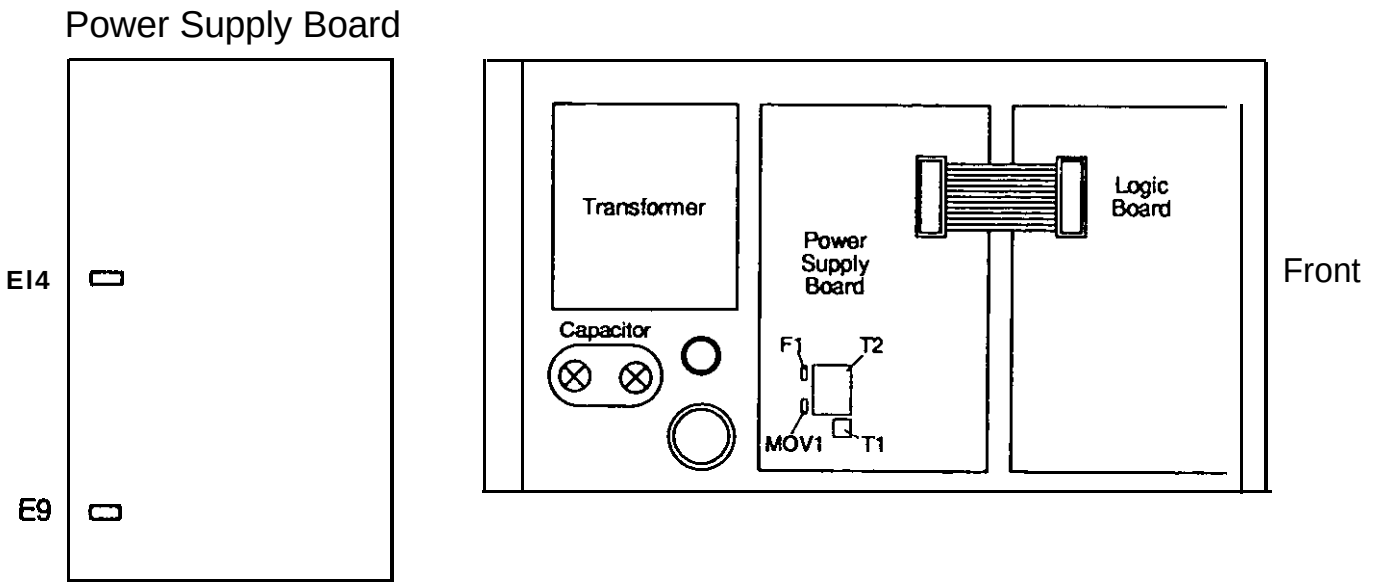


Figure l-l

6. Remove the transformer lead (attached to El4 on the power board). Find the new lead number from Table l-l and place this transformer lead on E14.

Table l-l

AC Input	Transformer Lead #	Power Board Connection
220 VAC	7	El4
230 VAC	6	El4
240 VAC	5	El4

For example, if the original input voltage was 220 VAC and the new voltage is 240 VAC, remove tramformer lead 7 *and put lead* 5 in *its place.*

7. Insulate the lead that was removed with shrink tubing and position it so that it cannot contact any live terminals or ground. Fasten it in place with a cable tie.

Next, change the output voltage.

Changing the Output Voltage

8. Refer to Table 1-2, below.

Table 1-2

AC Output	Transformer Lead #	Power Board Connection
220 VAC	11	E9
230 VAC	12	E9
240 VAC	13	E9

9. Remove the transformer lead from E9 on the power board. Refer to Table l-2 (above) and find the transformer lead for the new operating voltage. Place this lead on E9.

10. Insulate the lead that was removed and position it so that it cannot contact arty live terminals or ground.

11. Check that the input and output voltage terminal connections are correct. Good connections are essential. Tighten any connectors that are **loose** by **carefully pinching the connector tabs with the needle-nose pliers.**

Remove the black electrical tape from the positive (+) battery terminal. Reconnect the + battery cable in its original position to the positive (+) battery terminal. Retorque connection to 55 in/lb or 6.2 N/m.

Go to Appendix A for the Parameters and Calibrations part of this procedure.

QME1.15KVA AND QME1.4KVA VOLTAGE CHANGES for 220V/230V/240V

1. Unpack the MICRO-FERRUPS unit and follow the Startup procedure in the user manual. Check the operating voltage and ensure the UPS is operating normally.

2. Turn off the MICRO-FERRUPS unit and remove the AC input plug from the receptacle, or turn off AC input to the UPS at the service panel or AC disconnect switch.

3. There is a round piece of tape covering the screw access hole in the black plastic panel (in its lower right comer) on the front of the MICRO-FERRUPS unit. Remove the tape to uncover the Phillips head screw. Save the tape so it can be used again.

   3.A Loosen but do not remove the screw.

   3.B Slide the cover forward to gain access to the MICRO-FERRUPS unit

4. **Remember there are still hazardous voltages present in the UPS..**

Changing the Input Voltage

5. Refer to Figure 2-1 below. Disconnect the short cable from the positive (+) baitery terminal. Temporarily insulate the cable connector with black electrical tape and position it so it will not contact the battery terminal.

   Find the Auxiliary Power Board in the unit, and then refer to Table 2-1 on the next page.

QME 1.15KVA & QME1.4KVA Parts location

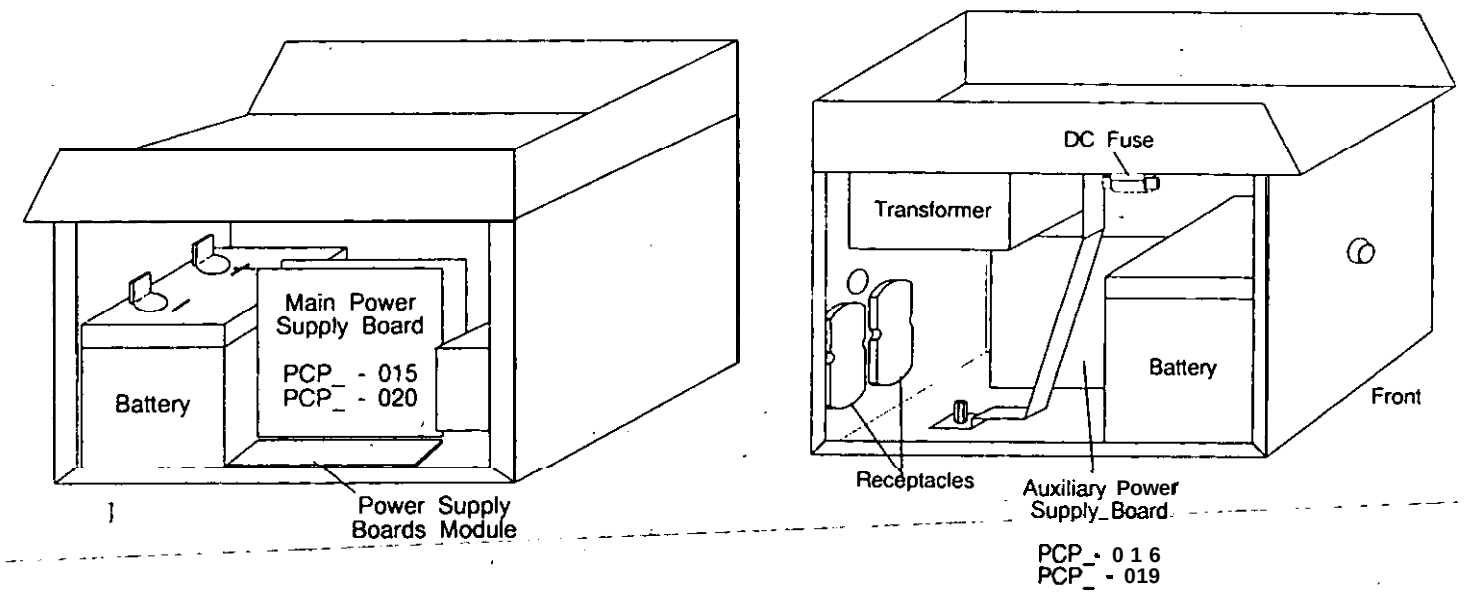


Figure 2-1

Table 2- 1

AC Input	*Transformer Lead #*		
220VAC	7	5	6
230VAC	6	5	7
240VAC	5	7	6
	E6	**E7**	**E8**
	Aux. Power Board Terminal		

6. **Remove transformer** leads 5, 6 **and 7 from terminals E6, E7, and E8 on the** Aux. Power Board. Refer to Table 2- 1, above, and install them on the terminals in the order corresponding to the new operating voltage.

For example, for 240 VAC input. lead # 5 goes to E6, lead # 7 goes to E7, and lead # 6 goes to E8.

Next, change the output voltage.

Changing the Output Voltage

7. Refer to Table 2-2, below.

Table 2-2

AC Output	*Transformer Lead #*		
220VAC	I2	***13***	***II***
230VAC	***11***	***13***	***12***
240 VAC	I2	***11***	13
	El 1	E l 2	**E9**
	Aux. Power Board Terminal		**Main Power Board Terminal**

8. Remove transformer leads from terminals El 1 and El2 on the Auxiliary Power Board and **E9 on the Main Power Board.** Refer to Table 2-2, above, and install them on the terminals in the order corresponding to the new operating voltage.

9. Check that the input and output voltage terminal connections are correct. Good connections are essential. Tighten any connectors that are loose by carefully pinching the connector tabs with the needle-nose pliers.

Remove the black electrical tape from the cable connector. Reconnect the short cable in its original position to the positive (+) battery terminal, and retorque the connection to 55 in/lb or 6.2 N/m.

Go to Appendix A for the Parameters and Calibrations part of this procedure.

QME1.8KVA, QME2.1KVA & QME3.1KVA VOLTAGE CHANGES for 220V/230V/240V

1. Unpack the MICRO-FERRUPS unit and follow the Startup procedure in the user manual. Check the operating voltage and ensure the UPS is operating normally.

2. Turn off the MICRO-FERRUPS unit and remove the AC input plug from the receptacle, or turn off AC input to the UPS at the service panel **or AC disconnect switch.**

3. There is a round piece of tape covering the screw access hole in the black plastic panel (in its lower right comer) **on** the front of the MICRO-FERRUPS unit. Remove the tape to uncover the Phillips head screw. Save the tape so it can be used again.

   3.A Loosen but do not remove the screw.

   3.B Slide the cover forward to gain access to the MICRO-FERRUPS unit.

4. **Remember there are still hazardous voltages present in-the UPS.**

Changing the Input Voltage

5. Note rhe position of the fuse on the battery terminal. Disconnect the + battery cable from the positive (+) battery terminal. Temporarily insulate the fuse and cable connectors, then position the cable so it will not contact a battery terminal.

   Refer to Figure 3-1 below. Find the power board in the unit, and rhen refer to Table 3-l on the next page.

Top View of UPS

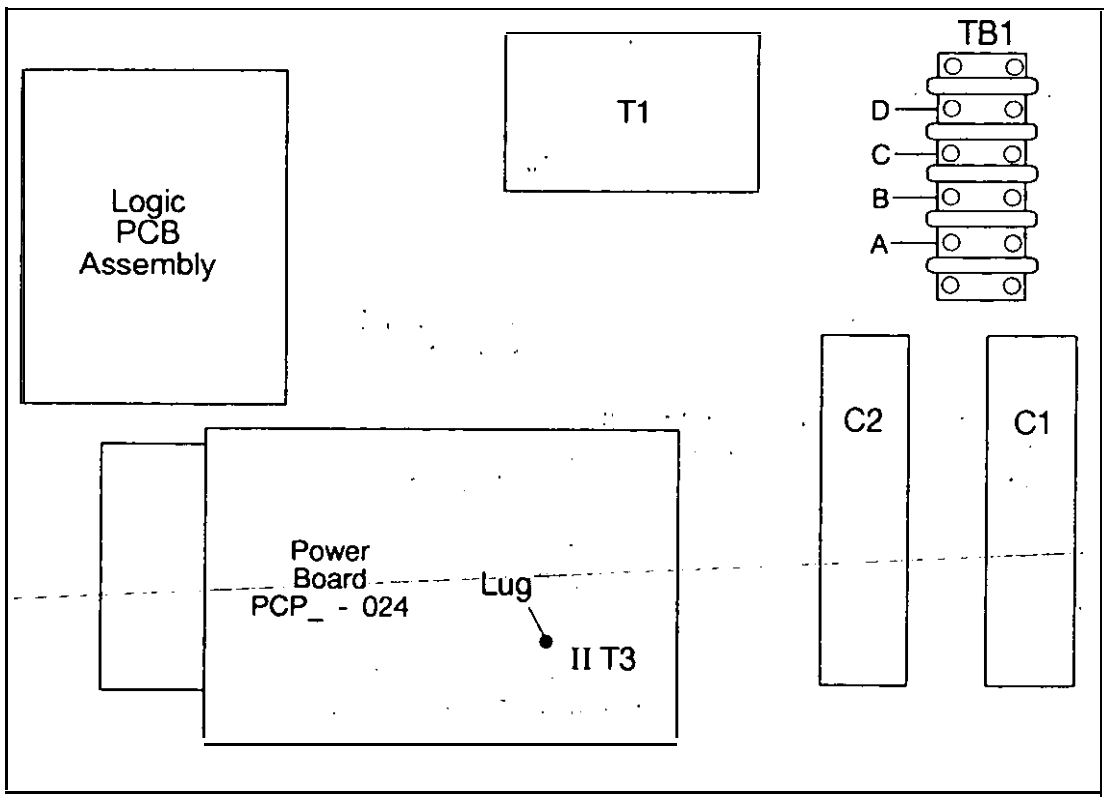


Figure 3-l

Table 3- 1

AC Input	Transformer Lead #	Power Board Connection
220 VAC	7	E1
230 VAC	6	E 1
240 VAC	5	E1

6. Remove the transformer lead (attached to El on the power board). Find the new lead number from Table 3- 1 and place this transformer lead on El.

For example, if the original input voltage was 220 VAC ***and the new voltage is 240*** VAC, ***remove transformer lead 7 and put lead 5 in its place.***

7. Insulate the lead that was removed with shrink tubing and position it so that it cannot contact any live terminals or ground. Use a cable tie to fasten it in place.

Next, change the output voltage.

Changing the Output Voltage

8. Refer to Table 3-2, below.

Table 3-2

AC Output	Transformer Lead #	Terminal Connection
220 VAC	11	N1
230 VAC	12	N2
240 VAC	13	N3

9. Move the Neutral-to-Earth (Neutral-to-Ground) bond wire (this wire is green with a yellow tracer) and the blue receptacle wire to the appropriate N terminal as shown in Table 3-2.

For example, to change the output voltage to 240 VAC, move the Neutral-to-Ground bond wire to N3.

10. Check that the input and output voltage terminal connections are correct. Good connections are essential. Tighten any connectors that are loose.

Remove the black electrical tape from the fuse attached to the positive (+) battery cable. Reconnect the fuse to the positive (+) battery terminal, positioning it so it will not contact the cabinet or battery clamp. Torque the connection to 55 in/lb or 6.2 N/m using the torque wrench.

Go to Appendix A for the Parameters and Calibrations part of this procedure.

QRE1.8KVA, QRE2.1KVA & QRE3.1KVA VOLTAGE CHANGES for 220V/230V/240V

1. Unpack the MICRO-FERRUPS unit and follow the Startup procedure in the user manual. Check the operating voltage and ensure the UPS is operating normally.

2. Turn off the MICRO-FERRUPS unit and remove the AC input plug from the receptacle or turn off AC input to the UPS at the service panel or AC disconnect switch.

3. Remove the screws holding the cover in place and remove the cover.

4. Remember there are still hazardous voltages present in the UPS.

Changing the Input Voltage

5. Disconnect the battery cable at the positive (+) battery terminal shown in Figure 4-1. Insulate the end of the cable with black electrical tape. and position it so it will not contact a battery terminal.

Refer to Figure 4-1 below. Find the power board in the unit, and then refer to Table 4-1 on the next page.

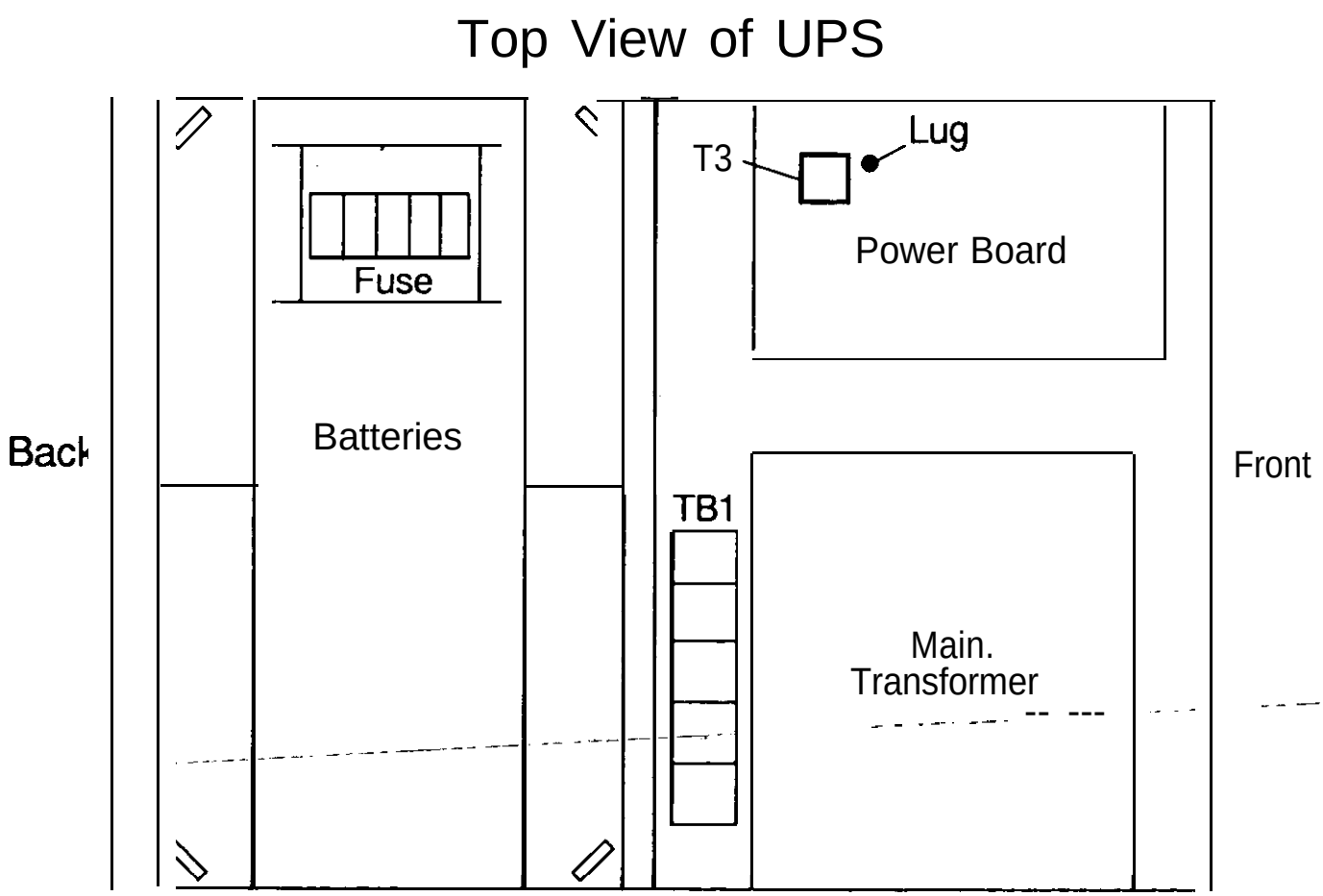


Figure 4-I

Table 4-l

AC Input	Transformer Lead #	Power Board Connection
220 VAC	7	El
230 VAC	6	El
240 VAC	5	El

6. Remove the transformer lead (attached to El on the power board). Find the new lead number from Table 4-1 and place this transformer lead on El.

For example, if the original input voltage was 220 VAC and the new voltage is 240 VAC, remove transformer lead 7 and put lead 5 in its place.

7. Insulate the lead that was removed with shrink tubing and position it so that it cannot contact any live terminals or ground. Use a cable tie to fasten it in place.

Next, change the output voltage.

Changing the Output Voltage

8. Refer to Table 4-2. below.

Table 4-2

AC Output	Transformer Lead #	Terminal Connection
220 VAC	11	N1
230 VAC	12	N2
240 VAC	13	N3

9. Move the Neutral-to-Earth (Neutral-to-Ground) bond wire (this wire is green with a yellow tracer) and the blue receptacle wire to the appropriate N terminal as shown in Table 4-2.

For example, to change the output voltage to 240 VAC, move the Neutral-to-Ground bond wire to N3.

10. Check that the input and output *voltage terminal* connections are correct. Good connections are essential. Tighten any connectors that are loose.

Remove the black electrical tape from the battery cable. Reconnect the cable in its original position to the positive (+) terminal, and retorque the connection to 55 in/lb or 6.2 N/m.

Go to Appendix A for the Parameters and Calibrations part of this procedure.

APPENDIX A: PARAMETERS AND CALIBRATIONS

1. Complete the voltage change now by recalibrating the MICRO-FERRUPS unit. You will have to recalibrate several parameters to match your new voltage. configuration. To do this you will need a handheld Remote Control Panel or a terminal. If you will use a terminal, refer to TIP 501.

2. With the ON-OFF switch in the OFF position, **connect the UPS to the AC service which will supply** the **new operating voltage.**

3. Turn the ON-OFF switch to the ON position: The UPS should operate normally. A High AC output or Low AC output alarm may sound. This is normal.

4. Connect the handheld Remote Control Panel (RCP) to the RS232 interface port on the back of the MICRO-FERRUPS **unit.** Use the RCP to enter the commands and parameter changes shown below.

	ENTER	DISPLAY
A)	[CLEAR] [1] [2] [3] [D] [C] [P]	"123DCP"
	[ENTER]	"FERRUPS BY BEST"
B)	[PROGRAM] [2] [6] [3] [9] [ENTER]	"SERVICE PASSWORD"

****

NOTE: If you have only changed the input voltage follow steps C through N; then go on to step 5. If you have only changed the output voltage, follow steps 0 through AA; then go on to step 5. If you have changed both the input and output **voltages follow all of the steps below.**

****

C) Before following steps D through G, you must enter the Factory Password. Call BEST Technical Support for the password if necessary.

AC Input Calibration

D)	[DISPLAY] [49] [ENTER]	"49 VinNom 240"*
E)	[PROGRAM]	"NEW VALUE"
F)	*(ENTER THE NEWAC INPUT VOLTAGE.)*	
G)	[ENTER]	"49 VinNom ???"*
H)	[DISPLAY] [1] [ENTER]	"1 V In 240"*
I)	[PROGRAM]	"NEW VALUE?"
J)	*(MEASURE THE ACTUAL INPUT VOLTAGE AND ENTER THE MEASURED VALUE.)*	
K)	[ENTER]	"1 V In ???"*
L)	[DISPLAY] [61] [ENTER]	"61 V Reftbl 238"*
M)	[PROGRAM]	"NEW VALUE?"
N)	*(SUBTRACT 2 VOLTS FROM THE VALUE PROGRAMMED INTO PARAMETER 1. ENTER THIS REDUCED VALUE.)*	

*Values will vary with operating voltage.

AC Output Calibration

O)	*Before following steps P through AA, you must enter the Factory Password. Call BEST Technical Support for the password if necessary.*	
P)	[DISPLAY] [50] [ENTER]	"50 VoutNom 240"*
Q)	[PROGRAM]	"NEW VALUE?"
R)	*(ENTER THE NEW OUTPUT VOLTAGE.)*	
S)	[ENTER]	"50 VoutNom ???"*
T)	[DISPLAY] [2] [ENTER]	*"2* V In 239"*
U)	[PROGRAM]	"NEW VALUE?"
V)	*(MEASURE THE ACTUAL OUTPUT VOLTAGE AND ENTER THE MEASURED VALUE.)*	
W)	[ENTER]	*"2* V In ???"*
X)	[DISPLAY] [4] [ENTER]	*"4* I Out 006.3"*
Y)	[PROGRAM]	"NEW VALUE?"
Z)	*(MEASURE THE AC AMPERES OUT WITH THE AMP METER. ENTER THE MEASURED AC AMPERES VALUE.)*	
AA)	[ENTER]	*"4* I out ???.?"*

*Values will vary with operating voltage.

If you have any problems or questions, call Technical Support.

5. Press [CLEAR] then [CLEAR] and [TEMP] simultaneously before disconnecting the handheld Remote Control Panel.

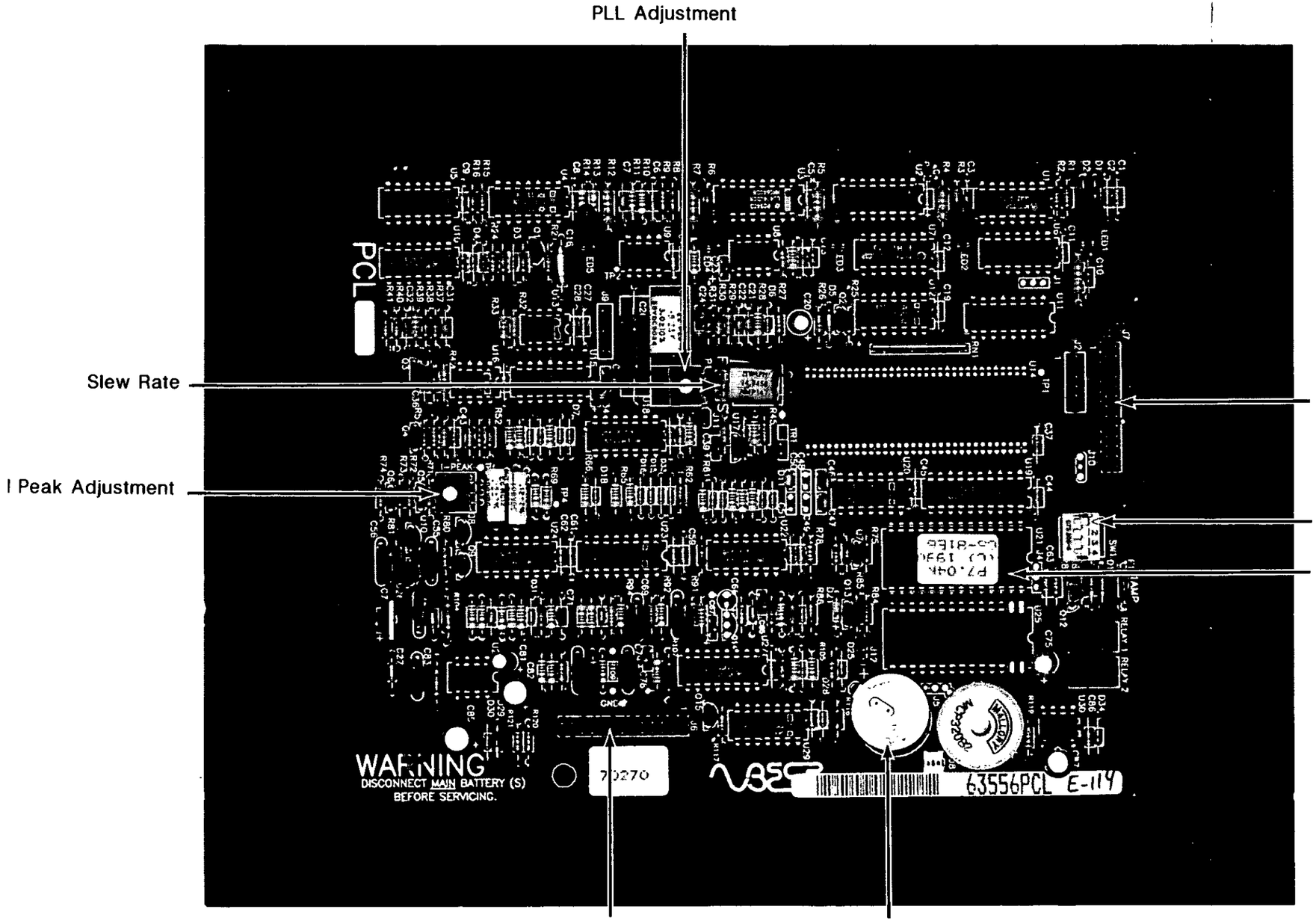
   When you are satisfied the UPS is operating correctly on the new voltage, slide the cover on, tighten the screw and replace the tape on the screw access hole. This completes the procedure for changing the MICRO-FERRUPS operating voltage.

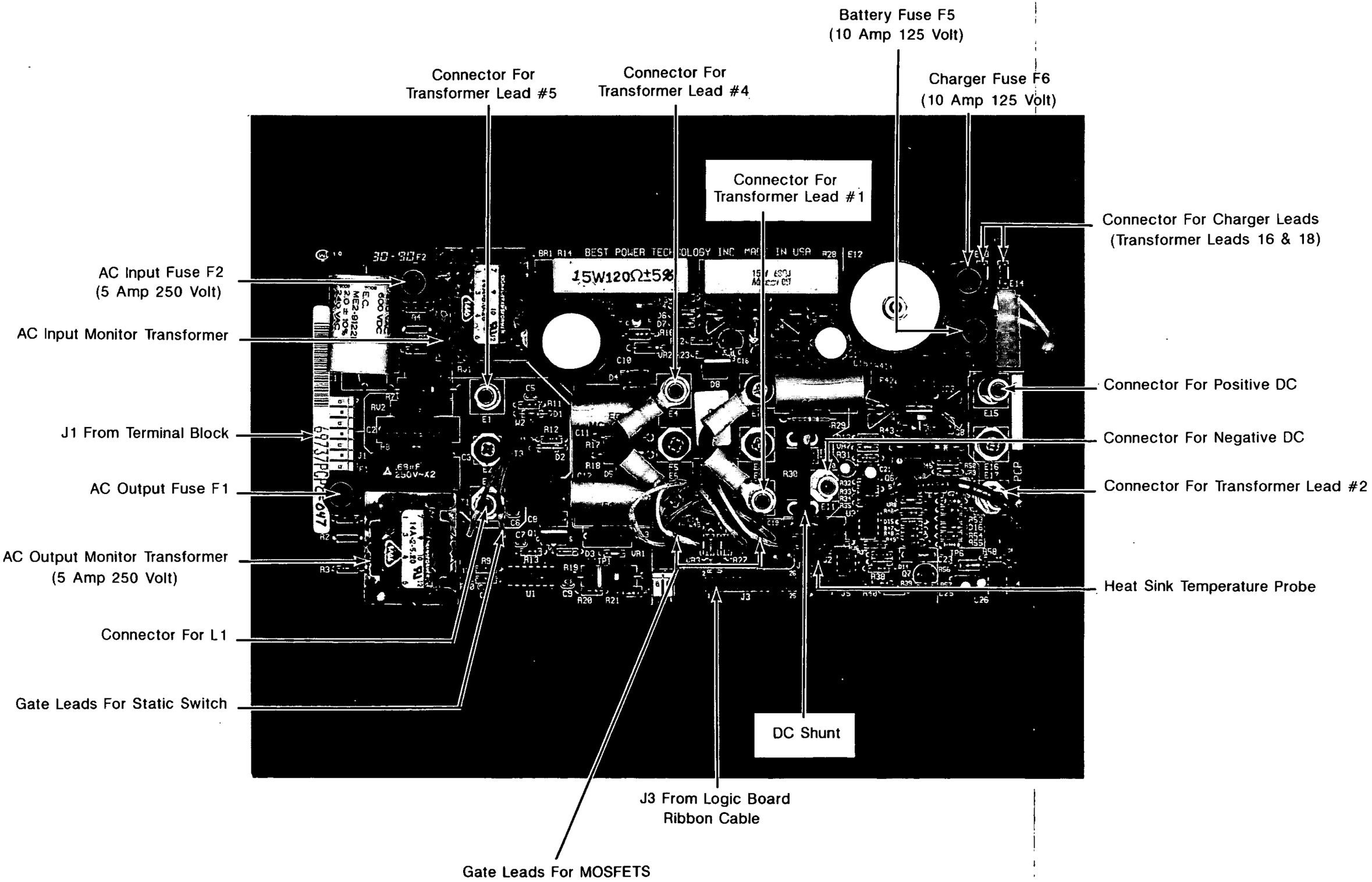
Pictorial Layouts and System Schematics

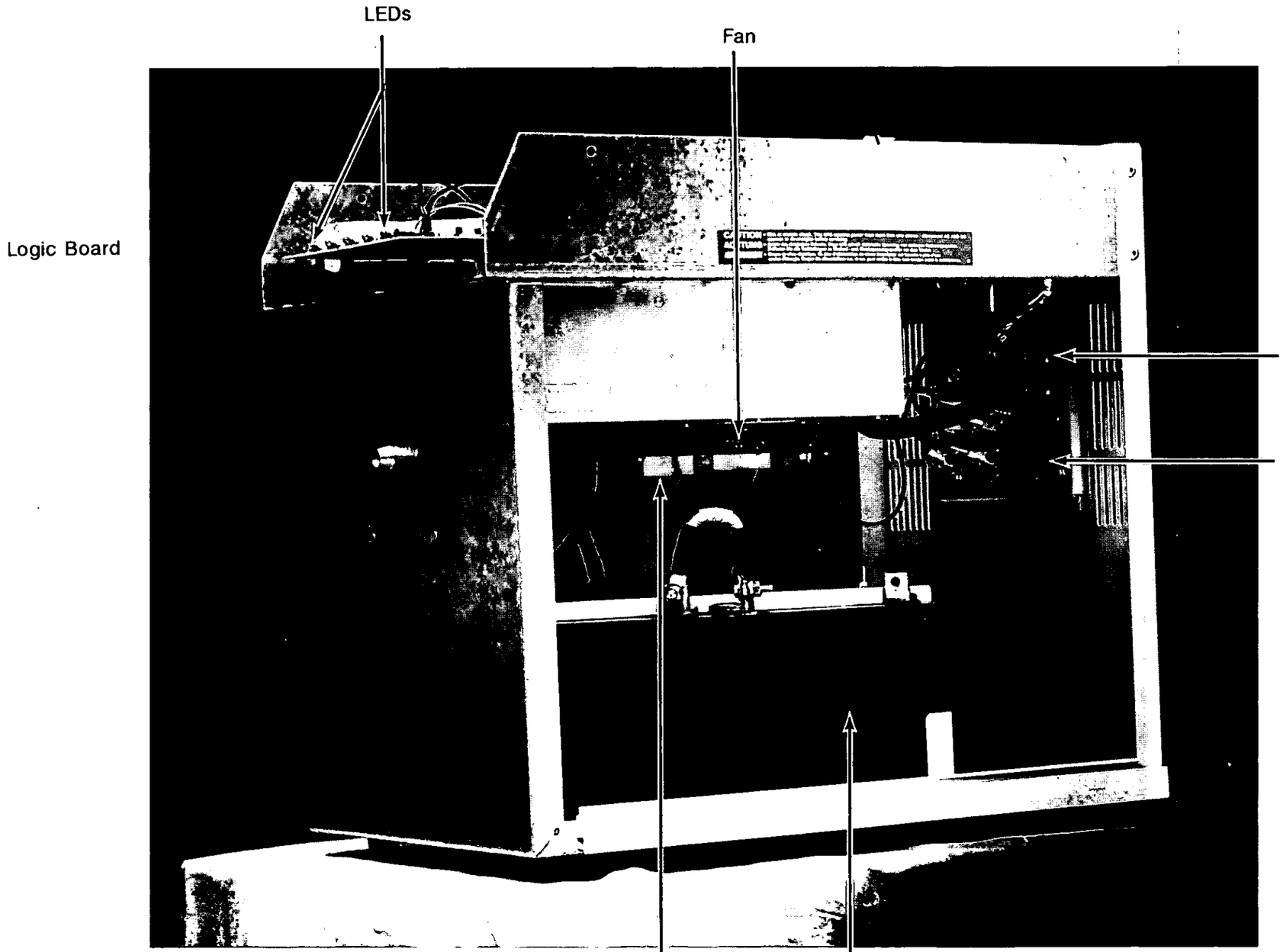
800 Module Pictorials

801 Unit Pictorials

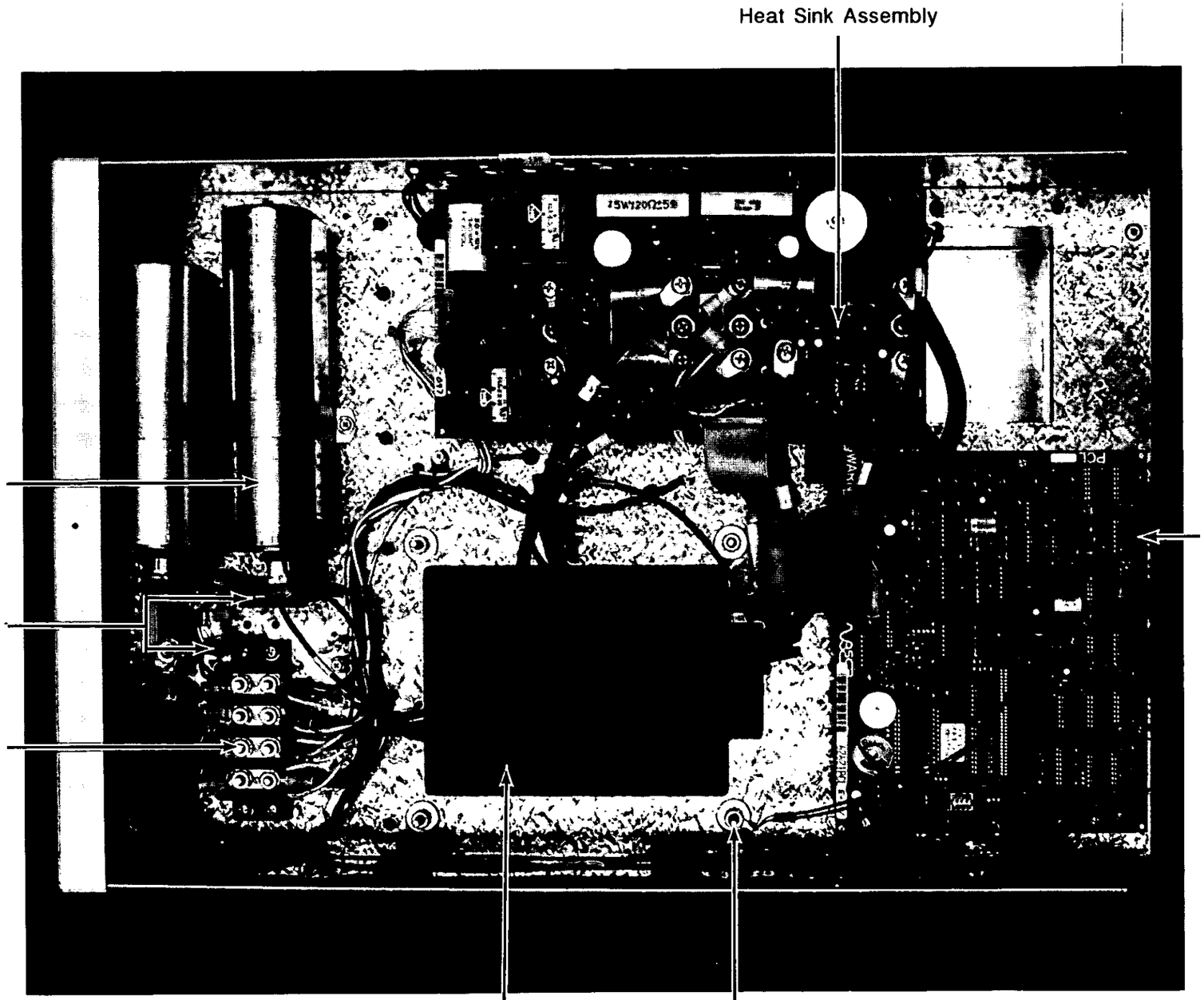
802 Schematics


PLL Adjustment
Slew Rate
I Peak Adjustment
J7 RS232 Port Ribbon Cable
DIP Switches
Micro-FERRUPS
Control Program EPROM
J6 Ribbon Cable
To Power Board
Back-Up Battery Power
WARNING
DISCONNECT MAIN BATTERY (S)
BEFORE SERVICING.
63556PCL E-114


Battery Fuse F5
(10 Amp 125 Volt)
Connector For
Transformer Lead #5
Connector For
Transformer Lead #4
Charger Fuse F6
(10 Amp 125 Volt)
Connector For
Transformer Lead #1
Connector For Charger Leads
(Transformer Leads 16 & 18)
AC Input Fuse F2
(5 Amp 250 Volt)
AC Input Monitor Transformer
Connector For Positive DC
J1 From Terminal Block
Connector For Negative DC
AC Output Fuse F1
Connector For Transformer Lead #2
AC Output Monitor Transformer
(5 Amp 250 Volt)
Heat Sink Temperature Probe
Connector For L1
Gate Leads For Static Switch
DC Shunt
J3 From Logic Board
Ribbon Cable
Gate Leads For MOSFETS



801-1 1.8-3.1 KVA Right Side



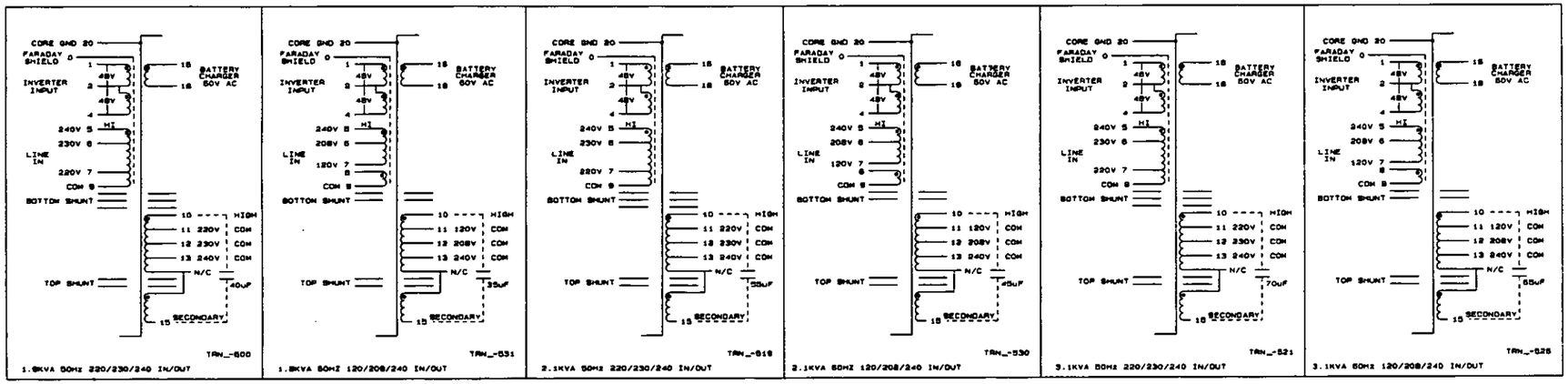
801-2 1.8-3.1KVA Top View

REV	DATE	DESCRIPTION
A	9/28/90	CLASS A RELEASE

TABLE 1

UNIT	VOLTAGE	FREQ	T1 TRANSFORMER	C1 TANK CAP		C2 TANK CAP		C3 ADJUSTMENT CAP														FAN1 FAN	F1 FUSE		LOGIC BOARD	HEATSINK ASSY/ POWER BOARD	STANDARD RECEPTACLE PANEL ASSY	BACKFEED RELAY OPTION	AS400 OPTION
								COLOR CODE BLK TOLERANCE -8 TO -3%		COLOR CODE BLK/WHT TOLERANCE -4.5 TO -1.5%		COLOR CODE WHT TOLERANCE -3 TO 0%		COLOR CODE BLK/RED WHT/YEL TOLERANCE -1.5 TO 1.5%		COLOR CODE YEL TOLERANCE 0 TO 3%		COLOR CODE YEL/RED TOLERANCE 1.5 TO 4.5%		COLOR CODE RED TOLERANCE 3 TO 8%									
				VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	VALUE	PART #	PART #	VALUE	PART #	PART #	PART #	PART #		
1.8KVA	110/115/120	50Hz	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	220/230/240	50Hz	TRN_-600	40uF	CPR_-268	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FAN_-018	70 AMP 130V	FUS_-025	PCL_-116	HSA_-025	PNA_-118	STANDARD	OPTIONAL
	120/208/240	60Hz	TRN_-531	35uF	CPR_-278	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FAN_-018	70 AMP 130V	FUS_-025	PCL_-114	HSA_-025	PNA_-121	OPTIONAL	OPTIONAL
2.1KVA	110/115/120	50Hz	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	220/230/240	50Hz	TRN_-518	30uF	CPR_-144	25uF	CPR_-113	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FAN_-018	70 AMP 130V	FUS_-025	PCL_-115	HSA_-027	PNA_-118	STANDARD	OPTIONAL
	120/208/240	60Hz	TRN_-530	30uF	CPR_-144	15uF	CPR_-115	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FAN_-018	70 AMP 130V	FUS_-025	PCL_-114	HSA_-027	PNA_-121	OPTIONAL	OPTIONAL
3.1KVA	110/115/120	50Hz	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	220/230/240	50Hz	TRN_-521	35uF	CPR_-278	35uF	CPR_-278	6uF	CPR_-106	5uF	CPR_-105	4uF	CPR_-117	3uF	CPR_-111	2.5uF	CPR_-265	1uF	CPR_-263	N/A	N/A	FAN_-017	150 AMP 130V	FUS_-165	PCL_-115	HSA_-027	PNA_-118	STANDARD	OPTIONAL
	120/208/240	60Hz	TRN_-526	35uF	CPR_-278	30uF	CPR_-144	5uF	CPR_-109	4uF	CPR_-117	4uF	CPR_-117	3.5uF	CPR_-265	2uF	CPR_-073	1uF	CPR_-263	N/A	N/A	FAN_-017	150 AMP 130V	FUS_-165	PCL_-114	HSA_-027	PNA_-121	OPTIONAL	OPTIONAL

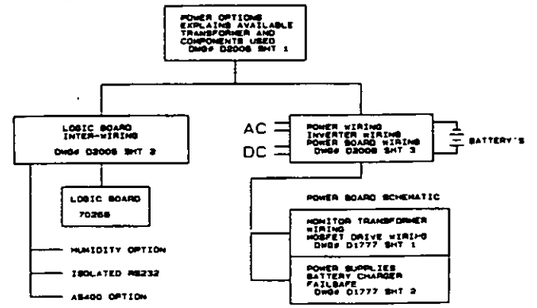
TABLE 2 TRANSFORMERS



NOTES : UNLESS OTHERWISE SPECIFIED

1. THIS SYMBOL. EXAMPLE: (101). IS USED TO RELAY INFORMATION FROM SHEET TO SHEET.
2. THIS SYMBOL. ⏚ IS USED FOR CHASSIS GROUND. ⏚ IS USED FOR EARTH GROUND.
3. FOR OTHER THAN STANDARD LINE CORD ASSEMBLY. SEE DRAWING #C2082
4. FOR OTHER THAN STANDARD PANEL ASSEMBLY. SEE DRAWING #C2087.
5. ALL CHARACTERS IN PARENTHESIS ARE FOR 60Hz UNITS.

SCHEMATIC BLOCK FLOW DIAGRAM



FILE NAME: 2721A001.SCH

ENGR APPROVAL					
			9/28/90	0.1	
			9/28/90	0.6	
		A	9/28/90	00	
ENGR	MCH	REV	DATE	BY	

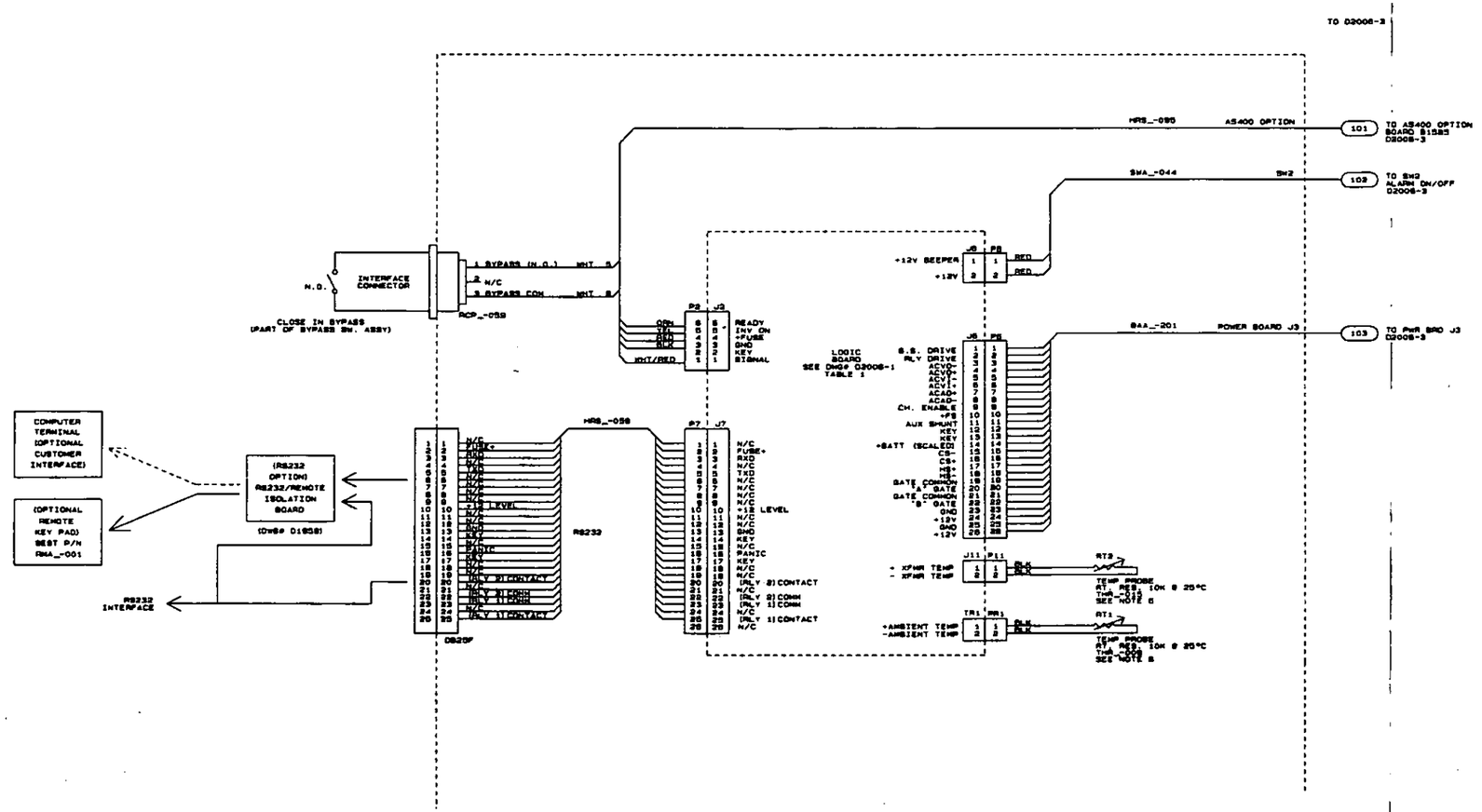
BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE HE 1.8 - 3.1KVA 50/60HZ

NOTE SYSTEM SCHEMATIC/WIRING DIAGRAM

DRAWN DG | SHEET 1 OF 3 | DWG# 02721

802-1



NOTE: UNLESS OTHERWISE SPECIFIED

6. TR1 IS THE CONNECTION FOR AMBIENT TEMPERATURE PROBE THAT IS SITUATED NEAR THE FAN.

FILE NAME: 30058073.SCH

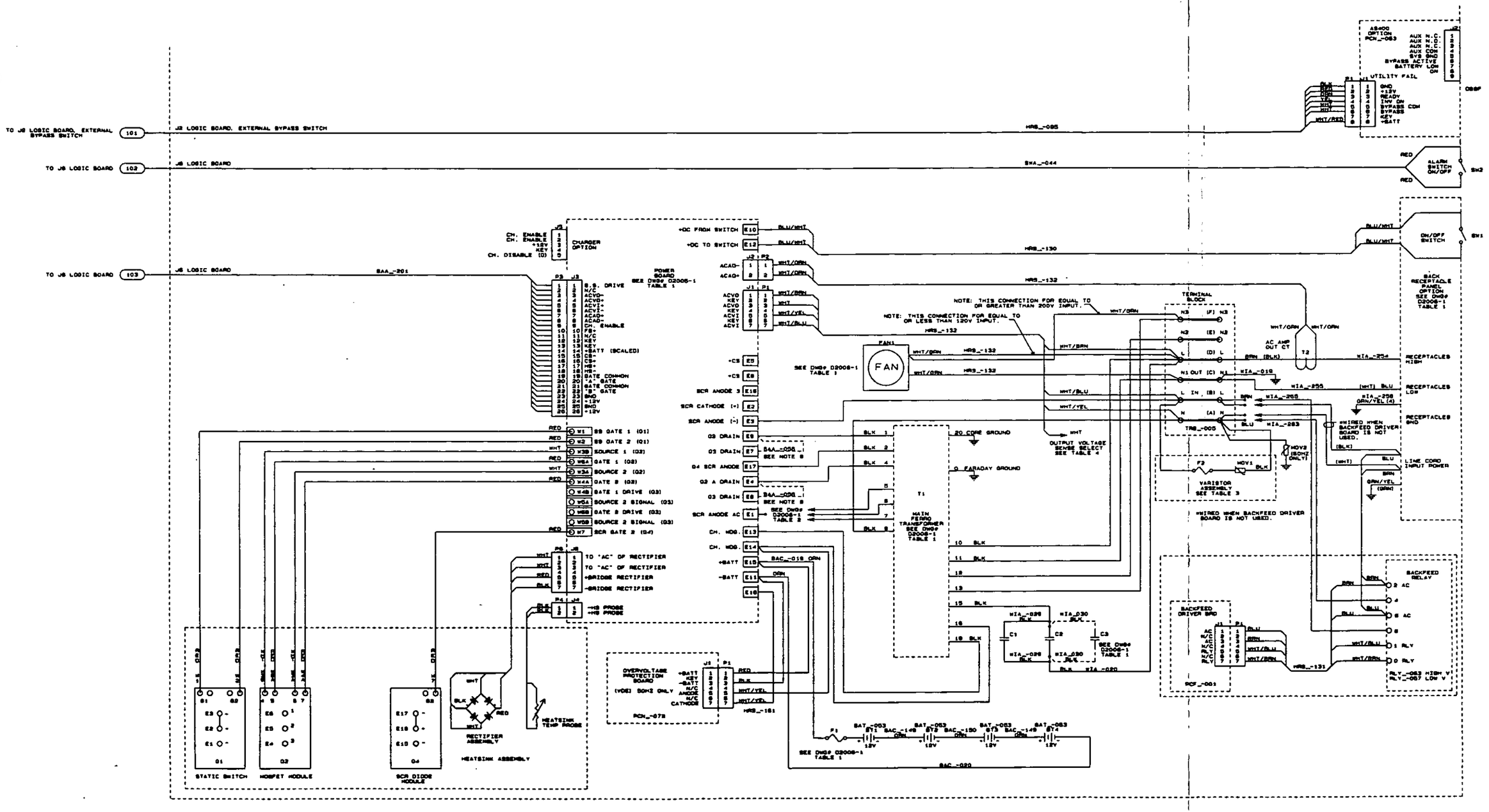
ENGR APPROVAL			9/27/90	D.L.
			9/27/90	D.K.
	883	B	9/25/90	DD
		A	8/22/90	DD

BEST POWER TECHNOLOGY, INC. BOX 280 NECEDAH, WI 54646 (608) 565-7200

TITLE ME 1.0 - 3.1 kVA 60HZ 120 IN & OUT

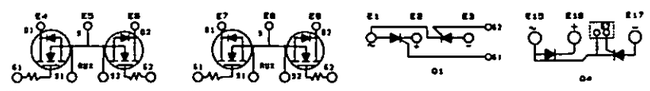
NOTE SYSTEM SCHEMATIC/WIRING DIAGRAM

ENGR | FSH | REV | DATE | BY | DRAWN TO | SHEET 2 OF 3 | DWG# 02008



DETAIL-A

HEATSINK MODULES ASSEMBLY



NOTE: UNLESS OTHERWISE SPECIFIED

7. SECOND OPTIONAL MOSFET MODULE USED ON HEATSINK ASSEMBLY FOR 2.1KVA AND 3.1KVA UNITS ONLY. SEE DWG# B2857 FOR DETAIL.

8. OPTIONAL JUMPER WIRES ON POWER BOARD. E7 AND E8. E8 AND E4 ARE USED ONLY ON 3.1KVA UNITS.

TABLE 4

WHT WIRE "VOLTAGE SENSE SELECT"	
TRANSFORMER	CONNECTION
120 IN & OUT	N1 (C)
120 IN 120/208 OUT	N2 (E)
120 IN 120/240 OUT	N3 (F)
208 IN 120/208 OUT	N3 (E)
208 IN 120/240 OUT	N3 (F)
240 IN 120/208 OUT	N2 (E)
240 IN 120/240 OUT	N3 (F)
220 IN & OUT	N1 (C)
230 IN & OUT	N2 (E)
240 IN & OUT	N3 (F)
110 IN & OUT	N1 (C)
115 IN & OUT	N2 (E)
120 IN & OUT	N3 (F)

TABLE 3

VOLTAGE	FREQ.	MOV1	MOV2
100/120	50HZ	RBA_-013	RBA_-014
200/240	50HZ	RBA_-013	RBA_-014
100/120	60HZ	RBA_-013	——
200/240	60HZ	RBA_-013	——

802-3

FILE NAME: 2721A003.SCH

ENGR APPROVAL					
			6/28/90	D.L.	
			6/28/90	D.K.	
		A	6/28/90	DD	

BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE: HE 1.8 - 3.1KVA 50/60HZ

NOTE: SYSTEM SCHEMATIC/WIRING DIAGRAM

FINISH	MTRL	SIZE	SCALE	WT.	DRAWN	TD	SHEET 1 OF 1	DRWG# 2721