UNITY/I® Single-Phase Service Manual

For models UT3K, UT4K, UT5K, and UT8K

This service manual includes information about the following:

- BEST Power Worldwide Service
- **UNITY/I** theory of operation
- System operation and communication
- Scheduled maintenance
- Troubleshooting
- Replacement of major parts

CAUTION

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

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

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

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

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Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UN618
November 1995

Replacing the Internal Batteries in UNITY/I™ Models UT3K, UT4K, UT5K, and UT8K

This publication describes how to change the internal batteries in **UNITY/I** models UT3K, UT4K. UT5K, and UT8K. This procedure is for units with the fuse board mounted below the front panel of the unit. If the fuse board is inside the chassis, see BEST publication UTY 619. **A qualified service technician must perform this procedure.**

If you have any questions or problems while performing this procedure, call BEST Power Worldwide Service at l-608-565-2100, or l-800-356-5737 (U.S.A. and Canada), or call your local BEST office.

Replace batteries with the **same series and type** battery

Tools Required (use insulated tools):

DC voltmeter	7/16" nut driver	½" heat shrink tubing or electrical tape
Phillips screwdriver	Diagonal cutters	***UNITY/I User Manual***
7/16" box wrench	1/4" nut driver	

Personal safety equipment required by local codes (also see the caution on pp. 2 - 3).

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UTY-0618B

RESTRICTED

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IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS!

This publication contains important instructions that you should follow during battery replacement.

⚠ CAUTION

Full voltage and current are always present at the battery terminals.

The batteries used in this system can produce dangerous voltages, extremely high currents, and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and bums caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.

A qualified technician or electrician who is familiar with battery systems and required precautions must service the batteries. Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Batteries must be replaced with BEST battery number BAT-XXXX or equivalent. The installation must conform to national and local codes.

Keep unauthorized personnel away from batteries.

The technician or electrician must take these precautions:

1. Wear protective clothing and eye wear. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Do not carry metal objects in your pockets where the objects can fall into the battery cabinet.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

3. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.

4. Align the cables on the battery terminals so that the cable lug will not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

5. Install the battery cables so they cannot be pinched by the battery cabinet door or UPS covers.

⚠ CAUTION

6. Make sure the fuse is positioned so that it will not contact any cabinet parts or other battery posts if the batteries move. Make sure there is enough clearance when the battery cabinet door closes.

7. If you are replacing batteries or repairing battery connections, follow the procedure in the ***UNITY/I User Manual*** to shut off the UPS and remove both AC and DC input power.

8. If your local or national code requires you to ground either battery terminal, remove the connection from the terminal to ground (earth) before you service the batteries. If any battery terminal is inadvertently grounded, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. An electric shock will be less likely if you disconnect the grounding connection before you work on the batteries.

9. Assume that old batteries are fully charged. Use the same precautions you would use when handling a new battery. Do not short battery terminals or the battery string with a cable or tool when you disconnect the batteries.

10. Do not dispose of batteries in a tire because the batteries could explode. Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

11. Batteries contain lead. Many state and local governments have regulations about disposing of used batteries. Please dispose of the batteries properly.

Section 100: Before Replacing the Batteries.. .

Before replacing the batteries in the UNITY/I UPS, you must do **one** of the following:

Power down the UNITY/I UPS
or
Enable the UNITY/I unit's "battery maintenance mode."

Whenever possible, you should power down the UPS while servicing the batteries. However, you may use battery maintenance mode if necessary Battery maintenance mode allows a qualified technician to service the batteries without powering down the UPS or the load equipment.

Use the two questions below to help determine whether to power down the unit (Section 101) or use battery maintenance mode (Section 102).

100-l. Can the load equipment be shut down while you service the batteries?

☐ YES Go to Section 101 now (skip question 100-2).
☐ **NO** Continue with question 100-2 below.

100-2. Does the UPS have an external bypass switch?

☐ YES Go to Section 101.
☐ **NO** Go to Section 102.

Section 101: Powering Down the UPS

> **IMPORTANT**
>
> Before beginning, measure the voltage of each replacement battery. Each battery should measure at least 12 V.

101-I. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

101-2. Open the front door of the UPS. Turn the key switch to "OFF."

101-3. Disconnect AC input power to the UPS.

NOTE: Turning the key switch to "OFF" is **not sufficient**.

101-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

101-s. Skip Section 102. Go to Section 200 on page 8.

Section 102: Using Battery Maintenance Mode

Battery maintenance mode allows a qualified technician to service the batteries without powering down the loads connected to the UNITY/I unit. Battery maintenance mode should be used only when the unit does not have an external bypass switch and is powering critical loads that cannot be shut down while servicing the batteries.

> **IMPORTANT**
>
> In battery maintenance mode, the unit does not regulate voltage or provide back up power in case of a power outage.
>
> Before beginning, measure the voltage of the replacement battery. Each battery should measure at least 12 V.

⚠ CAUTION

When the unit is in battery maintenance mode (Parameter 63 set to "1"), there is still **live voltage inside the UPS.**

Battery maintenance mode (Parameter 63 set to "1") should be used during **battery maintenance only.** Do **not** use battery maintenance mode for any other type of UPS service or maintenance.

102-l. Verify the stability of the AC line. If there are irregularities with the input AC line, BEST recommends that you do not use battery maintenance mode at this time.

- Press the [VLINE] key on the front of the unit. Watch to see if the input voltage is stable.
- You can also check the UPS system log to see if the unit has frequently switched to battery power (inverter) recently. See the ***UNITY/I User*** *Manual* for instructions on viewing the system log. Look for the system event code "in" (inverter).

102-2. Access parameter mode and enter the user password (377) as follows:

NOTE: When the unit is in parameter mode, each of the front panel keys has a specific function. The label inside the front door of the unit explains the parameter mode key functions. The label also shows a "Programming Template" with alternate key names that correspond to the parameter mode key functions.

a. Simultaneously hold down the **[CANCEL]** and **[RUNTIME]** keys for two seconds. Release them when the display reads P-00.

b. Press **[CANCEL].** The display should read 0.

c. Use the [%LOAD] key **or** the **[VOUT]** key to change the display reading to 377.

NOTE: Use the [%LOAD] key to **increase** the value. Use the **[VOUT]** key to **decrease** the value. If you hold down either key, the display begins to scroll more quickly.

d. Press **[RUNTIME].** The display should read 1. If it does not, repeat steps "c" and "d."

e. Press **[CANCEL].** The display should read P-00.

102-3. Enter the nominal AC input line voltage in Parameter 62 (Nominal Input Voltage) as follows:

a. The display should show P-XX (where XX is a parameter number). Use the [%LOAD] key **or** the **[VOUT]** key to change the display reading to P- 6 2.

b. Press **[CANCEL]**

c. Use the [%LOAD] key or the **[VOUT]** key to change the display reading to the nominal AC input line voltage (200, 208, 220, 230 or 240).

NOTE: If the UPS has optional 380-415 VAC input, set the nominal AC input voltage value to "240."

d. Press **[RUNTIME] to** enter the new **value.**

e. Press **[CANCEL].** The display should read P- 6 2.

102-4. Put the unit into battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "1" as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key **or** the **[VOUT]** key to change the display reading to P- 6 3.

b. Press **[CANCEL].** The display should read 0

c. Press the [%LOAD] key to change the display reading to 1.

d. Press **[RUNTIME].** The display should read 1.

102-5. Look at the LEDs on the UPS front panel. The LINE, BYPASS, and ALARM LEDs should be on, and the BATTERY LED should be off, as shown in Figure 1.

Figure 1: Battery Maintenance Mode LEDs

⚠ CAUTION

If the front panel LEDs are not lighted as shown in Figure 1, the unit is not in battery maintenance mode and it is not **safe** to service the batteries. Repeat all of Section 102 or power down the UPS as instructed in Section 101.

NOTE: If, after repeated attempts, the unit does not transfer to battery maintenance mode, the AC input voltage may be out of tolerance. Call BEST Worldwide Service for technical assistance.

Section 200: Removing the Batteries

> **IMPORTANT**
>
> The steps in Sections 200 and 300 must be performed **in order.**

200-1. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit. Also, remove the bottom narrow front panel(s). See Figure 2.

NOTE: On a UT8K, also remove the front kick plate (found below the front ventilation panel); slide it upward, then pull it away from the unit

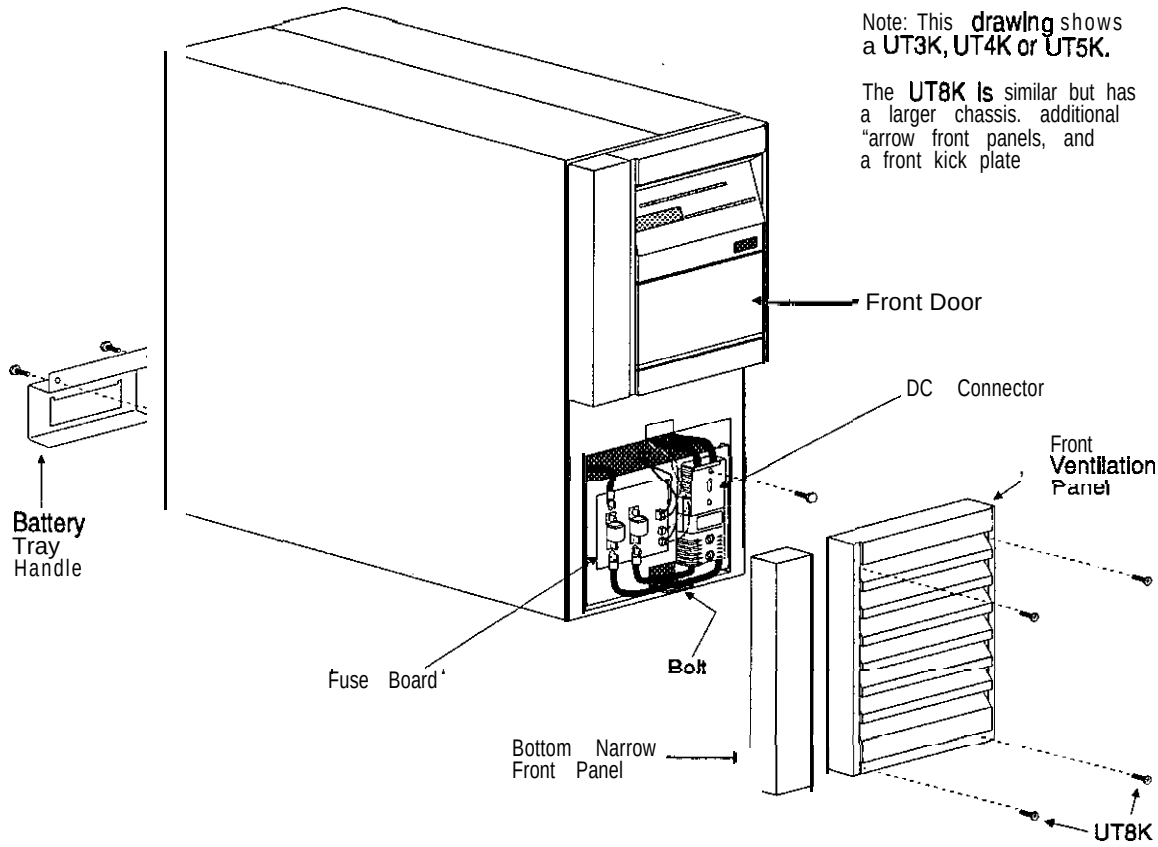

Figure 2: Single-Phase UNITY/I UPS

200-2. Remove the battery tray handle from the back of the unit (see Figure 2). Keep the two bolts handy to use in step 200-4.

200-3. At the front of the unit, remove the bolt that secures the battery tray to the floor of the chassis. To find the bolt, look under the two cables labeled "+" connected between the bottom DC connector and the fuse board (see "Bolt" in Figure 2).

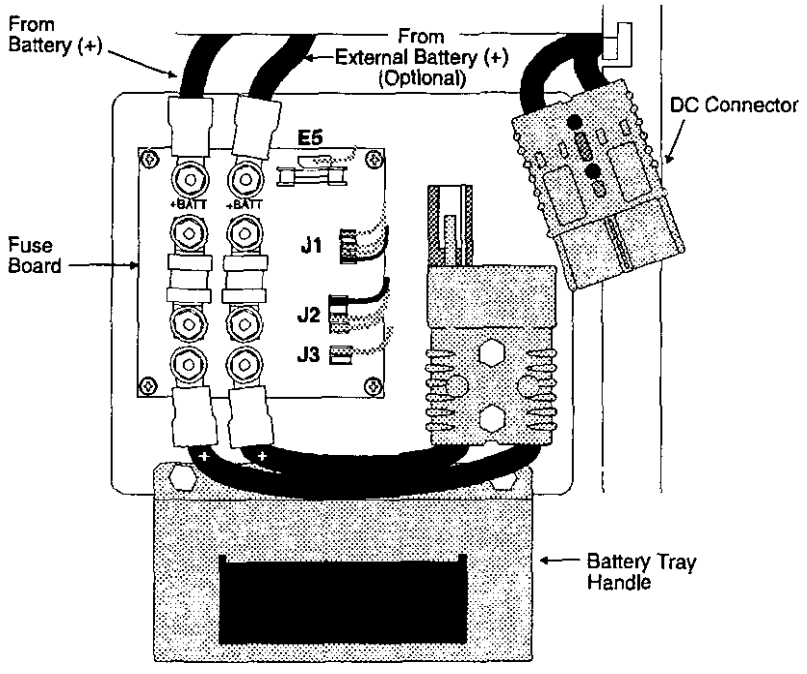

Figure 3: Battery Tray, Front View

200-4. Use the two bolts to attach the battery tray handle to the battery tray at the front of the unit (see Figure 3).

200-S. Remove the bolt from the top DC connector. See Figure 3 for DC connector location.

200-6. Disconnect the top DC connector as shown in Figure 3.

200-7. If the unit has external batteries, perform the following steps:

a. Switch off the DC disconnect switch on the external battery cabinet(s).

b. Disconnect the external battery cable (+) from the "+BATT" post at top of the fuse board (see Figure 3). **Insulate the cable lead with electrical tape or heat shrink tubing.**

200-S. **In the order listed,** disconnect the following from the fuse board. Remove any tie wraps. See Figure 3 for connection locations.

a. Fast-on connector from E5.
b. Connector from J3.
c. Connector from J1.

200-9. Pull the battery tray out just far enough to expose the first battery.

200-10. Disconnect the negative (-) battery cable from the first battery.
Insulate the cable lead with electrical tape or heat shrink tubing.

⚠ CAUTION

The battery tray will drop to the floor if it is completely removed from the unit. Make sure that your feet/hands are not under the battery tray while pulling the tray out of the unit.

200-l 1. Read the CAUTION above. Then, carefully pull the battery tray out of the unit just far enough to expose all of the battery terminals.

Section 300: Replacing the Batteries

300-I. Replace the old batteries with new ones of the **same series and type** and rewire in the same order. See Figure 4.

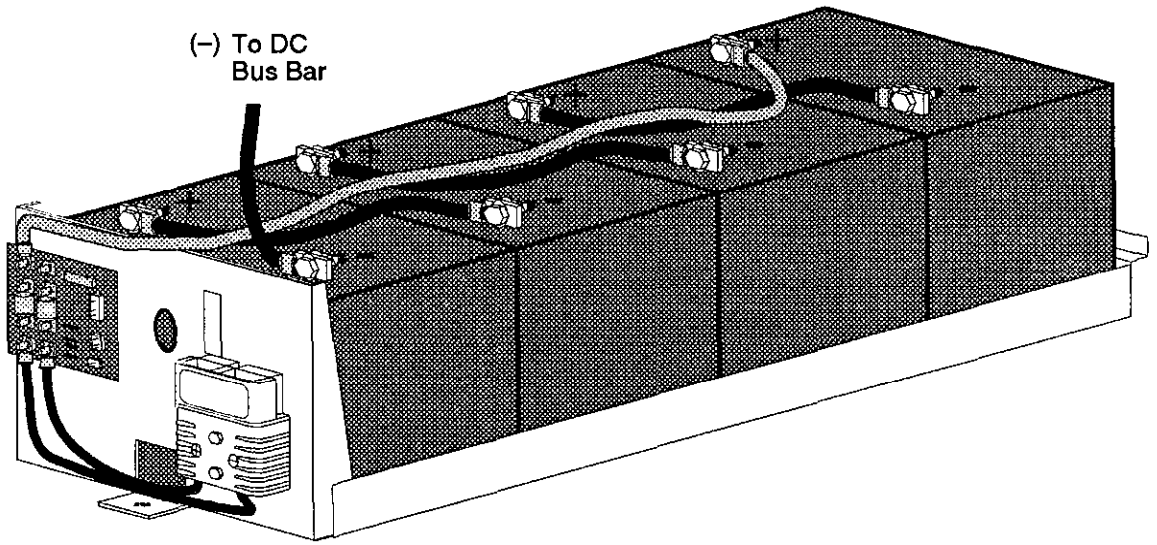

Figure 4: Battery Tray with Batteries

300-2. Slide the battery tray into the unit until only the front battery is exposed

300-3. Attach the negative (-) battery cable to the first battery.

⚠ CAUTION

When pushing the battery tray into the unit, be careful not to pinch your fingers between the battery tray and the chassis.

300-4. Use the palms of your hands to push the battery drawer all the way into the unit.

300-5. If the unit has external batteries, connect the external battery cable (+) to the "+BATT" post at the top of the fuse board (see Figure 3). Reassemble in this order: cable, flat washer, split lock washer, nut or cable, flat washer, nut with attached star washer.

300-6. Switch on the DC disconnect switch on the external battery cabinet(s), if applicable.

300-7. **In the order listed,** reconnect the following. See Figure 3, on page 9, for connection locations.

a. Connector to J1 on the fuse board.
b. Connector to J3 on the fuse board.
c. DC connector and bolt.
d. Fast-on connector to E5 on the fuse board. There may be a small spark,
e. Replace any tie wraps that were removed.

300-8. Remove the handle from the battery drawer and reattach it to the back of the unit.

300-9. Replace the bolt that secures the front of the battery tray to the floor of the chassis.

300-10. Replace the bottom narrow front panel(s). If you have a UT8K, also replace the front kick plate.

300-11. Replace the front ventilation panel and secure it with the screws.

300-12. • **If you powered down the UPS:**

a. Switch on the DC disconnect switch on the external battery cabinets (if applicable).

b. Reapply AC line to the UPS.

c. Turn the UPS key switch to "AUTO."

d. Reapply the loads,

e. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The LINE LED should be on, and the BATTERY, BYPASS, and ALARM LEDs should be off.

- **If you used battery maintenance mode:**

a. Access parameter mode and enter the user password (377) as follows:

1. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two seconds. Release them when the display reads P-00.

2. Press [CANCEL]. The display should read 0.

3. Use the [%LOAD] key or the [VOUT] key to change the display reading to 371.

4. Press [RUNTIME]. The display should read 1.

5. Press [CANCEL]. The display should read P-00.

b. Take the unit out of battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "0" as follows:

1. The display should read P-00. Use the [%LOAD] key or the [VOUT] key to change the display reading to P-63.

2. Press [CANCEL]. The display should read 1.

3. Press the [VOUT] key. The display should read 0.

4. Press [RUNTIME]. The display should read 0.

> **IMPORTANT**
>
> The **BYPASS** LED should be off and the **LINE** LED should be on.
>
> If the **BYPASS** LED is on, the unit is still in battery maintenance mode. Repeat steps "a" and "b" above. If the BYPASS LED remains lit, call BEST Power Worldwide Service for technical assistance.

c. Press [VLINE] twice to escape parameter mode.

d. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The **LINE** LED should be on, and the **BATTERY, BYPASS,** and **ALARM** LEDs should be off.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UTY 619
II
December 5.1997

Replacing the Internal Batteries in UNITY/I UT3K, UT4K, UT5K, and UT8K (Internal Fuse Board)

This publication describes how to change the internal batteries in UNITY/I™ models UT3K, UT4K, UT5K, and UT8K. This procedure is for units with the fuse board mounted inside the chassis; see Best Power publication UTY 618 if the fuse board in your unit is mounted below the front ventilation panel.

NOTE: If your UNITY/I UPS has an extended runtime option and has external batteries, refer to UTY 620 for replacing both external **and internal batteries.**

Replace batteries with the same series and type of battery.

A qualified service person **must perform this procedure.** Should questions or problems arise while performing this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S.A. and Canada only), l-608-565-2100, or your local Best Power office.

Tools Required – Use Insulated Tools:

Safety Equipment Required by Local Codes	'%-inch Heat Shrink Tubing or Electrical Tape
DC Voltmeter	7/16-inch and 1/4-inch Nut Drivers
7/16-inch Box Wrench	*UNITY/I User* Manual

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

IMPORTANT SAFETY INSTRUCTIONS – SA VE THESE INSTRUCTIONS!

⚠ CAUTION!

This procedure must be performed by a qualified service person only. UNITY/I UPS units are designed to provic le power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or D C voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

Turn off the UNITY/I UPS according to the procedure describing "Shutting Down the UNITY/I" in the *UNITY/I Us er Manual.* Make sure that the UNITY/I batteries and AC input are off or disconnected before you replace the batterie s.

This unit contains electrostatic sensitive devices (ESD). If you do not follow proper ESD procedures, you ma y cause severe damage to electronic circuitry.

UNITY/I UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage and injury. A short circuit can cause a battery to explode. Always wear protectiv e clothing and eye protection and use insulated tools when working near batteries.

Best Power recommends the following for qualified service people servicing the UNITY/I UPS:

A) Remove rings, watches, and other jewelry before servicing the UNITY/I UPS.
B) Always wear protective clothing and eye protection, and use insulated tools when working near batteries.
C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follo w all local safety codes.

⚠ CAUTION!

Full voltage and current are always present at the battery terminals.

The batteries used in this system can produce dangerous voltages, extremely high currents, and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminal! during battery installation. Do not touch uninsulated battery terminals.

A qualified service person who is familiar with battery systems and required precautions must service the batteries Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard fo: r emergency lighting and power equipment, UL 924. Batteries must be replaced with Best Power battery number BAT-*XXXX* or equivalent. The installation must conform to national and local codes.

Keep unauthorized personnel away from batteries.

The technician or electrician must take these precautions:

1. Wear protective clothing and eye wear. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Do not carry metal objects in your pockets where the objects can fall into the battery cabinet.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

3. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.

4. Align the cables on the battery terminals so that the cable lug does not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

5. Install the battery cables so they cannot be pinched by the battery cabinet door or UPS covers.

6. Make sure the fuse is positioned so that it will not contact any cabinet parts or other battery posts if the batteries move. Make sure there is enough clearance when the battery cabinet door closes.

7. If you are replacing batteries or repairing battery connections, follow the procedure in the UNITY/I User *Manual* to shut off the UPS and remove both AC and DC input power, unless you must use "Battery Maintenance Mode."

8. If your local or national code requires you to ground either battery terminal, remove the connection from the terminal to ground (earth) before you service the batteries. If any battery terminal is inadvertently grounded, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. An electric shock will be less likely if you disconnect the grounding connection before you work on the batteries.

9. Assume that old batteries are fully charged. Use the same precautions you would use when handling a new battery. Do not short battery terminals or the battery string with a cable or tool when you disconnect the batteries.

10. Do not dispose of batteries in a fire because the batteries could explode. Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

11. Batteries contain lead. Many state and local governments have regulations about disposing of used batteries. Please dispose of batteries properly.

Section 100: Before Replacing the Batteries. . .

IMPORTANT: Before beginning, measure the voltage of each replacement battery. Each battery should measure at least 12 VDC.

Hardwired or Softwired..... Whenever possible, you should shut down your UPS and remove all AC and DC power to replace the batteries. However you may use "Battery Maintenance Mode" if necessary. To help you select the best way to change batteries in your UNITY/I System, look at your system's wiring configuration. Most UNITY/I units are "soft-wired." This means they have a line cord and plug that connects to utility power at a wall electrical outlet. The "Protected Loads" are plugged into outlets on the back of the UNITY/I. If your unit is softwired, go to Table 1, below.

If your UNITY/I was installed so it is wired directly, without an input AC plug or receptacles for the loads, it is "hardwired." Go to the next page for information regarding hard wired UNITY/I units.

Table 1 - Softwired

❑ **Do this if your "Protected Loads" can be shutdown:**

1. Turn off protected loads.
2. Unplug them and then plug them into wall receptacles. Switch them on while you replace the batteries. Battery replacement takes up to about eight hours.
3. Turn off the UNITY/I UPS by opening the front door and turning the key switch to "OFF."

⚠ **CAUTION!** Turning the key switch to "OFF" is **not sufficient.** Shut off UPS circuit breaker or remove UPS AC input plug from the wall receptacle.

4. Go to Section 200, "Removing the Batteries" on page 13. Complete steps 5 through 8, below, **after** you complete the battery installation.

When battery installation is finished, complete steps 5 through 8 to restart the UPS.

5. Reapply AC line to the UPS.
6. Turn the UPS key switch to "AUTO."
7. Turn off the protected loads and plug them into the UNITY/I UPS receptacles. Switch on the loads.
8. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied, The LINE LED should be on, and the BATTERY, BYPASS, and ALARM LEDs should be off

❑ **If your "Protected Loads" cannot be shut down, go to Section 103, "Using Battery Maintenance Mode."**

Use Table 2 below to help determine how to proceed.

1. Decide if your protected loads can be shut down for a few minutes, for up to four hours while you replace the batteries, or whether they must not be shut down at all. Find a statement that applies under "Protected Load Status," and note the row in Table 2.

2. Under "Bypass Switch Status" find the column that fits your installation,

3. Where the row and column selected meet, place a check mark. Go to the Section and page indicated.

Table 2 - Hardwired

Protected Load Status	Bypass Switch Status		
	Break-Before-Make Bypass Installed	**Make-Before-Break Bypass Installed**	**No Bypass Switch Installed**
Load can be shut down for only a few minutes	❑ Go to Section 101 on page 6.	❑ Go to Section 102 on page 7.	❑ Go to Section 103 on page 9.
Load can be shut down while batteries are replaced (about 4 hours)	❑ Go to Section 101 on page 6.	❑ Go to Section 102 on page 7.	❑ Go to Section 101 on page 6.
Load must *not* be shut down	❑ Go to Section 103 on page 9.	❑ Go to Section 102 on page 7.	❑ Go to Section 103 on page 9.

Section 101: Powering Down the Loads

101-1. Shut down the load equipment.

101-2. If you have an external Break-Before-Make Bypass Switch, and your protected loads can be shut down for only a few minutes while you replace the batteries, set the BBM Switch to "LINE." You can now switch on the loads and operate on utility line power.

101-3. Open the front door of the LIPS. Turn the key switch to "OFF."

101-4. Disconnect AC input power to the UPS

⚠ **CAUTION!** Turning the key switch to "OFF" is **not sufficient**

101-5. Go to Section 200, "Removing the Batteries" on Page 13. You will complete steps 101-6 through 101-10 after you complete the battery installation.

When battery installation is finished, complete steps 101-6 through 101-10 to restart the UPS.

101-6. Reapply AC line to the UPS

101-7. Turn the UPS key switch to "AUTO."

101-8. If you have a BBM Switch, shut down the loads, set BBM Switch to "UPS"

101-9. Switch on the loads.

101-10. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The LINE LED should be on, and the BATTERY, BYPASS, and ALARM LEDs should be off.

Table 3-Alarm Status Table (table duplicated on page 10)

UNITY/I Model	Serial Number	ALARM LED State-Battery Maintenance Mode
3 K	25098 and below	ON
	25099 and above	OFF
4K	25097 and below	ON
	25098 and above	OFF
S K	20778 and below	ON
	20779 and above	OFF
8K	**25097** and below	ON
	25098 and above	OFF

Section 102: Using the Make-Before-Break Bypass Switch

102-1. If you do not need to operate the protected load while you replace the batteries, you may want to shut it down. To connect the protected loads to utility power while you replace the batteries, follow the procedure in steps 102-2 through 102-6.

To switch the MBB bypass switch from "UPS' to "LINE" (or vice versa) with a UNITY/I single-phase unit, **the unit must be operating in BYPASS mode** (the BYPASS light must be ON).

To operate the bypass switch, enter the BYPASS mode by following the instructions below:

102-2. Enter the user password (377):

a. Hold down the [CANCEL] and [RUNTIME] keys; release the keys when the display shows "P-00."
b. Press [CANCEL]. The display should show "0."
c. Press and hold the [%LOAD] key until the display shows "377." (If you go past "377," press [VOUT] to scroll backwards.)
d. Press [RUNTIME]. The display should show "l."

102-3. Program parameter 62 (nominal input voltage):

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-00."
b. Press [%LOAD] to scroll up to "P-62." (If you go past "P-62," press [VOUT] to scroll backwards.)
c. Press [CANCEL] to toggle to the parameter value.
d. Set the value to the nominal input voltage (200, 208, 220,230, or 240). Press [%LOAD] to increase the setting or [VOUT] to decrease the setting.

NOTE: If the UPS has optional 380-415 VAC input, set the nominal AC input voltage value to "240."

e. Press [RUNTIME] to enter the value. The new value should remain on the display.

102-4. Program parameter 63 to "l":

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-62."
b. Press [%LOAD] to go to parameter 63 (P-63).
c. Press [CANCEL]. The display should show "0."
d. Press [%LOAD] to change the parameter value to "l."
e. Press [RUNTIME] to enter the new value. The display should still show "l," and the BYPASS light should be on. Refer to the Alarm Status Table on the preceding page and see if ALARM light should be on or off. If either light is incorrect, repeat steps 102-4, d and e.

102-5. **If the BYPASS light will not** come **on:** When input line is bad, the UPS will not transfer to bypass mode, and the BYPASS light will not come on. Follow these steps:

a. Turn off the load equipment.
b. Turn the UPS keyswitch to "OFF."
c. Turn the AC Disconnect switch to **"OFF."**
d. Turn the MBB bypass switch to "LINE."
e. Turn on the load equipment.

102-6. If the BYPASS light came on, you can safely operate the MBB bypass switch. Quickly turn the bypass switch from "UPS" to "LINE."

Now you can shutdown the UPS to replace the batteries.

102-7. Open the front door of the UPS. Turn the key switch to "OFF."

102-8. Disconnect AC input power to the UPS

CAUTION! Turning the key switch to "OFF" is **not sufficient.**

102-9. Go to Section 200, "Removing the Batteries" on page 13. Do not do Section 103. You will come back and complete steps 102-10 through 102-14 after completing the battery installation.

When battery installation is finished, complete steps 102-10 through 102-14 to restart the UPS.

102-10. Before continuing:

a. Reapply AC line.
b. Turn the UPS key switch to "AUTO."
c. Look at the UPS front panel lights:
   - The ALARM light status is shown in Table 3-Alarm Status. (See page 6 or 10.)
   - The BYPASS light should be ON.
   - The LINE light should be OFF.

IMPORTANT! If the ALARM light status is wrong or the BYPASS light is OFF, repeat steps 102-2, 102-3 and 102-4 before continuing.

102-l 1. Quickly turn the MBB bypass switch back to "UPS."

102-12. Enter the user password (377). See step 102-2.

102-13. Program parameter 63 back to "0":

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-00."
b. Press [%LOAD] to scroll to "P-63." (Use [VOUT] to scroll backwards if you go past "P-63.")
c. Press [CANCEL]. The display should show "I."
d. Press [VOUT] to change the value to "0."
e. Press [RUNTIME]. The display should show "0," and the BYPASS and ALARM lights should now be OFF. The LINE light should be ON.

If the BYPASS light will not turn off: When input line is bad, the UPS will not transfer out of bypass mode, and the BYPASS light will stay ON. If this occurs, you must wait until input AC line is good. If the BYPASS light stays ON for an extended period of time, have an electrician check your AC line or call Best Power Worldwide Service at I-800-356-5737 or l-608-565-2100.

102-14. Press [VLINE] twice to exit the parameter mode. The load is once more protected by the UPS.

Section 103: Using Battery Maintenance Mode

Battery maintenance mode allows a qualified service person to service the batteries without powering down the loads connected to the UNITY/I unit. Battery maintenance mode should be used only when the unit does not have an external bypass switch and is powering critical loads that cannot be shut down while servicing the batteries.

IMPORTANT! In battery maintenance mode, the unit **does not** regulate voltage or provide back-up power in case of a power outage.

> ⚠ CAUTION!
>
> When the unit is in battery maintenance mode (Parameter 63 set to "I"), there is still live voltage inside the UPS.
>
> Battery maintenance mode (Parameter 63 set to "I") should be used during **battery maintenance only.** DO **not** use battery maintenance mode for any other type of UPS service or maintenance.

103-l. Verify the stability of the AC line. If there are irregularities with the input AC line, Best Power recommends that you do not use battery maintenance mode at this time.

- Press the [VLINE] key on the front of the unit. Watch to see if the input voltage is stable.
- You can also check the UPS system log to see if the unit has frequently switched to battery power (inverter) recently. See the *UNITY/I* User Manual for instructions on viewing the system log. Look for the system event code "in" (inverter).

103-2. Access parameter mode and enter the user password (377) as follows:

NOTE: When the unit is in parameter mode, each of the front panel keys has a specific function. The label inside the front door of the unit explains the parameter mode key functions. The label also shows a "Programming Template" with alternate key names that correspond to the parameter mode key functions.

a. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two (2) seconds. Release them when the display reads "P-00."

b. Press [CANCEL]. The display should read "0."

c. Use the [%LOAD] key **or** the [VOUT] key to change the display reading to "377."

NOTE: Use the [%LOAD] key to **increase** the value. Use the [VOUT] key to **decrease** the value. If you hold down either key, the display begins to scroll more quickly.

d. Press [RUNTIME]. The display should read "l." If it does not, repeat steps "c" and "d."

e. Press [CANCEL] The display should read "P-00."

103-3. Enter the nominal AC input line voltage in Parameter 62 (Nominal Input Voltage) as follows:

a. The display should show P-*XX* (where *XX* is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to "P-62."

b. Press [CANCEL]

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to the nominal AC input line voltage (200,208, 220, 230 or 240).

NOTE: If the UPS has optional 380-415 VAC input, set the nominal AC input voltage value to "240."

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read "P-62."

103-4. Put the unit into battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "I" as follows:

a. The display should read P-*XX*, where *XX* is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to "P-63."

b. Press [CANCEL]. The display should read "0."

c. Press the [%LOAD] key to change the display reading to "I."

d. Press [RUNTIME]. The display should read "I."

103-5. Look at the LEDs on the UPS front panel. The LINE and BYPASS LEDs should be on, and the BATTERY LED should be **off,** as shown in Figure 1. The ALARM LED state is shown below.

Table 3-Alarm Status Table (table duplicated on page 6)

UNITY/I Model	Serial Number	ALARM LED State-Battery Maintenance Mode
3K	25098 and below	ON
	25099andabove	OFF
4K	25097 and below	ON
	25098 and above	OFF
5K	20778 and below	ON
	20779andabove	OFF
8K	25097 and below	ON
	25098 and above	OFF

See the table on page 10 for Alarm status

Figure 1: Battery Maintenance Mode LEDs

> **⚠ CAUTION!**
>
> If the front panel LEDs do not light as shown in Figure 1, the unit is **not** in battery maintenance mode and it is **not safe to service the** batteries. Repeat Section 103-I to 103-5 or power down the UPS as instructed in Section 101.

NOTE: If, after repeated attempts, the unit does not transfer to battery maintenance mode, the AC input voltage may be out of tolerance. Call Best Power Worldwide Service for technical assistance.

103-6. Once the UPS is in battery maintenance mode, go to Section 200, "Removing the Batteries," on page 13. You will complete steps 103-7 through 103-10 after the battery installation is done.

When battery installation is finished, complete steps 103-7 through 103-10 to restart the UPS

103-7. Access parameter mode and enter the user password (377) as follows:

a. Simultaneously hold down the **[CANCEL]** and **[RUNTIME]** keys. Release them when the display reads **"P-00."**

b Press **[CANCEL].** The display should read "0."

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to "377."

d. Press **[RUNTIME].** The display should read "I."

e. Press **[CANCEL].** The display should read **"P-00."**

103.8. Take the unit out of battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "0" as follows:

a. The display should read **P-00. Use** the [%LOAD] key or the [VOUT] key to change the display reading to "P-63."

b. Press **[CANCEL].** The display should read "I."

c. Press the [VOUT] key. The display should read "0."

d. Press [RUNTIME]. The display should read "0."

IMPORTANT:

The BYPASS LED should be off and the LINE LED should be ON.

If the BYPASS LED is ON, the unit is still in battery maintenance mode. Repeat steps "A" through "D" above. If the BYPASS LED remains lit, call Best Power Worldwide Service for technical assistance.

103-9. Press [VLINE] twice to escape parameter mode. If you have an "A-l 7 " alarm, press CANCEL for five (5) seconds to clear alarm.

103-10. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The LINE LED should be ON, and the BATTERY, BYPASS, and ALARM LEDs should be off.

Section 200: Removing the Batteries

IMPORTANT: The steps in Sections 200 and 300 must be performed in order.

201. To gain access to the batteries, take the front panel off the UPS as shown in 201-1, below.

201-1. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit. (See Figure 2. This figure shows the 8K model. There are only two screws in the 3K, 4K and 5K models.) Also, remove the bottom narrow front panel. There are two narrow front panels on the 8K.

On the 8K, remove the front kick plate (found below the front ventilation panel); slide it upward, then pull it away from the unit.

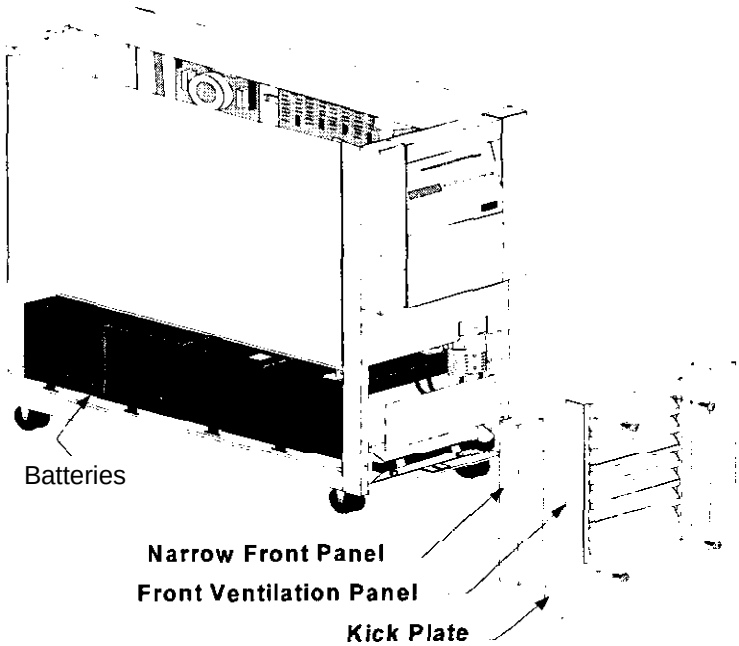


Figure 2

201-2. At the front of the unit, remove the bolt that secures the battery tray to the chassis floor. (See Figure 3).

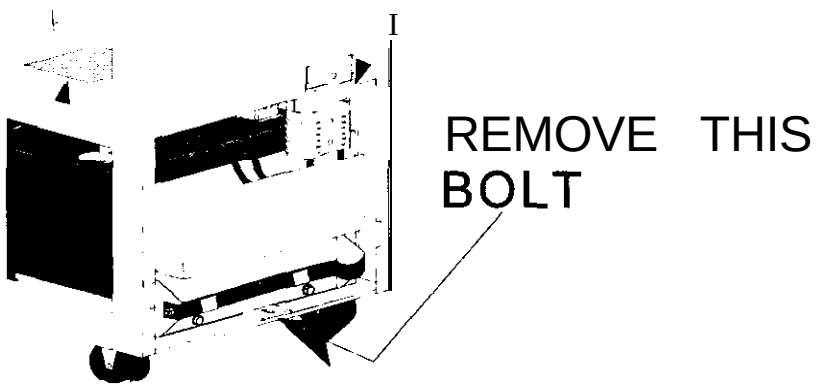


Figure 3

201-3. Disconnect the DC connector by pulling it down. (See Figure 4.)

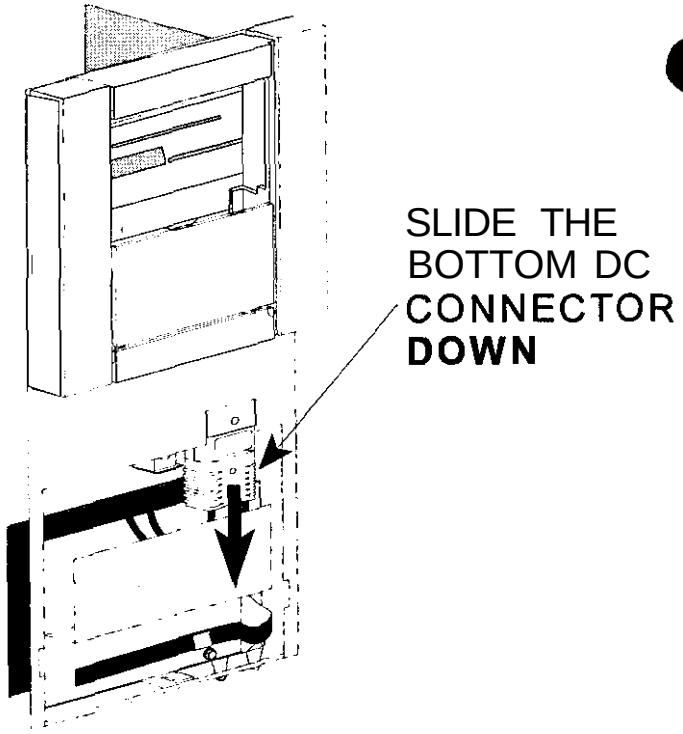


Figure 4

201-4. Disconnect the HRS-370 "quick connect" connector on the front of the battery tray. (See Figure 5.)

201-5. Note! The end of the battery tray with the strap will drop to the floor as you slide out the tray. Do not drop this very heavy hay on your toes or hands! Take the strap and *carefully* pull the battery tray out of the unit just far enough to expose all of the battery terminals.

Note the battery cable wiring order and the position of the battery tie down buckles so that you can install new batteries in the same fashion.

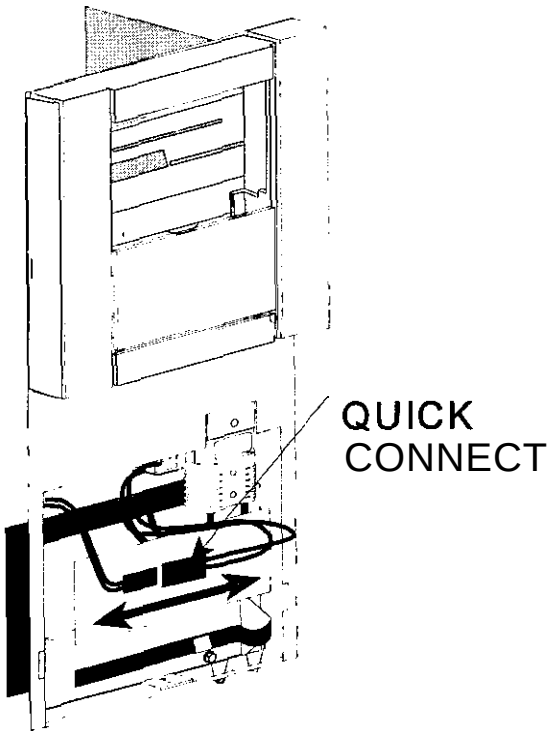


Figure 5

Section 300: Replacing the Batteries

a

301. Installing batteries and putting the UPS together.

301-1. Replace the old batteries with new ones of the same **series and type** and rewire in the same order See Figure 6.

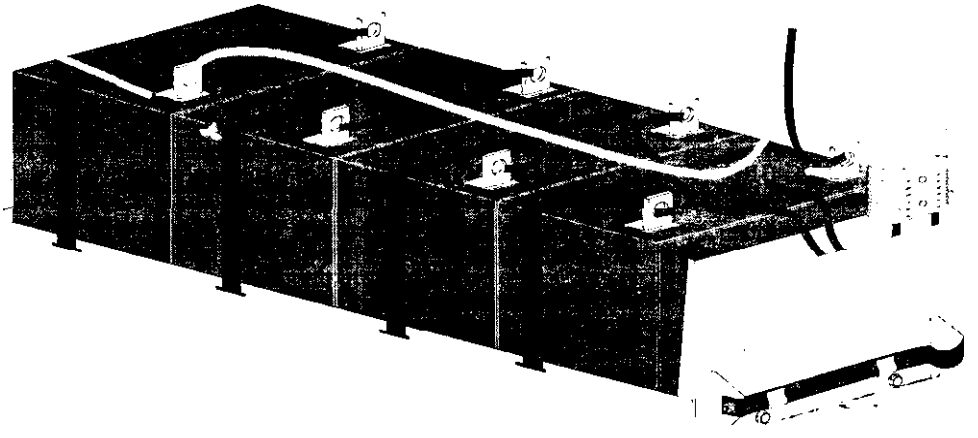


Figure 6

> **⚠CAUTION!**
>
> **When pushing the battery tray into the unit, be careful not to pinch your fingers between the battery tray and the chassis.**

301-2. Make sure that the HRS-370 “quick connect” connector is not in the battery cavity. Use the palms of your hands to push the battery drawer all the way into the unit.

301-3. Precharge and then switch on the DC disconnect switch on the external battery cabinet(s), if applicable.

301-4. Reconnect the “quick connect” connector on the front of the battery tray. (See Figure 5 on page 14.)

301-5. Replace the bolt that secures the front of the battery tray to the floor of the chassis. (See Figure 3 on page 13.)

301-6. Reconnect the DC connector at the bottom of the unit. (See Figure 4 on page 14.)

301-7. Replace the bottom narrow front panel(s). If you have a UT8K, also replace the front kick plate. (See Figure 2 on page 13.)

301-8. Replace the front ventilation panel and secure it with the screws. (See Figure 2 on page 13.)

30 1-9. **If your UNITY/I is softwired,** and you shut down your loads, return to Table 1 on page 4, and complete the remaining steps. If you did not shut down your loads and used the "Battery Maintenance Mode," complete steps 103-7 through 103-10 on page 11.

If your UNITY/I is hard-wired, go to the Section you selected from Table 2 on page 5, and complete the remaining steps to return the UNITY/I UPS to normal operation.

UTY 608
U
August 29, 1997

Generator Setup for UNITY/I UT3K, UT4K, UT5K, and UT8K

This UNITY/I technical supplement (UTY) describes how to program UNITY/I models to accept generator power. A qualified technician who is familiar with the UNITY/I must program the unit. If you encounter problems during this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S. and Canada only), 1-608-565-2100, or call your local Best Power office.

UNITY/I units automatically adjust to the input power available. This means that you should not need to reprogram a UNITY/I using input power from a generator. However, in some cases the UNITY/I does not accept generator power because the generator power is relatively unstable. To help the UNITY/I work with the input from the generator, you must follow steps 101 through 108 below to reprogram some parameters.

You can perform this procedure using the front control panel on your unit. (See Figure 1.) You can also perform this procedure through a dumb terminal or a computer running terminal emulation software connected to the DB9 communication port on the back of the unit. You must know how to display and program parameters. If you need more information, see the User Manual if you are using the control panel or UTY 501 if you are using a terminal or computer.

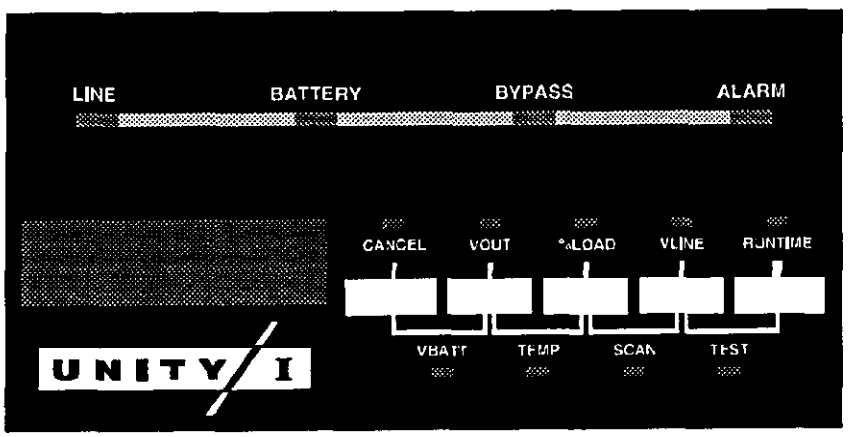
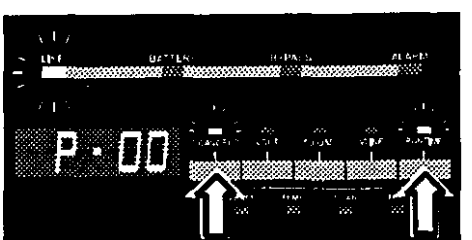


Figure 1

101. Enter the Service password.

From the front control panel:

a. Press the [CANCEL] and the [RUNTIME] keys together until the display shows P-00. (See Figure 2.)



Press [CANCEL] and [RUNTIME] together until the display shows P-00

Figure 2

b. **Then,** press **[%LOAD] until** the unit displays 2639. (See Figure 3.)

c. Then, press [RUNTIME]. The **display** should read 2 (for **password** level 2). (See **Figure** 4.)

Press [%LOAD] until the display shows 2639

Figure 3

From a computer or terminal:

a. **Set the UNITY/I to the proper baud rate. If the baud rate** needs to be changed:

i. press **the** [CANCEL] **and** the [RUNTIME] **keys** together until the display **shows** P-00. (See Figure 2 **on** page. **1.)**

ii. Then, press **[%LOAD] until** the **unit** displays 22. (See Figure **5.)**

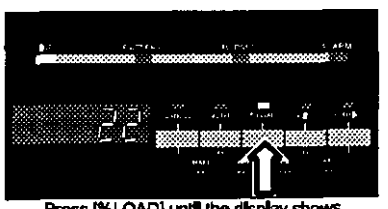
iii. Once **you** reach P-22, press [CANCEL]. Use the **[%LOAD]** key **or the [VOUT]** key **to** change the **display** to the **correct setting.** (See Table 1 below to determine the **correct** setting.)

iv. **To enter the new setting, press [RUNTIME].** To escape parameter mode, press [MINE] twice.

NOTE: ***To escape without saving,*** press the **[MINE] or the [CANCEL]** key.

Press [RUNTIME] until the display shows 2

Figure 4



Press [%LOAD] until the display shows 22

Figure 5

Table 1 Baud Rate Settings

Parameter 22 Setting*	Communication Mode
0 - F	Contact *mode.* Sets the delav (in seconds) on pin 2.
10	RS232 mode, 1200 baud.
20	RS232 mode, 2400 baud
30	RS232 mode, 4800 baud
40	RS232 mode. 9600 baud

*** Parameter 22 settings are in hexadecimal.**

b. Type P 00 2639 **and** press **<ENTER>.** The display should **read OK=>.**

102. Change parameter **#8** (Glitch Limit) to a value of **"25."**

From the front control panel:

press [CANCEL] to **return to** the parameter display, **then** press **[%LOAD]** or **[VOUT] until** the display reads P-06. **Then,** press [CANCEL] to display the **parameter** value. **Press [%LOAD] or [VOUT] until** the display reads 25. **Press** [RUNTIME] to save the value. The **UPS** should beep to indicate that you have saved the new value for parameter 8.

From a computer or terminal:

Type **P 08 = 25, then press <ENTER>.** The display should read **OK=*.**

103. **Change parameter #86** (Generator) to a value of **"1."** This sets the **inverter** lockout.

*From the front **control panel:***

Press [CANCEL] to return to the parameter display, **then** press **[%LOAD] or [VOUT] until the** display reads **P-66. Then, press [CANCEL] to** display the parameter value. Press **[%LOAD] or [VOUT] until the** display reads **1. Press [RUNTIME] to save the value. The** UPS should beep **to** indicate **that you have** saved **the** new value for parameter 86.

*From **a** computer or terminal:*

Type **P 86 = 1, then press <ENTER>.** The display should read **OK=>.**

104. **Change parameter #87 (Inverter Lock** Out) to a value of "5." This sets the number of cycles **after** a transfer **to** line **that** line-interactive operation is prohibited.

*From the front **control panel:***

Press [CANCEL] to return to the parameter display, **then** press **[%LOAD] or D/OUT] until the** display **reads P-67. Then, press [CANCEL] to** display **the** parameter **value.** Press **[%LOAD] or [VOUT] until the display reads 5. Press [RUNTIME] to save the value. The UPS** should **beep** to indicate **that** you **have** saved the new value for parameter 87.

*From **a** computer or terminal:*

Type **P** 87 **=** 5, then press **<ENTER>.** The display should read **OK=>.**

105. **Change** parameter **#78** (Line Delta Mode) **to** a **value** of 'Y." This sets the Line Delta to poor line.

*From the front **control panel:***

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display **reads P-76. Then,** press **[CANCEL] to** display the parameter value. Press **[%LOAD] or [VOUT]** until **the display reads 2. Press [RUNTIME] to save the value. The UPS** should beep to indicate **that** you **have** saved **the** new value for parameter 78.

***From a** computer **or** terminal:*

Type **P 78 = 2, then** press <ENTER>. **The** display should read **OK=>.**

106. Change parameter #9 (Frequency Slew Rate) to a value in the range of "400" to "700."

From the front control panel:

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display reads P-OS. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads a value between400 and 700. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 9.

From a computer or terminal:

Type P OS =, enter a value between 400 and 700, then press <ENTER>. The display should read OK=>.

Adjust this parameter until you find the optimum setting.

107. Change parameter #85 (Tap Delay Count) to a value of "4." This programs the "N" cycle delay for the relay operate and debounce times.

From the front control panel:

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display reads P-85. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 4. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 85.

From a computer or terminal:

Type P 85 = 4, then press <ENTER>. The display should read OK=>.

Table 2 Parameter Changes for Generator Setup

Parameter		New Value	Explanation
8	(Glitch Limit)	25	Increases number of glitches before unit goes to inverter.
86	(Generator)	1	Enables the inverter lockout to be set.
87	(Inverter Lock Out)	5	Sets the number of cycles after transfer to line that line-interactive operation is prohibited.
7 8	(Line Delta Mode)	2	Sets the Line Delta to poor line.
9	(Frequency Slew Rate)	400-700	Maximum frequency of slew rate of change.
85	(Tap Delay Count)	4	Programs the "N" cycle for relay and debounce times.

108. Exit from the parameter *mode.*

From the front control panel, press [VLINE] *twice* to exit from the parameter mode.

From a computer or terminal, type P 00 = ● .

Your UNITY/I UPS should now be set for the generator used in your application. If you still have trouble with the UPS locking to line, call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only), I-608-565-2100, or call your local Best Power office.

REVISIONS						
REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
A	ECN-7023	RELEASE TO PRODUCTION	02/28/01	TMM		

DWG NO. 9624S01 SH 1 REV A

POS. 2 OFF
POS. 1 MANUAL
POS. 3 AUTO
POS. 1 MANUAL 2-3 CLOSED 6-7 CLOSED
POS. 2 OFF 1-4 CLOSED 7-8 CLOSED
POS. 3 AUTO 4-5 CLOSED 8-1 CLOSED

S1 KEYSWITCH

SEE NOTE 3
360 VAC TRANSFORMER
TRN-0765

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB PCS-0029 (380V PCS-0038)

DIN RAIL

C1 70uF
C2 70uF

INLINE CONNECTOR

XMFR SIDE

DIN RAIL SIDE

CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.

TRN-1531
TRANSFORMER
PRIMARY
SECONDARY
INVERTER

AC PCB PCP-0428

INVERTER PCB #1 PCP-0420

TO OPTIONAL BATTERY CHARGER E6

.012uF CHASSIS FILTER CAP SHD NO. 1

INVERTER PCB #2 PCP-0420

USER INTERFACE PCB PCI-0017

LOGIC PCB PCL-0852

SW1 EPO RESET

TO OPTIONAL CHARGER

LAB DIAGNOSTICS PORT

CHASSIS GND VIA MOUNTING SCREW

DC PCB PCP-0432

E5 +BATT

S2

YELLOW (WIA-1843)
YELLOW (WIA-1843)
RED (WIA-1842)
(WIA-1800)
(WIA-1841)
(WIA-1192)

SEE NOTE 2 OPTIONAL EXTERNAL DC

F1
F2
FUSE HOLDER CHASSIS MOUNTED
FUSE BUS-BAR BUS-0303
FUSE HOLDER CHASSIS MOUNTED

ANDERSON CONNECTOR

WIRE STUD

AUXILLARY CHARGER OPTION WITH NO INTERNAL BATTERIES

OPTIONAL AUX CHARGER PCB PCP-0286

INTERNAL BATTERIES (STANDARD)
PRECHARGE

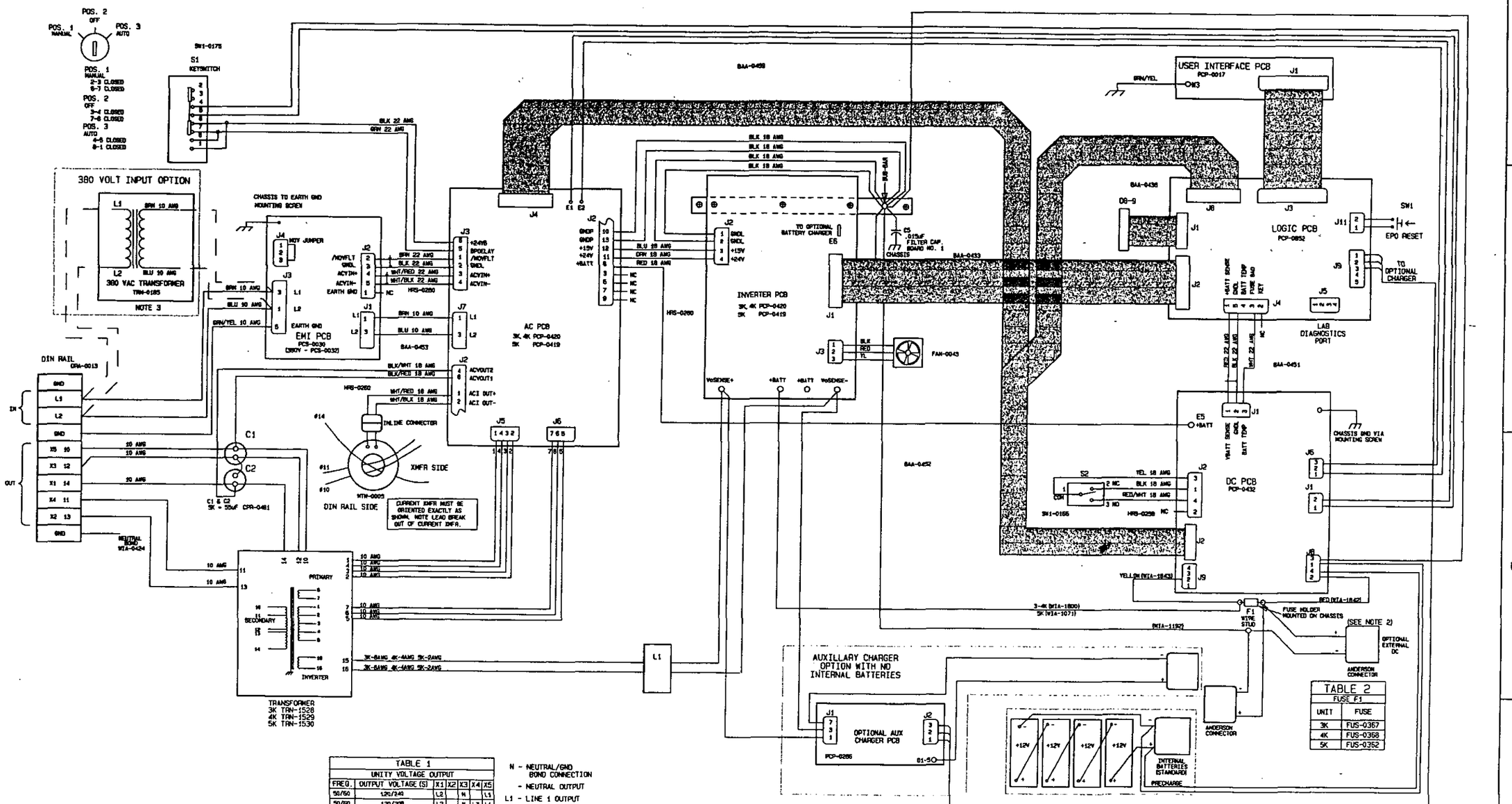
TABLE 2	
F1 & F2 FUSE	UNIT
FUS-0308	8A

TABLE 1 UNITY VOLTAGE OUTPUT						
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220*	L2	N		L1	
60	127/254	L2		N		L1
60/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
60	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. 380 VOLT INPUT OPTION ONLY.

CAD SYSTEM: PCAD 8.7	DIMENSION TOLERANCE	APPROVED	BEST POWER A UNIT OF GENERAL SIGNAL
DATABASE: /9624-A.PCB		TIM WALSH 02/28/01	UNITY I 8 KVA SYSTEM SCHEMATIC-STANDARD & WITH OPTIONS
PROPRIETARY	DO NOT SCALE DRAWING	N/A	SIZE D DWG NO. 9624S01 REV A
			SCALE: NONE SHEET 1 OF 1



REVISIONS						
REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
A	ECN-7023	RELEASE TO PRODUCTION	02/28/01	TMW		

9623S01 — 1 — A

TABLE 1
UNITY VOLTAGE OUTPUT

FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
60	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2
FUSE F1

UNIT	FUSE
3K	FUS-0367
4K	FUS-0368
5K	FUS-0352

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. 380 VOLT INPUT OPTION ONLY. (5K ONLY)

CAD SYSTEM: PCAD 8.7
DATABASE: /9623-A.PCB
PROPRIETARY
PROPRIETARY INFORMATION ON THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE EXPRESSLY PROHIBITED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED TO BEST POWER UPON DEMAND.

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
INCHES ±
MM. XX. ± .4 MM
MM. XXX. ± .13 MM
ANGLE ± 1°
DO NOT SCALE DRAWING

APPROVED
DRAWN BY: TIM WALSH 02/20/01
CHECKED BY: 2-28-01
ENGINEERING APPROVAL: 2-28-01
MANUFACTURING APPROVAL: 2-28-01
QUALITY APPROVAL: 2/28/01
P.C. PART NUMBER ASSIGNED: N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
TITLE: UNITY I 3-5 KVA SYSTEM SCHEMATIC & OPTIONS
SIZE: D — 9623S01 — REV: A
SCALE: NONE — SHEET 1 OF 1

100 Introduction

The following sections provide general information about UNITY/l, including technical support information, warranty information, information on ordering exchange parts, available options, and product specifications on standard models. Before using this service manual you should be familiar with the UNITY/I User *Manual* and the *UNITY/I Installation Manual*. If the user or installation manual has been misplaced, contact Best Power Worldwide Service or your local BEST office for a replacement.

101 General Information

This manual covers the following UNITY/I single-phase units:

- **Models UT3K, UT4K, UT5K and UT8K.** The model number is located on a label inside the unit's front door.

- **Units with versions 1.00 to** 1.09 **software.** To find the software version, view Parameter 128 or look at the label on the EPROM located on the logic board. See Section 308 of this manual for instructions on how to check parameters.

BEST product changes ensure that our customers get a competitively priced product that provides optimum performance and reliability. There have been three major phases of products in the UNITY/I line.

PHASE I was the early production UNITY/I product. This included serial numbers O-19999 for 3 to 5 KVA models and 0 to 24999 for the 8 KVA model.

PHASE II followed for the 3 to 5 KVA model serial numbers 20000 to 24999 and included these changes:

A. External DC connections made standard with a gray DC plug mounted at the rear of the UPS, mating to the plug on the fuse box at the external battery connection.
B. External battery cabinets became available.
C. Internal battery tray connections changed and the fuse board was moved inside.

PHASE III changes for the 3 to 5 KVA model serial numbers 25000 and up consisted of:

D. Fuses were removed from the fuse board and the board was moved from bottom to the inside of the front panel.
E. Logic daughterboard was added.
F. AC daughterboard was added.
G. Default voltage regulation was set to 5%, programmable to 3%.
H. Circuit board mountings were improved.
I. Wooden packaging was used for shipping.

PHASE II and III changes (listed in A through I) occurred at the same time in the 8 KVA model, beginning with serial numbers 25000 and up.

This manual does not cover Customer Purchase Options (CPOs) or changes made in the UNITY/I product after this manual was published.

102 Technical Support

Best Power has an outstanding Service Center. If you have a question about your UNITY/I UPS, write or call BEST Power Worldwide Service. BEST Power Worldwide Service is open every business day from 7:00 a.m. to 8:30 p.m. (U.S. central time), and a technician is on call to answer questions 24 hours a day, 365 days a year.

Before contacting Best Power Worldwide Service, please have the following information available for the technical support staff

- **The unit serial number,** located inside the unit's front door. BEST uses the serial number to track service records and system modifications.
- **A description of the** question or problem, including any display lights or alarm codes.

Call from a telephone located near the UPS, if possible.

Technical Support Toll-Free:	l-800-356-5737 (U.S.A. and Canada)
Technical Support Phone:	I-608-565-2100 (Worldwide)
Technical Support Fax:	l-608-565-2509
BBS:	l-608-565-7424
Worldwide Web Site:	http//www.bestpower.com
e-mail:	best.service@bestpower.gensig.com

Mailing address: Best Power Worldwide Service
P.O. Box 280
Necedah, Wisconsin 54646 U.S.A.

Outside the U.S.A. and Canada, contact your local BEST office. See the back cover of this manual for Best Power offices located worldwide.

The following technical services are also available:

- **Field** Support: To have your system started up, maintained or repaired by a BEST factory-trained technician, call Best Power Worldwide Service.

- **Service Training:** To arrange factory training for your in-house service technicians, call l-800-356-5794 (U.S.A. or Canada) or l-608-565-7200 for pricing and workshop information.

103 Warranty Information

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

Besides the standard two year warranty, Best Power offers Warranty Enhancement Plans to meet your service and maintenance needs. Contact BEST Power Worldwide Service for detailed information about these and other warranty enhancement plans

104 Ordering Exchange Parts

BEST's products are warranted for two years; see the Limited Two-Year Warranty in the *UNITY/I User Manual* for details. If a product fails while it is under warranty, you may order replacement parts for exchange or you may send in the failed part for repair; you are responsible for all shipping costs. After the warranty has expired, you may order exchange parts or send in the failed parts for repair.

To order exchange parts, call BEST Power Worldwide Service at l-800-356-5737 (U.S.A. and Canada), or l-608-565-2100, or the nearest BEST office. Best Power Worldwide Service will determine which parts you need and tell you the cost of the parts. You must then fax or mail a Purchase Order, a MasterCard/VISA number, or accept COD delivery, even if the parts to be replaced may still be under warranty. BEST will ship you the new exchange parts with an invoice.

After your unit has been repaired, return the old parts for exchange. If the parts are under warranty, you will receive a credit memo from Best. The exchange parts procedure can vary For additional information, please call BEST Power Worldwide Service. For more warranty information, see the *UNITY/I User Manual.*

105 Options

BEST offers a number of options for the UNITY/I If you would like more information, please contact your local BEST office or dealer.

Bypass Switches:

If your UPS does not have an AC input plug, an external bypass switch lets you conveniently transfer your protected equipment to direct AC input power when it's time to service the UPS. Your local BEST office can tell you if an external bypass switch is recommended for your UPS.

CheckUPS® Automatic Shutdown Software:

CheckUPS software runs on your computer and enables a computer to communicate with the UPS. CheckUPS does a complete unattended shutdown of your computer if you have an extended power outage. CheckUPS II also monitors site power quality and has graphic display capabilities. Some CheckUPS II contain a resident SNMP agent to work with selected Network Management Software. Check with BEST for the application to fit your system.

Environmental Monitoring:

EnviroCom™ I and II models monitor many UPS and environmental conditions and phones you when there is a problem.

Extended Runtime and Faster Charging:

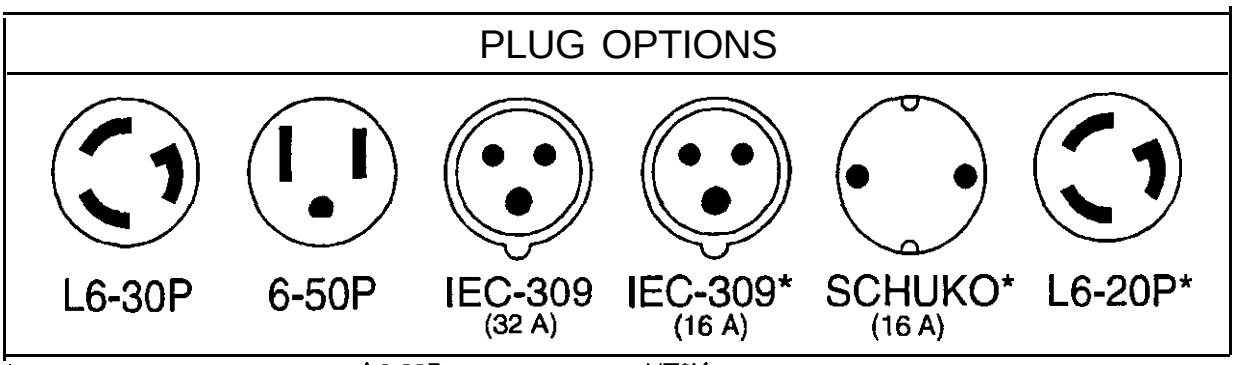
If you want extended runtime, call BEST for information on adding additional battery or charger capacity. (See BEST publication FSS-393, in Section 700, for further information.)

Interface Kits:

Interface cables and assemblies are available for a number of computer systems. These kits allow your computer's software to shut down your protected equipment safely during an extended power outage. See the CheckUPS Automatic Shutdown Software option.

Plugs:

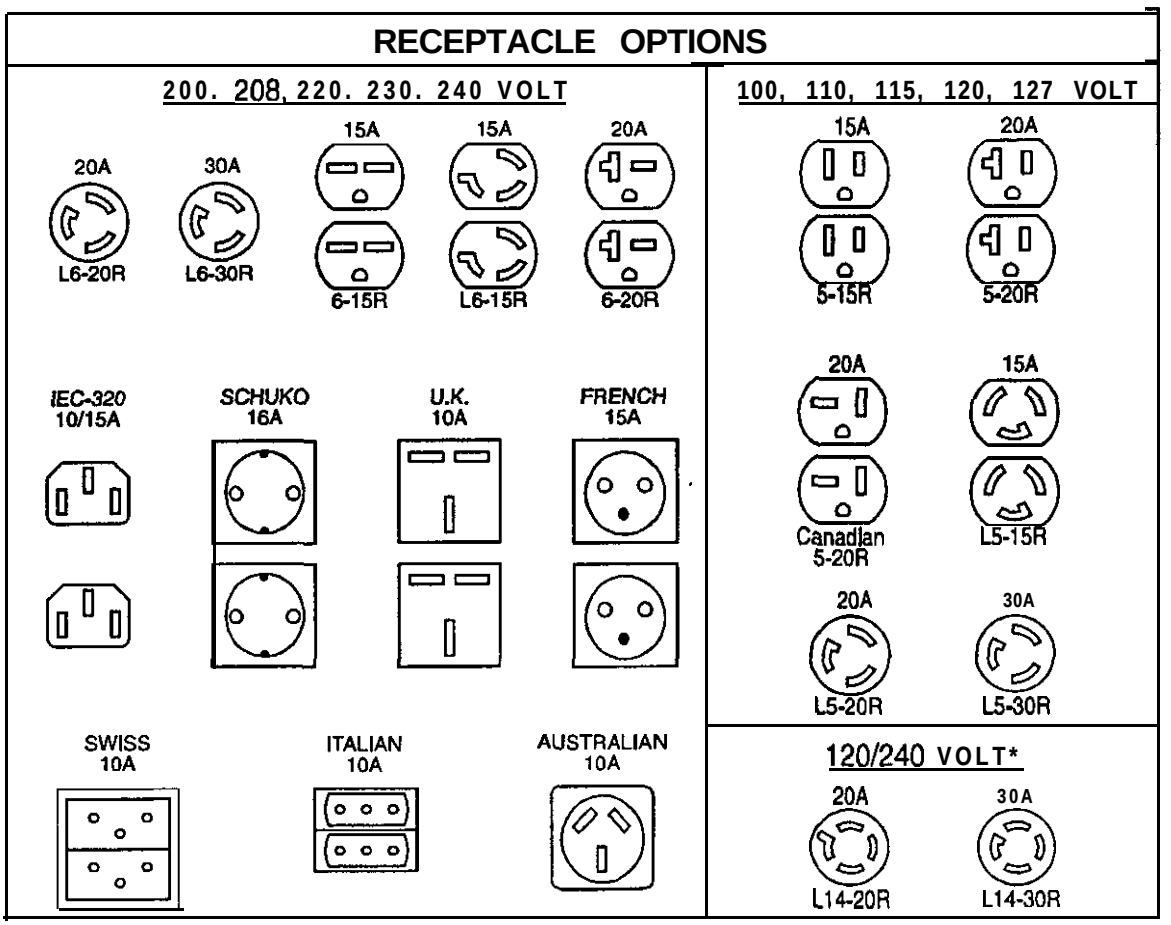
The following input plugs are available for UT3K, UT4K and UT5K units:



*** IEC-309 (16 A), SCHUKO. and L6-20P plugs available on UT3K only.**

Receptacles:

The following output receptacles can be ordered on new units:



*L14-20R and L14-30R available for 120/240 volts only.

Warranties: Besides the standard two-year warranty, BEST offers warranty enhancement plans to meet your service and maintenance needs. Call the nearest Best Power office for more information.

106 Specifications, Standard Models

Table 106-l: Specifications, Standard Models

Model Number	UT3K	UT4K		
Capacity (KVA/KW)	3	4	28	45
Max. Input Current (Amps)			27	43
200 VAC input	17	22	25	41
208 VAC input	17	22	24	39
220 VAC input	16	20	23	38
230 VAC input	15	20		
240 VAC input	14	19		
Mar. Output Current per phase (Amps)				
127 VAC output	12	16	20	31
100/200 VAC output	15	20	25	40
208 VAC output	14	19	24	38
1 10/220 VAC output	14	18	23	36
11 5/230 VAC output	13	17	22	35
120/240 VAC output	13	17	21	33
Audible Noise (dBA) on AC Line at 1 meter	40	40	40	40
Maximum DC Amps (Nominal Battery)	72	98	123	196
Nominal DC Voltage	48	48	48	48
Efficiency on AC Line	95%	96%	96%	96%
Frequency on AC Line	50/60 Hz • 3Hz	50/60 Hz ±3 Hz	50/60Hz • 3Hz	50/60 Hz ±3
Total Harmonic Distortion THD	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Heat Dissipation				
BTU/hour:	539	569	711	1138
KW/hour:	0.158	0.167	0.208	0.333
Noise Rejection	Up to 90 dB in normal mode from 100 kHz to 10 MHZ. Up to 50 dB in common from 100 kHz to 10 MHZ.			
Operating Temperature	0" to 40" c 32" to 104" F	0" to 40" c 32" to 104" F	0" to 40" c 32" to 104" F	0" to 40' 32" to 10
Relative Humidity (non-condensing)	0 to 95%	0 to 95%	0 to 95%	0 to 95

Model Number	UT3K	UT4K	UT5K	UTSK
Capacity (KVA/KW)	3	4	5	8
Mar. Input Current (Amps)				
200 VAC input	17	22	28	45
208 VAC input	17	22	27	43
220 VAC input	16	20	25	41
230 VAC input	15	20	24	39
240 VAC input	14	19	23	38
Runtime (min.)				
100% Load:	4.5	9	6	11
75% Load:	7	14	9	17
50% Load:	13	24	16	27
Unit Weight (lbs/kg) with Standard Batteries	200/91	280/127	2951134	490/222
Steady State Output Voltage Regulation'	± 5% of nominal	± 5% of nominal	± 5% of nominal	± 5% of nominal

'Early versions of the UNITY/I product were rated at ± 3 % regulation. This includes all models with 1.00 - 1.08 software.

Later models are rated at ± 5 % regulation, when changes to reduce unnecessary tap changing were incorporated in software version v1.09.

200 System Description and Theory of Operation

The following sections describe the **UNITY/I** system, the theory of operation, and a description of the major system components found on each board.

201 System Description

The single-phase **UNITY/I** UPS protects sensitive electronic equipment from blackouts, brownouts, lightning, spikes, sags, **surges,** and noise. The UPS provides computer grade power and current models provide ± 5% steady state voltage regulation to the loads.

The **UNITY/I UPS is line-interactive,** modifying and conditioning line power by interacting with AC input (see Figure 201-A). Raw line power passes through the EMI board, which provides electromagnetic interference filtering and lightning protection. Output voltage is regulated over a wide input voltage range using the multi-tap transformer. While the unit is on AC line, the microprocessor controls the charger to keep the batteries charged to the optimum level.

If AC line fails, if there is a power outage, or if AC line is unstable, the UPS switches off AC line input and turns on the inverter. The inverter converts DC battery power into pulse-width modulated DC. This power is supplied to the transformer and the output filter to create computer-grade AC power.

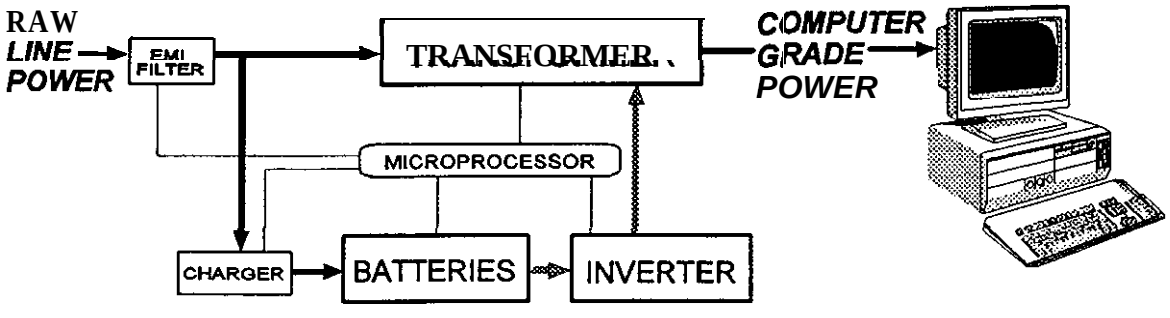


Figure 201-A: UNITY/I Simplified Block Diagram

Features of the UNITY/I include the following:

- **Full Kilowatt Rating:** The UNITY/I UPS is rated at unity power factor. This means that UNITY/I always supplies the same amount of capacity in KVA. As the power factor approaches unity (1.0), the unit provides more KW. At unity power factor, the unit provides full KW capacity.

- **Microprocessor Control:** An internal microprocessor controls, monitors, and meters the unit's internal functions. You can change and calibrate the unit's parameters from the unit's front panel or from a terminal, computer, or modem connected to the DB9S communication port.

- **Universal Input and Output Voltages in Every Unit:** The UNITY/I UPS is a universal product. A single power transformer per model means that every unit can be configured for **any** of the possible UNITY/I input/output voltage configurations. Every unit operates over the nominal input voltage range of 200 to 240VAC, and output frequency can be selected at either 50 or 60Hz. Output voltage is dependent on wiring and a software setting. The output can be configured for 200, 208, 220, 230, 240, 100, 110, 115, 120, 127 (60Hz only), 100/200, 110/220, 115/230, or 120/240. Call BEST for other configuration options.

  An optional internal auto-transformer can be factory-installed so that the unit can operate at 380/400/415VAC input with the same available output voltage configurations as the standard unit.

- **Automatic Frequency Selection:** Every UNITY/I UPS can operate at 50Hz or 60Hz. The unit automatically selects a nominal frequency of 50Hz or 60Hz based upon the input frequency. When the unit runs on battery power, it provides output voltage at the selected frequency. When the unit runs on AC line, the output frequency is the same as the input frequency.

- **Software-Controlled, Multi-Mode Battery Charger:** The battery charger is designed to maximize battery life. The charger can be programmed according to battery manufacturers' recommendations, or a customer's preferred method.

- **Internal Bypass Switch:** The UNITY/I UPS has a built-in internal bypass switch that can be activated via a software parameter or a key switch. The "Battery Maintenance mode" software parameter allows a qualified technician to service the batteries without shutting down the loads. The key switch bypass (break-before-make) allows the loads to be powered directly from AC line if necessary. Although the unit cannot provide backup power or voltage regulation when in internal bypass mode, it does continue to provide lightning protection, noise protection, and isolated output.

- **PhonTek®:** PhonTek enables the UNITY/I to transmit UPS status data, including parameters and system logs, to Best Power Worldwide Service via a telephone line. This information assists service technicians in remote troubleshooting. The only equipment needed is a telephone with a detachable handset. Recent production models with V1.09 software were not sold as PhonTek-enabled units.

- **Alarms:** The UNITY/I UPS has alarms to alert you to conditions which require your attention. If the unit detects an alarm condition, it illuminates a red LED, sounds an audible beep, and shows an alarm code on its front display identifying the alarm. Early production models had 18 alarms, while more recent production models have 16 alarms and 2 advisory conditions. See Section 503 for more alarm information and details based upon Model and Serial Number.

202 System Theory of Operation

The UNITY/I UPS interacts with incoming AC line, modifying and conditioning the AC input to produce a specified AC output. The UNITY/I's control circuits, including the microprocessor, continuously monitor AC input and output voltage and other power conditions.

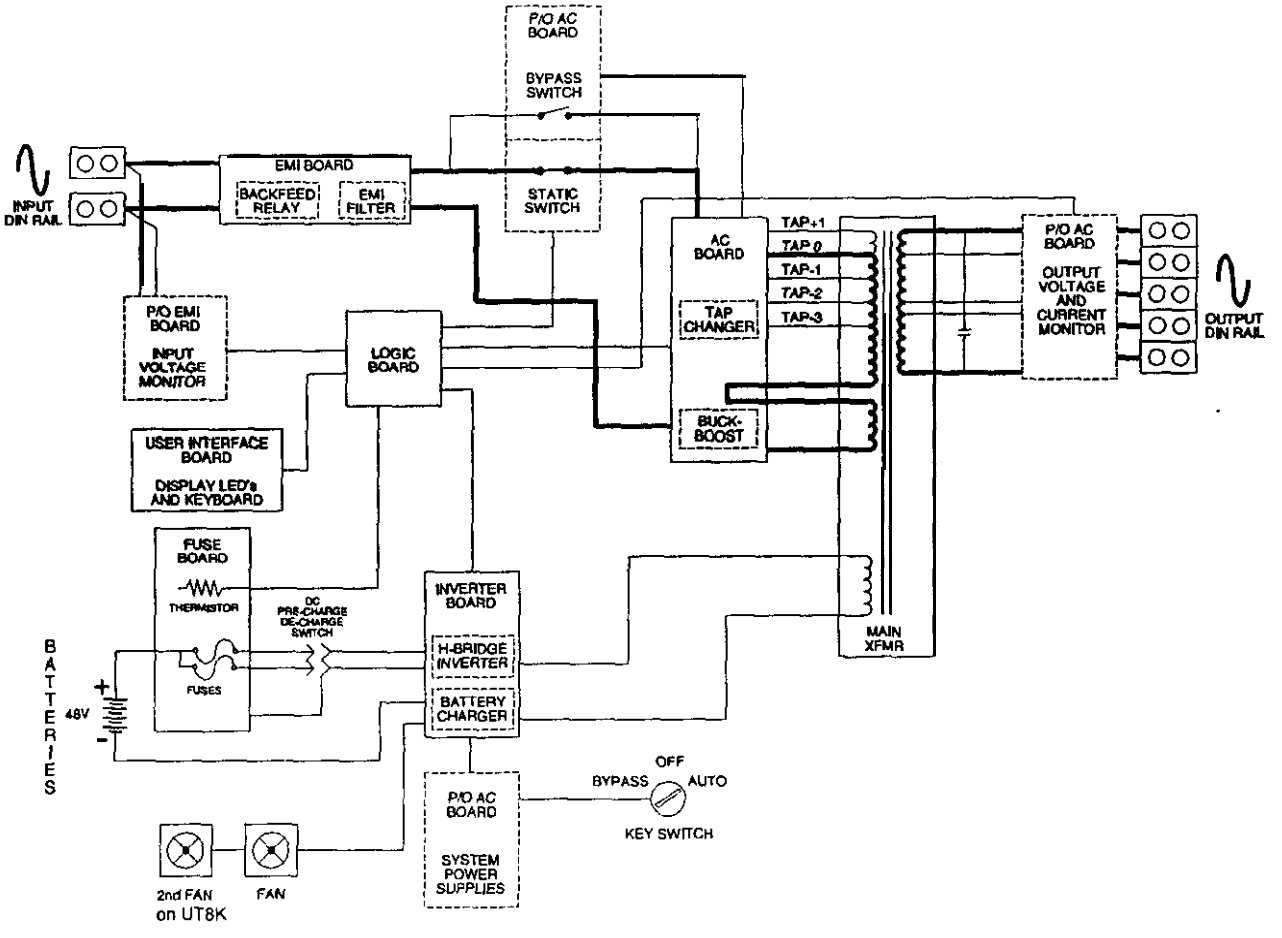


Figure 202-A: UNITY/I Operation on Line

During **operation** on **line (see** Figure 202-A), AC line passes through the EM1 filter and static switch to the tap-changing circuits on the AC board.

These circuits, controlled by the microprocessor, select the proper taps on the transformer's primary to compensate for highs or lows on the AC input line. The AC line is then coupled to the transformer's secondary and applied to the monitoring circuits and to the loads. Using this process, the UNITY/I regulates the steady state **output** voltage to ± 5% (default) of nominal and exceeds recommended CBEMA voltage regulation standards under any line, load, or battery condition.' See the information in Section 106, Specifications. Note the regulation differences in the footnote under Table 106-l.

When there is a power outage or when AC line does not meet the requirements set by the parameters, the control circuits **turn** off the static switch and open the tap relays. This removes AC line **from** the transformer's AC line primary (see Figure 202-B).

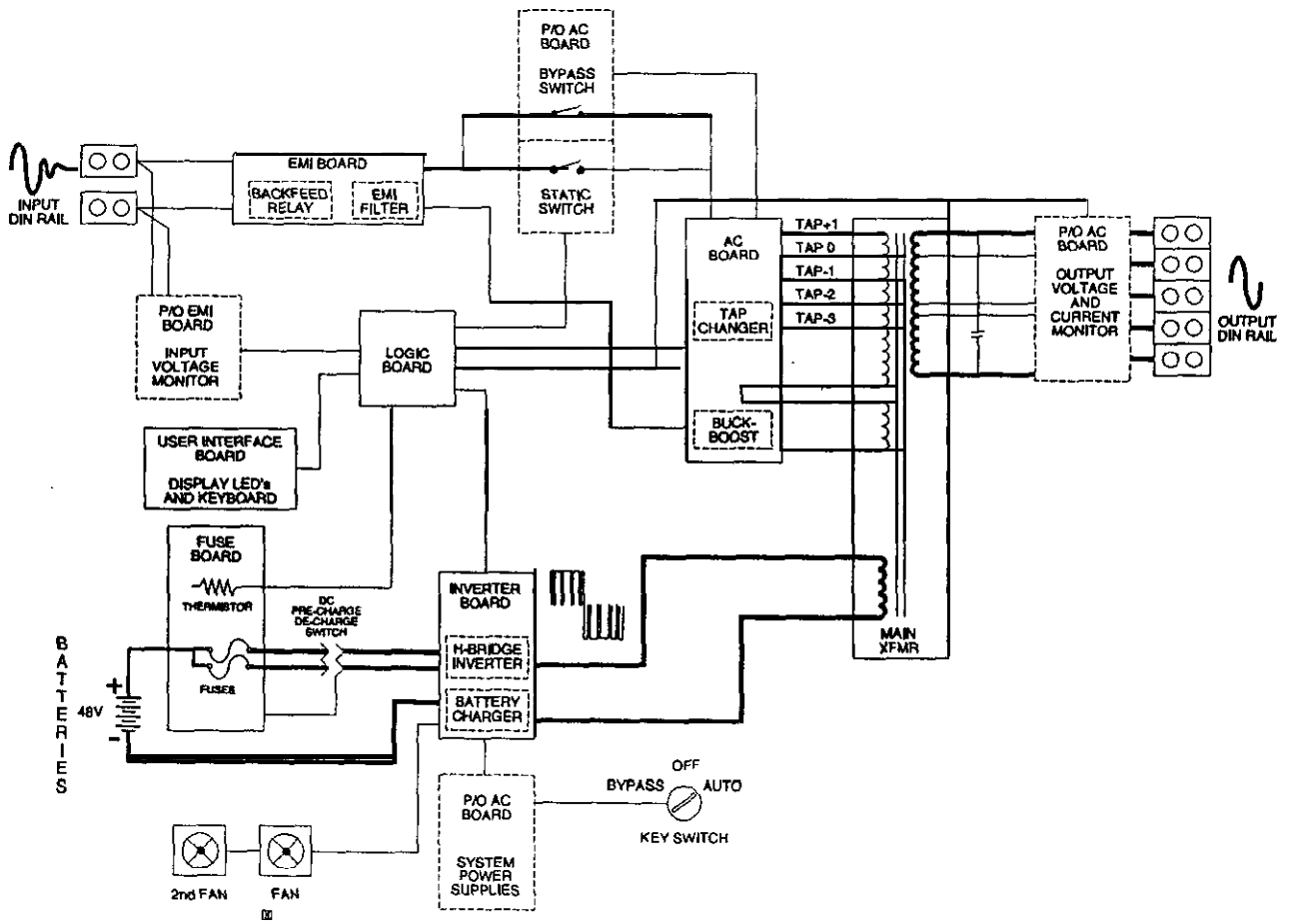


Figure 202-B: UNITY/I Operation on Invetter (Battery Power)

*In bypass mode and on initial restart after a Low Battery shutdown, the unit does not provide voltage regulation.

Before output voltage begins to decrease, the high-frequency H-bridge inverter uses battery power to provide pulse-width modulated DC to the transformer's inverter primary. The transformer and output capacitors smooth the pulsed DC into high quality sine wave output. The switching process is completed instantaneously, so the loads receive uninterrupted power.

If the AC line fault is a glitch, the inverter provides clean power to the loads by acting as a sub-cycle gap filler, filling in the missing portions of the sine wave. When line ghtches become excessively frequent, the unit switches to inverter operation for a minimum of two seconds. If the AC line fault is a high or low voltage condition within the adjustable limits of the tap changer, the control circuits adjust the tap changer and transfer the unit back to AC line. This process allows the unit to operate on line power over a wide input voltage ran ge (147-276VAC) and provide superior steady state output voltage regulation of ± 5%(default) of nominal. See Section 106 and Table 106-l along with the footnote about voltage regulation.

If the AC line voltage is not within the adjustable limits of the tap changer, the unit continues to run on battery power (inverter). When the unit runs on battery power, the BATTERY LED illuminates, and the unit beeps once per minute. The control circuits continue to monitor all parameters. Approximately every ten seconds, the micro processor calculates the estimated nmtime remaining, which can be viewed by pressing the [RUNTIME] key. If the estimated runtime falls below the Low Runtime Set Point (parameter 07), the unit activates a Low Runtime alarm (A-00), which alerts you to perform an orderly shutdown of the loads.

If the unit continues to run on battery power and the battery voltage drops below a load-dependent value calculated by the microprocessor, the unit activates a Low Battery alarm or advisory condition (A-08), a Low AC Out alarm (A-13), and an Auto Bypass alarm or advisory condition (A-16). If line does not return, the unit shuts down. When AC line does return, the unit automatically restarts' and begins to recharge the batteries. During this initially recharging, the unit provides unregulated output voltage to the loads while continuing to provide lightning protection, noise protection, over-vo ltage protection, and isolated output. Once the batteries reach 48 volts (from 2 to 5 hours), the unit continues to run in the non-regulating mode for an additional two minutes. The unit then resumes normal line-interactive operation.

If the UPS is running on battery power and acceptable AC line returns before a Low Battery shutdown occurs, the system matches the inverter's phase and frequency to the incoming AC tine using a software pbase-locked-loop (PLL) routine. AC line is monitored until two seconds (120 line cycles) of stable AC tine is detected. Control circuits then transfer the system to AC line by turning off the inverter and turning on the static switch. The unit resumes normal line-interactive operation and recharges the batteries.

The multi-mode battery charger is software controlled. Charger set points are programmable, so the charging profile can be tailored to the recommendations of a specific battery manufacturer or to a customer's preferred method. The battery charger has four charging modes (see Section 203-4.4).

A periodic battery test is done once every seven days (default). During the test, the unit first shuts off the charger and checks the battery voltage. The unit then switches itself to battery power for a set length of time. If the unit detects a possible battery problem or low battery voltage during the test, it immediately switches back to AC line power. A Check Battery alarm (A-04) is then activated. You can program the time of day that the test occurs, the number of days between tests, the test duration, and the day that the first test should occur.

You can disable the periodic battery test by setting parameter 76 to zero. If parameter 77 is enabled, "test on demand" can be activated via the front panel keys.

* If Auto Restart (parameter 03) is disabled, the unit must be manually restarted

Internal **bypass mode** provides power **to** the loads while replacing batteries, or if the UPS system fails. A bypass relay is connected in parallel with the static switch. This redundant power path can be used to bypass the static switch and power the output, provided that input AC line voltage is adequate to energize the bypass relay. In internal bypass mode, AC line continue! to be routed through the EMI board, thus maintaining lightning and noise protection. AC line IS then routed through the main transformer via the bypass relay and the tap changer on the AC board (see Figure **202-C).**

In internal bypass mode, the unit does not provide voltage regulation and does not charge the batteries or provide backup power from the batteries. The unit also provides over-voltage protection, as long as the logic board remains active (see Section 203-l .3).

To activate internal bypass mode, you can put the unit into either "Battery Maintenance Mode" via parameter 63 or, with loads disconnected, turn the key switch inside the unit's front door to "Bypass." The **BYPASS** LED on the front panel shows that the unit is in internal bypass mode.

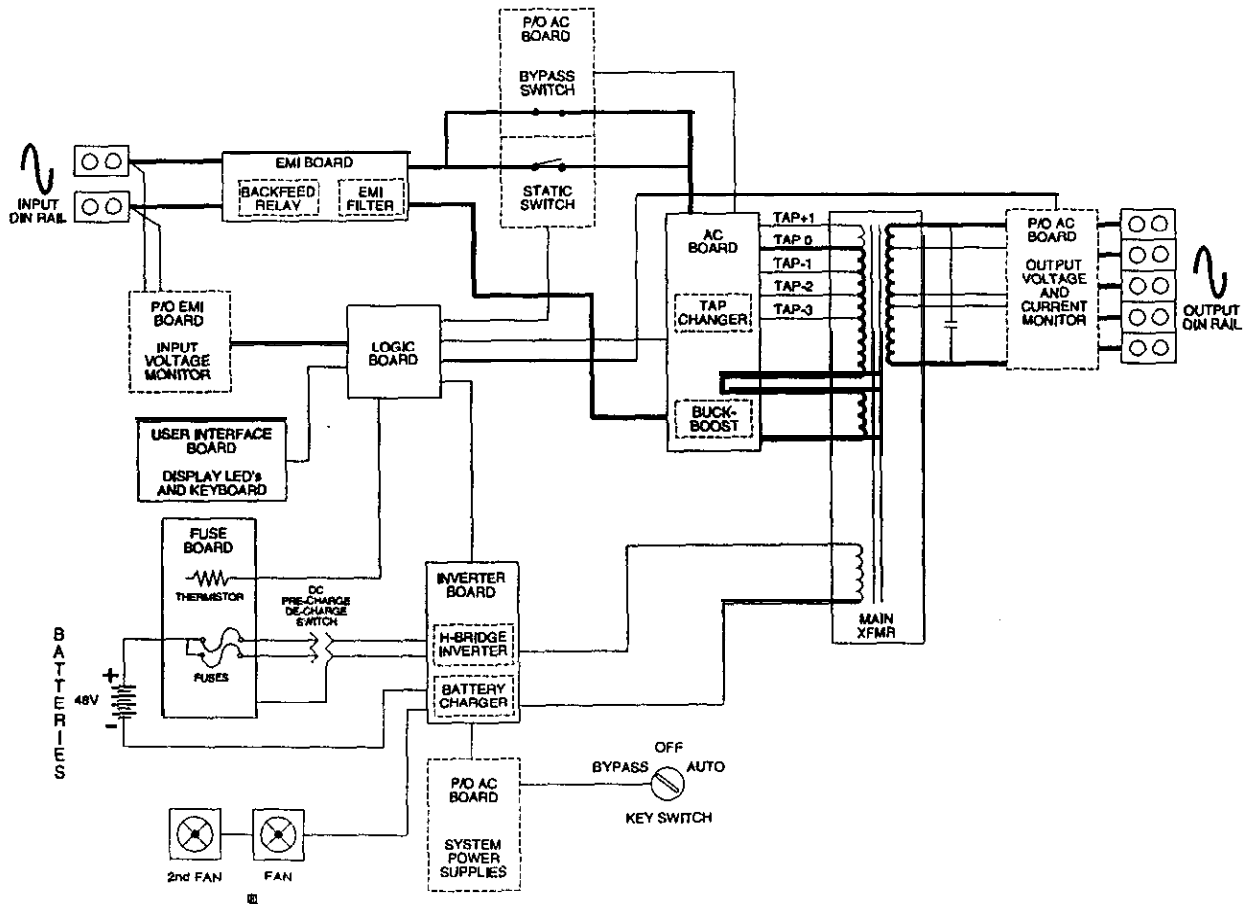


Figure 202-C: UNITY/I Operation in Internal Bypass Mode

The **UNITY/I is** designed to be **fault tolerant** so that, typically, the loads continue to receive power even if a UPS fault occurs,

- Parallel MOSFETs are used in the inverter, and parallel MOVs on the AC board. To improve the chances of continued run in the event of MOSFET or MOV failure, the failed component is isolated from the remaining components.

  The MOVs and the gates of the MOSFETs are fused individually, and the secondary components can handle the load. A MOSFET failure activates a Check Inverter (A-05) alarm MOV failure activates a Check MOVs alarm (A-15).

- The control circuits perform diagnostics on the tap system during every tap change se uence. If a tap system fault is found, the unit indicates a Tap Regulator alarm (A-12) and reches s to verify the fault, If the fault is an open tap relay, the unit identifies the faulty relay(s) and continues to regulate AC line with the functional taps whenever possible. If the unit detects a welded contact in the tap system, the unit remains on battery power to prevent internal damage to the UPS.

- Under normal conditions, the microprocessor generates a "watchdog" signal. In the unlikely event of a microprocessor failure, this signal disappears, and the bypass relay closes automatically. The loads can then receive power from the AC line even if the unit shuts down. The BYPASS LED on the front panel indicates that the unit is in internal bypass mode.

When an alarm condition occurs, the unit illuminates the ALARM LED, sounds an audible alarm (default), and shows an alarm code so you can identify the alarm condition. This information 'is stored in the unit's alarm log. (Refer to the alarm tables in Section 500 for more information.)

203 Major System Components

The **UNITY/I** consists of several major circuit boards: the AC board, the EMI board, the fuse board, the inverter board, the logic board, and the user interface board. The following sections contain the theory of operation for each of these boards, the transformer, and the batteries.

203-l AC Board Theory of Operation

The AC board :

- selects the proper transformer tap to regulate output voltage to +/- 5%.
- opens AC input line for inverter operation, closes it for AC line operation.
- keeps loads powered during a UPS failure by bypassing UPS circuitry.
- dampens power supply oscillations, detects MOV overcurrent conditions.
- supplies +24VDC and +15VDC to UPS circuits.
- monitors AC output voltage and current.

These functions are performed by the following: the static switch and static switch driver, the tap-changing circuits, the bypass circuit, the AC snubber and MOV failure detection circuit, the power supply, and the monitoring circuitry.

203-1.1 Static Switch and Static Switch Driver

The static switch responds to microprocessor signals to open or close the current path between AC line input and the main transformer.

The static switch is an Insulated Gate Bipolar Transistor (IGBT). Typically, the static switch opens when the UPS transfers to battery power, and closes when the UPS transfers back to line. The switch is closed during normal operation, and open during inverter or bypass operation. Whenever a Low Battery alarm or advisory condition (A-08) occurs, the unit operates in a non-regulating mode employing the static switch.

The ZGBT static switch is ON when the microprocessor sends a command via the control line SSON (Static Switch ON). When the static switch is ON, current flows from line to supply power to the main transformer and the loads.

The ZGBT static switch is turned OFF on command from either the microprocessor or the IGBT conduction limit circuit.

203-1.2 Tap-Changing Circuits

As incoming AC varies, the microprocessor signals the tap changing circuits to switch relays to select the appropriate transformer taps, The UNITY/I supplies all available voltage combinations from one linear transformer by changing the tap configuration (see Section 203-7 for information on the transformer).

Control signals are sent from the logic board to the AC board where they are decoded. The decoding circuitry opens and closes the major tap changing relays and buck/boost relays while also preventing illegal relay configurations.

During the tap change process, the unit transfers to battery power (inverter). This causes "dry" switching of the relays, which prevents arcing and prolongs relay life and reliability. When the tap change is complete, the unit transfers from battery power to line, and power is applied to the tap configuration via the IGBT static switch (see Section 203-1.1).

203-1.3 Bypass Circuit

The bypass circuit provides an alternate path for AC line to keep the loads energized. Bypass mode can be used to power loads when replacing batteries. When the unit is in bypass mode, AC line continues to be routed through the EMI board, providing electromagnetic interference filtering and lightning protection. AC line is then routed through the bypass circuit, the tap changers, and the main transformer, maintaining isolated output, As long as the logic board is active, the unit protects against over-voltage conditions, The unit does not provide voltage regulation or backup power when it is in bypass mode.

You can put the unit into internal bypass mode using the front key switch or the software parameter HotSwap (parameter 63). The front key switch is a break-before-make switch; power must be removed from the loads before a key switch bypass. During a key switch bypass, the logic board is not active, During a HotSwap bypass, (make-before-break) the loads remain powered, and the logic board remains active (unless it becomes de-energized).

The logic board activates alarms if conditions warrant. The system may begin an internal bypass automatically if a system failure occurs, The disappearance of the watchdog signal activates the bypass circuit (see Section 203-5.2).

203-1.4 AC Snubber Circuit and MOV Failure Detection

The AC snubber circuit dampens power oscillations and protects the IGBT static switch from over-voltage transients. Transients occur when loads are turned off, or when lightning-induced transients or other transients appear on the AC input.

MOVs clamp the short, high-energy pulses when the static switch turns off. Filter capacitors capture and dissipate transient energy. If the IGBTs are forced to turn off in an overcurrent condition, the voltage seen across the switch is clamped by the capacitors and MOVs. This clamping action brings the voltage across the IGBTs to a safe level, preventing possible damage to the IGBTs.

In the AC snubber circuit, each bank of three parallel MOVs has a series 4-amp fuse. If a MOV shorts, the fuse opens. This causes the control line MOVFLT to go LOW, which activates a Check MOVs alarm (A-15). Refer to Section 203-2.3.

203-1.5 Power Supply

The main power supply consists of two step-down (buck) converters. One supplies +15VDC at up to 1.5 amps (3 amps on the UT8K). The other supplies +24VDC at up to 1 amp. Both converters operate from the 48-volt DC bus.

The +5VDC power supplies consist of five-volt linear regulators that *get* their input power from either the +24VDC or +15VDC power *supply*. Each printed circuit board in the system has *one* or more five-volt regulators.

If either the +24VDC or +15VDC is low or fails, a Check Power Supply alarm (A-19) activates. In addition to indicating t-24 or +15 VDC failures, in Phase III models, if the 48 volt DC bus falls below the battery threshold (typically 44 VDC), the A-19 alarm will sound. Refer to Section 101 for a listing of UNITY/I model and serial number in relation to Phase I, II and III units.

203-1.6 Monitoring Circuitry

A step-down transformer rated at 230V primary and 28V secondary monitors AC output voltage. The primary is connected to the AC output filter capacitor via the main harness. The 28V secondary is fed via a ribbon cable to the logic board, where it is scaled and used for metering.

A current transformer near the terminal blocks and a burden resistor on the AC board (the UT8K has two burden resistors in parallel) monitor AC output current. The burden resistor develops *the* signal and sends *it to the logic* board *to be used for metering.*

203-2 EMI Board Theory of Operation

The EM1 board provides these functions:

- electromagnetic interference (EMI) filtering.
- lightning protection.
- AC input monitoring.
- MOV failure detection.
- backfeed protection (in models UT3K, UT4K, and UT5K).

203-2.1 EMI Filtering

An inductor-capacitor circuit filters common mode noise (line-to-chassis ground). Capacitors filter differential noise (line-to-line). A resistor-capacitor circuit forms a snubber that dampens ringing on the line caused by line inductance oscillating with the line capacitors.

203-2.2 AC Input Monitoring Circuitry

To monitor AC input, a line monitor transformer steps down the AC input voltage signal to a level that can be used by the control circuitry to monitor and meter line. The monitor transformer also provides electrical isolation from line for the control circuits. The AC input monitoring signal is sent via the AC board to the logic board. Control signals from the logic board are then sent to the tap-changing circuits on the AC board to regulate AC input (see Section 203-1.2).

203-2.3 Lightning Protection and MOV Failure Detection

A combination of metal oxide varistors (MOVs) and gas-discharge tubes (arrestors) provide lightning suppression. The EMI board contains three 220VAC MOVs and two 600V (peak) arrestors. MOVs in series provide line-to-lime suppression. Voltage transients exceeding a nominal 622V cause the MOVs to conduct and dissipate power in the transient spike. The higher the transient, the more current the MOVs conduct.

MOVs and arrestors in combination control line-to-chassis ground suppression. The MOVs are rated at 220VAC and the arrestors are 600V peak. If the voltage rating of the arrestor is exceeded, the voltage across it decreases to as low as 25V, then increases as current increases, During a transient, the MOVs pass enough leakage current to activate the arrestors. When the arrestors activate, the voltage across the arrestors decreases, which causes most of the transient voltage to be seen across the MOV network, clamping the transient.

The MOVs are protected by fuses. If a MOV shorts, the current increases and blows the fuses. This causes the control line MOVFLT to go LOW, which causes the microprocessor to activate a Check MOVs alarm (A-15).

203-2.4 Anti-Backfeed Relays and Relay Drive Circuitry

On UT3K, UT4K, and UT5K units, two anti-backfeed relays open when line is not present, preventing voltage from being backfed onto the line cord while the unit is running on inverter (battery power). Anti-backfeed relays are not required for hardwired units (UT8K).

The relay drive circuit is designed to energize the relays from a low of 147VAC to a high of 276VAC. When incoming line falls below 147VAC or rises above 276VAC, the unit switches to battery power and the relays de-energize. Since the relays have 48VDC coils connected in series, the incoming AC is rectified to supply the 96VDC required to operate the relays.

203-3 DC Fuse and Fuse Board Theory of Operation

The DC fuses and fuse board performs several functions:

- protect the batteries from overcurrent conditions.
- supplies positive battery voltage to the inverter board for powering loads.
- supplies positive battery voltage to AC board for +24VDC and +15VDC converters.
- pre-charges or discharges the main DC filter capacitors when connecting or disconnecting the batteries.
- monitors the temperature of the battery compartment and the main DC fuses.

The fuse board includes the fuses (for Phase I and II models) and interconnection points, the blown-fuse diagnostics, the thermal probe, and the pre-charge and discharge circuitry as discussed in the following sections. In Phase III models, the fuses were removed from the "fuse" board and located on the shelf where the fuse board was located in Phase I and II models, The "fuse" board in Phase III models is on the back of the front panel near the fuses.

2033.1 DC Fuses and Interconnection Points

The DC fuses protect the battery cables from over-current conditions. The fuse board has the interconnection points between the positive (+) battery and the inverter board, and supplies (+) DC to the AC board for the +24VDC and +1 SVDC power supplies.

203-3.2 Blown Fuse Diagnostics

Blown fuse diagnostics are found across the DC fuses. The network is designed to sense either positive current (charging) or negative current (discharging). Current from either direction causes the LED in an opto-isolator to illuminate, which in turn activates a transistor. The logic board senses the ON state of the transistor and activates a Check Fuse Board alarm (A-17).

203-3.3 Pre-Charge/Discharge Circuitry

The pre-charge/discharge circuit conditions the main DC filter capacitors on the inverter board when the positive battery terminal is connected or disconnected via the DC connector. When connecting the (+) from the batteries, the circuit provides a low rate of charge to bring the capacitor voltage up before making the DC connection. When disconnecting the batteries, the circuit provides a discharge path to bleed the capacitors.

The pre-charge/discharge is activated by a micro switch found behind the DC connector. When the DC connector is connected, the micro switch closes, directing battery voltage to turn on a MOSFET, which causes a circuit to charge the capacitors. The pre-charge time is about one-half second. When the DC connector is disconnected, the micro switch common is connected to ground and the capacitors are bled to provide a safe working environment for service personnel. The discharge time is about five minutes.

If a fault occurs during the pre-charge time, such as a short on the inverter board, two positive temperature coefficient thermistors quickly heat up and become a high impedance, limiting the current and protecting the batteries from the overcurrent condition.

203-3.4 Thermal Probe

A negative temperature coefficient (NTC) thermistor is used to monitor the temperature of the battery compartment. This probe is used as a means to provide temperature compensation to the battery charger. The temperature signal is sent to the logic board to control the charger current. As battery temperature in the battery compartment increases, the charge current decreases. If the battery compartment temperature is less than parameter 71 (10°C default), the battery float voltage is changed to the value of parameter 70 (cold float voltage).

203-4 Inverter Board Theory of Operation

The inverter board (two boards in UT8K) performs the following functions:

- provides power to loads when incoming AC line is unstable or fails,
- charges the batteries.
- provides DC voltage to the cooling fan(s).

These functions are performed by the gate drive circuits, gate fault diagnostics, inverter conduction limit, battery charger, and fan drive diagnostic circuits as discussed in the following sections.

203-4.1 Gate Drive Circuits

When incoming AC line fails or is unstable, the logic board sends gate drive signals to the inverter board. These signals, pulse-width modulated (PWM) at 19.2kHz rate, control the polarity and frequency of the output signal. Different banks of MOSFETs are selected by the gate drive signals for the positive and negative half cycles of the AC output. Each bank of MOSFETs conducts for a time duration determined by these gate drive signals. Using the battery voltage as a power source, the inverter MOSFETs send a PWM signal to the primary of the transformer. The transformer and output capacitors shape the signal into a high quality sine wave.

203-4.2 Gate Fault Diagnostics

The gate diagnostics function whenever the unit is running on line or inverter. A failed MOSFET typically shorts gate to drain. If a MOSFET shorts, the voltage on the gate puts a high on the INVFLT control line. The logic board detects this and activates a Check Inverter alarm (A-OS). The voltage on the drain also lights a LED on the inverter board (LED1) to aid in troubleshooting, especially in the UT8K, which has two inverter boards. Due to space limitations on the board, not all MOSFETs are monitored.

203-4.3 Inverter Conduction Limit

The conduction limit circuits protect the MOSFETs from excessive current flow. The circuits compare the voltage drop across the inverter MOSFETs to a DC reference level while the MOSFETs are conducting, If the voltage across the MOSFETs exceeds the limit, the MOSFET gate signal is canceled.

A temperature-compensated conduction limit circuit decreases the current allowed to flow through a MOSFET as its temperature increases. The circuit contains a 110°C positive temperature coefficient (PTC) thermistor. If the inverter MOSFET temperature exceeds 1 10°C, the conduction limit reference decreases to a safe level.

203-4.4 Battery Charger

The battery charger delivers five amps nominal (ten amps in UT8K) at a battery voltage of 48V. Charging current decreases as battery voltage increases. The battery charger's input power is derived from the inverter windings at the main transformer and is protected by two 20A fuses. A timer chip is used to control the minimum charger frequency, which is set at 20kHz. Minimum frequency operation keeps the charger from becoming audible and allows the monitoring transformer to be pulsed so that a proper signal develops to control the current in the charger inductor. The battery charger has both a hardware and software shutoff for high battery conditions.

The charger operates whenever the system is in line-interactive mode (i.e., running on AC line power), except brief periods required *to* measure open circuit voltage of the battery for the runtime algorithms and for other miscellaneous reasons (see Section 203-3.4). When the unit is running on battery power, the charger does not operate.

The charger operates in one of four modes: *periodic mode, constant current mode, constant voltage mode,* or *maintenance* mode. The modes can be programmed according to time and voltage constraints to accommodate a variety of charging profiles (see parameters 64-71). Parameter 72 indicates the current charging mode (see Table 203-4.4).

Table 203-4.4: Charging Modes

Charger Mode	Parameter 72, Displayed Number
Periodic	1
Constant Current	2
Constant Voltage	3
Maintenance	4

- **Periodic Mode.** The charger brings the batteries to a programmable float voltage of 57.60VDC (default) for 18 hours, every 30 days (default). This "controlled overcharge" allows any batteries that are in a lower state of charge to be brought up to the equivalent charge of the other batteries. Periodic mode supersedes and terminates any other mode. The charger enters this mode when the UPS is installed, when the ROMs are changed, when EPROM is defaulted, or as the result of certain battery diagnostic test results.

  The time interval between charges is programmable. NOTE: During the initial installation, do not turn off the unit until the charging cycle is complete (see parameter 18).

  After the initial installation charge is complete, the unit does a periodic charge every thirty days (programmable). If the unit is turned off while in periodic mode, the unit terminates the charge cycle, and does not resume the cycle when it is restarted. If the unit switches to inverter during periodic mode, it resumes charging when power is restored.

- **Constant Current Mode.** In this mode the charger brings the batteries to a programmable float voltage of 57.60VDC (default). If the batteries are brought to float voltage within four minutes (default), the charger reverts directly to maintenance mode. If the duration of constant current mode exceeds four minutes, the charger switches to constant voltage mode. The charger enters this mode after each inverter run. This is actually a constant power mode since the current tapers off as batteries acquire capacity.

- **Constant Voltage Mode.** In this mode the charger holds the batteries at the float voltage 57.60VDC (default) for four hours (default). The charger then returns to maintenance mode. If constant current mode persists for more than four minutes (default) after battery operation, the constant voltage timer is reset. Once the constant voltage timer of four hours has expired, the charger enters maintenance mode.

- **Maintenance Mode.** When the batteries have been filly charged, the charger enters maintenance mode to maintain battery voltage (default 53.30VDC). This mode compensates for the self-discharge of the batteries and provides enough charge current for the housekeeping power supplies. No current is drawn from the batteries for the housekeeping operation; the batteries essentially remain in a rest state, extending battery life.

203-4.5 Fan Drive Circuit and Fan Diagnostics

The unit uses a +24VDC fan for cooling (two fans in the UT8K). The fan operates at low speed during line operation and at high speed during inverter operation. Fan speed is controlled by changing the voltage supplied to the fan: +1 5VDC for low speed, +24VDC for high speed. The fan is off during a key switch bypass and when the battery charger is in constant current mode.

The fan diagnostic circuitry monitors the fan tach signal at pin 3 on J3 on the inverter board. If the fan turns too slowly or stops, the fan tach signal slows or stops. The logic board senses this and activates a Check Fan alarm (A-09).

203-5 Logic Board Theory of Operation

The logic board:

- uses monitored signals, preset parameters, and external commands to regulate the operation of the unit.
- sets the nominal center frequency of the unit automatically.
- controls switching from line to battery and back, smoothly and in phase.
- controls tap-changing circuitry on the AC board.
- controls inverter regulation and battery charging.
- transmits UPS system status information via the PhonTek jack. Late production units with v1.09 software, were not marketed as Phon-Tek enabled.

These functions are performed by the Siemens 80C166 16-bit microprocessor. The logic board also contains two g-bit RAM devices, and two S-bit EPROMS (which contain the controlling software for the microprocessor). The following sections discuss the automatic frequency detection and phase-locked-loop, tap changing and static switch, inverter regulation, battery charging, and PhonTek features.

203-5.1 Control Circuits

- **Automatic Frequency Detection and Phase-Locked-Loop:** With AC input power applied, the UNITY/I monitors the AC input signal. The auto-frequency detection system (if enabled) determines the input frequency and resets the unit center frequency to match the incoming AC line frequency (50 or 60Hz). If no input AC line is present when the UPS is powered, the center frequency circuit will revert to its most recent setting.

  The phase-locked-loop (PLL) circuit allows the UNITY/I to switch from AC line to battery power and back to line smoothly and in phase. The PLL does this by monitoring the input AC line signal and changing the phase of the unit's center frequency to match the phase of the AC line frequency.

  The rate of phase shift, or "slew rate," (parameter 9) is usually changed to accommodate an unstable source of AC input such as a generator. ***Whenever*** the input frequency is outside programmable limits, the unit switches to battery power and the PLL slews to the unit's center frequency.

- **Tap Changing:** The tap-changing circuitry provides stable AC output by selecting different windings on the input transformer. AC output voltage is monitored to determine the proper main transformer tap to be used to maintain ± steady state output voltage regulation. The microprocessor sends tap setting information to the AC board, where the correct transformer tap relays are energized. When tap changes are required, the microprocessor senses the zero cross point of the AC line and switches to battery power at this point, reducing voltage distortion. Switching to battery power allows "dry switching" of the relays (without voltage on the relay contacts), reducing relay stress. After the proper tap is selected, the unit switches from inverter to line.

Each time the microprocessor selects a new tap configuration, the unit performs diagnostics on the tap-changing circuit. The diagnostic system tests for the presence or absence of voltage available to the tap relays. If the diagnostic system senses inappropriate voltage responses, the microprocessor infers shorted or open windings. If a problem is detected, the system responds as follows: (1) the tap change is terminated; (2) the unit uses the inverter-and in some cases any functional taps-to provide output voltage, and (3) the unit activates a Tap Regulator alarm (A-12).

- **Static Switch:** While operating on AC line, the microprocessor sends a SSON (Static Switch ON) signal to the AC board. When the output voltage cannot be kept within ± 5% by tap changing, the microprocessor disables the SSON signal to open the static switch. Simultaneously the microprocessor generates an Inverter Enable (INVEN) signal to turn on the inverter. This (INVEN) signal is always on under normal conditions, allowing the inverter to "gapfill" AC line irregularities.

- **Inverter Regulation and Battery Charging:** When the microprocessor senses that a switch to battery power is necessary, it generates control signals feeding the inverter gate drive circuits on the inverter board to control the conduction of different banks of MOSFET gates. These inverter control signals are Pulse Width Modulated (PWM) at a rate of 19.2kHz. These PWM signals determine the polarity and cycle duration of the output signal to maintain ± 5% steady state regulation of the output voltage.

  The microprocessor monitors battery voltage and the settings of battery charging parameters to determine the battery charger mode of operation (see Section 203-4.4 for charger mode descriptions). The battery charger is software-protected against AC input over-voltage and limits the maximum output current,

- **PhonTek:** The PhonTek feature provides a way to transmit UPS system data to Best Power Worldwide Service for remote troubleshooting.

  Phontek transmits:

  - the current status of the unit
  - all parameters
  - the taps in use
  - the status of the programmable contacts
  - the system and alarm logs
  - information about the transmission

  A standard telephone handset cord connects to the PhonTek jack (found behind the front door of the unit). Initial data transmission and the number of repeat transmissions can be programmed via parameter 26. The parameter can also be set for continuous transmission The data stream originates on the logic board and is sent to the PhonTek jack.

Data transmission is FSK conforming to International Standard CCITT V.23 mode 2 operating at 1200 BPS. (See BEST Publication UTY 628, in section 700 of this manual, for more detailed instructions.)

- **Power Supplies:** The logic board uses +24VDC and +15VDC from the AC board to generate internal -12VDC and +5VDC. These voltages are used to provide power to the logic board circuits.

203-5.2 Monitoring Functions

The logic board monitors AC input voltage, AC output voltage, AC output current and battery voltage. It also monitors for alarm conditions and many other system conditions. (Refer to the parameter tables in Section 300 and the alarm tables in Section 500 for more information).

- **AC Input Voltage (ACVI):** AC input voltage is monitored to determine line quality. If the microprocessor and other logic control circuits determine line quality is poor, the unit switches to inverter, either continuously or on a sub-cycle basis, to maintain the required RMS output voltage.

  ACVI is monitored on the EMI board, scaled down by a monitor transformer, and sent to the logic board via the AC board. The AC sensing signal is used to establish a reference for the PLL and the automatic frequency detection system, as well to control the inverter.

- **AC Output Voltage (ACVO):** ACVO is monitored at the output capacitors, fed to the AC board where it is scaled down by a monitor transformer, and passed to the logic board. This AC signal determines the proper main transformer taps to be used. ACVO is used along with AC output current (ACIO) to calculate output power (watts and VA), and with AC output current and battery voltage (VBATT) to calculate estimated remaining runtime.

- **AC Output Current (ACIO):** ACIO is monitored by a current toroid located below the DIN rail. The AC current passes through this coil and generates the ACIO signal. This signal travels to the logic board via the AC board.

  ACIO is used to detect unit overload. If there is a system overload, the unit activates an Overload alarm (A-01). If the overload condition continues, the unit activates a Circuit Breaker alarm (A-02) and shuts down.

  NOTE: The unit only shuts down if an (A-02) occurs. (A-01) = 115% load, (A-02) = 115% load for *x* amount of time (x based on circuit breaker curve).

  ACIO is used with ACVO to calculate output power (watts and VA) and power factor, and with AC output voltage (ACVO) and battery voltage (VBATT) to calculate estimated remaining runtime.

- **Battery Voltage (VBATT):** Battery voltage is monitored at the fuse board and sent to the logic board, where it is used to determine the battery charger mode.

VBATT is also used with ACVO and ACIO to determine estimated remaining runtime and unit shutdown at the Low Battery setpoint.

- **Temperature (AMB TEMP) (BATT TEMP):** The logic board monitors ambient temperature and battery temperature signals and compares them with stored parameter settings, Ambient temperature is monitored by a thermistor mounted on the logic board Battery temperature is monitored by a thermistor mounted on the fuse board. The logic board uses the battery temperature signal to control charger operation. Ambient temperature is monitored for a possible alarm condition.

- **Watchdog Signal:** The microprocessor sends out a watchdog signal that monitors the unit for microprocessor failure, system power supply failure, and other conditions. If the watchdog signal disappears, the bypass relay closes automatically and the static switch opens. The incoming line bypasses the static switch and powers the loads, even if the unit shuts down due to the event that caused the watchdog signal to disappear.

203-6 User Interface Board Theory of Operation

The user interface board (UIB) performs the following functions:

- displays UPS operating conditions, parameters, and alarm and system logs.
- accepts data input from the user.

The UIB has LED status indicators, a keypad, and a four-digit, seven-segment display. The circuitry takes in a serial data stream from the microprocessor and converts it into signals that drive the LEDs.

203-7 Transformer Theory of Operation

One linear transformer per model size, provides all available output voltage combinations. The transformer isolates the UPS input from the output (see Section 203-1.2 for additional information).

The tap-changing circuits include relay-switched transformer winding taps. Five "major taps" are in series with the main body of the primary winding. Two additional relays are found on each end of a separate "buck/boost" winding. The buck/boost winding, by means of two relays at each end, can aid (boost), oppose (buck), or leave the primary winding flux unmodified (bypass*). Steady state output voltage regulation of ± 5% is obtained by choosing one of the five major taps and one of the buck/boost winding configurations (buck, boost, or bypass'). The various combinations create 15 "virtual taps".

* As used here. "bypass" refers to a state of the buck/boost winding in which the buck/boost winding is not used to modify the transformer primary turns ratio (and is therefore "bypassed"). In this case, "bypass" does *not* refer to the bypass circuit discussed in 203-1.3.

203-S Internal Batteries

The standard internal batteries are an absorbed glass mat (AGM), sealed lead acid. The AGM battery has the electrolyte absorbed in a fiberglass material compressed between plates. These do not contain any free-flowing electrolyte and are termed "dry" batteries. This type of battery is very low-gassing.

Power is stored in a battery bank for use by the inverter. When the UPS detects a condition that warrants switching to battery power, the inverter uses the stored power in the batteries to provide AC power to the protected equipment. The battery bank must be designed for the proper ampere-hour rating of the system. All units have four batteries connected in series to generate a nominal 48VDC bus. Battery strings can also be connected in parallel to increase the total ampere-hour rating and increase runtime. UT8K units have 8 batteries standard, while UT3K and 5K models have 4 batteries standard.

203-9 Optional External Battery Packs

The UNITY/I may be connected to as many as three optional external battery cabinets. These battery cabinets are designed to complement the UNITY/I systems with a plug-n-play connection. Each battery cabinet consists of:

- Two fuses for overcurrent protection
- One or two strings of batteries
- A precharge circuit and switch to precharge the inverter
- A DC disconnect switch to isolate the battery cabinet from the UPS
- An ON-LINE indication when the battery pack is on
- Various wiring options to connect to the UPS

For installation instructions see BEST Publication FSS 393, "Connecting External Battery Pack(s) to the UNITY/I Single Phase UPS," in Section 700 of this manual.

- Fusing: There are two fuses affiliated with the battery cabinet: one is found inside the battery cabinet chassis, and one is found in the small connection box at the back of the unit. The fusing is designed to protect the wiring between the cabinet and the unit, in case of a short circuit in the wiring itself There is no visual indication of a blown fuse. To check a fuse, use a true RMS voltmeter or similar device.

- Batteries: If only one string of batteries is installed, it is located on the battery shelf. If two strings are installed, one string is on the battery shelf and the other is in the battery tray. The batteries are paralleled together at the main DC switch, therefore, when either string is attached, the battery side of the switch terminals are live. (For additional information see Best Publication FSS-393 in Section 700 of this manual).

- **Precharge circuitry and switch:** The precharge board in the battery cabinet serves to precharge the inverter when the precharge switch is pressed. The precharge switch is located on the front panel of the cabinet, next to the main DC switch.

This switch is used to precharge the inverter capacitors before engaging the main DC switch. It should be pressed for 5 seconds prior to engaging the main DC switch. If the main DC switch is turned on before precharging the capacitors, fuses inside of the UPS and fuses in the battery cabinet may open. Discharge of the inverter capacitors is not done through the battery cabinet.

- **Main DC switch:** The DC switch is an emergency-off type. To turn the switch off, push it in; to turn it on, pull it out. The key locks the switch in the "Off" position, not the "On" position, It is removable when in the locked position. To turn the battery cabinet on, turn the key clockwise and pull out the DC switch. Then, the key may be turned counterclockwise and removed, and the battery cabinet will remain on line. The cabinet can still be shut off by pushing in the DC switch.

  The switch is intended for use only when the UPS is off, in battery maintenance.mode, or in case of emergency. Pushing in the switch while the UPS is running on battery power will completely shut off the unit, provided the LIPS has no internal batteries, and can cause a low battery and/or battery missing alarm when the unit is powered back up. Pushing in the switch while the unit is operating on-line can cause a variety of alarms, and the unit may switch to BYPASS mode.

- **ON-LINE indicator:** The ON-LINE indicator is on whenever the main DC switch is on. When the UPS is shut off, the battery cabinet should be shut off. The ON-LINE indicator draws a small current. This may cause the batteries to drain down over time with the battery pack on and no charge current present. Circuitry for the ON-LINE indicator is located on the precharge board.

- **Wiring options:** Sol-l-wired cabinets have flying tye-wrapped power and ground leads coming from the battery cabinet leading into a small box. This box contains a fuse and a DC connector. It is plugged into the DC port on the back of the UPS, and the ground lead is secured to the ground bolt on the back of the UPS.

  Hardwired cabinets have a conduit containing the power and groundleads leadinginto a small box. This box is plugged into the DC port on the back of the UPS, and the ground connection is made through the mounting of the box.

  Small battery cabinets can only plug into small units (3-5KVA). Large battery cabinets built with a small connector can be connected to small (3-5KVA) units; large cabinets without the small connector are used with large units (8KVA). If more than one cabinet is used on the 8KVA unit, additional cabinets may have a large connector.

  UPS units ordered without internal batteries have a dummy DC connector where the internal batteries would otherwise connect, and the precharge connector remains empty. This means that an A-17 alarm is avoided, because the internal DC connector is disconnected, and the inverter discharge path through the fuse board is turned off If this DC connector is not present, the battery pack batteries will discharge through the fuse board if the Main DC switch is on, even with the UPS shut off.

300 System Operation and Communications

The following sections provide information for operating and communicating with the UPS, including procedures for starting the UPS (Startup), disconnecting AC and DC power (Shutdown), operating the front panel key switch and the front panel keys, accessing and changing system parameters, and accessing alarm and system logs.

See the *UNITY/I Single-Phase* User Manual for more detailed startup procedures and for basic operational information.

301 Starting the UPS

> **⚠ CAUTION!**
>
> To avoid possible equipment damage or personal injury, assume that there may be AC voltage at the UPS's output terminals/receptacles any time AC input power or DC battery voltage is applied. The UPS can provide output voltage from the batteries even when there is no input line voltage. When AC input voltage is present, the UPS can provide output voltage even when the batteries are disconnected.
>
> If you want to be certain there is no UPS output voltage, disconnect the AC input source, turn the UPS's key switch to "OFF" AND disconnect DC.

Startup Procedure

1. Make sure that the key switch inside the front door of the UPS is turned to "OFF" (see Figure 301-1A).
2. If your UNITY/I has **an input line cord** and plug, plug *in* the UPS.
3. If your UNITY/I is **hardwired** (does not have an input line cord and plug), it should have an external bypass/AC disconnect switch mounted on the wall nearby (see Figure 301-1B). Turn the UPS AC line disconnect switch to "ON" and the UPS BYPASS switch to "OFF."

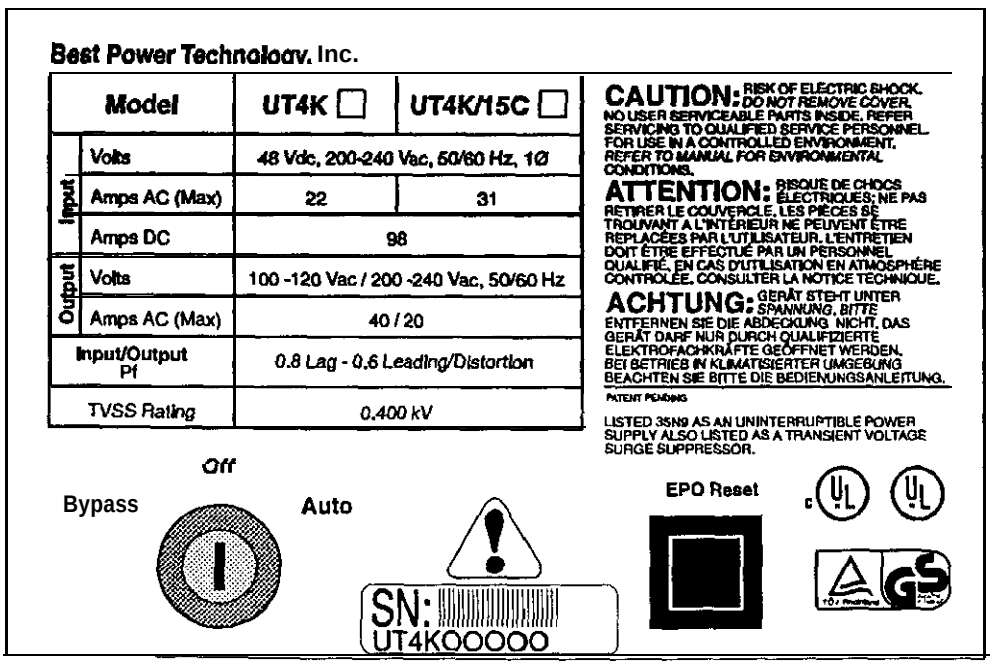


Figure 301-1A: Front Panel (behind door)

> **⚠ CAUTION!**
>
> Never turn the BYPASS switch while the unit is on battery power. Output and line current will not be in phase.

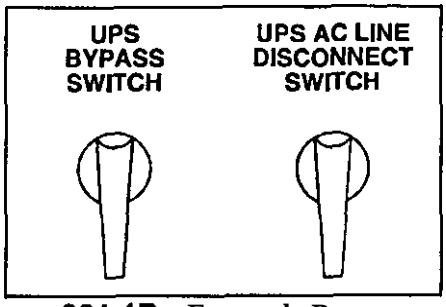


Figure 301-1B: External Bypass Switch

4. Some units have optional external batteries located in a separate cabinet. On the battery cabinet find the Precharge Switch. Then, press the Precharge switch for 5 seconds. Next find the Main DC **Key Switch.** Insert the key, **turn** it to the right and pull the DC switch on (see Figure 301-1C).

5. Turn the key switch inside the **front** door of the UPS to "AUTO." The yellow BATTERY LED will flash briefly, then the green LINE LED will turn on. The unit's four-digit display will show estimated **runtime** in minutes **and seconds.** Estimated **runtime is high** when there is no equipment drawing power from the unit.

   If the red ALARM LED is on: See Section 503 before **continuing. NOTE: Do** not continue until the green **LINE** LED is on.

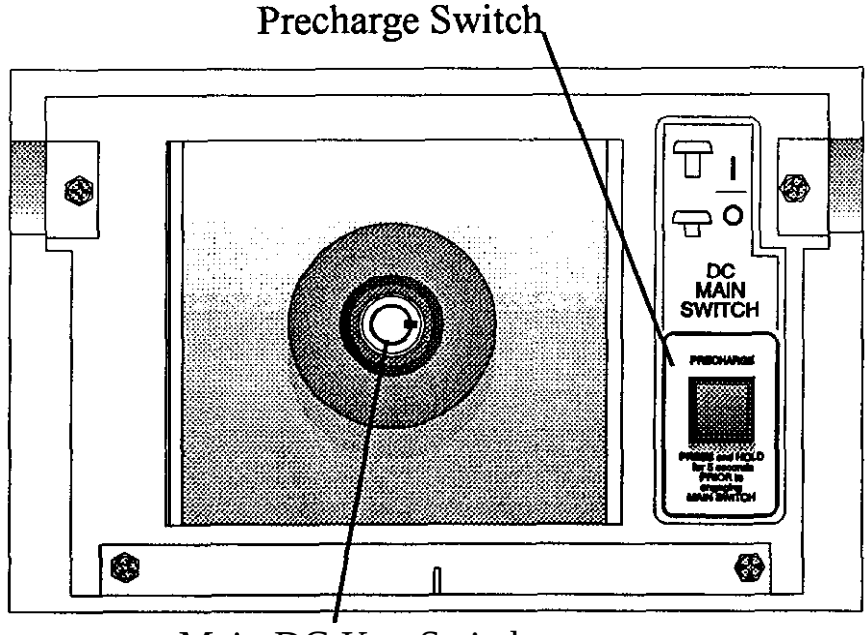


Figure 301-1C Battery Pack Front Panel

Once you switch on the unit and the LINE LED comes on, the UPS will begin to charge the batteries. You may use the UPS right away. The UPS's battery **runtime** will be reduced until the UPS fully charges the batteries.

6. **If your UNITY/I has receptacles** on **the back:** Plug in and switch on the load equipment.

7. **If your UNITY/I does not have receptacles** on **the back:** Turn the UPS BYPASS switch (see Figure 301-1B) to "UPS." Then, switch on the loads.

NOTE: You may occasionally hear short "clicks" inside the unit; these clicks are the tap-changing circuits compensating for irregularities in the AC input, and are a normal part of the unit's operation.

The UNITY/I is now providing continuous, computer-grade power to your equipment, and is ready to provide battery backup power when needed.

302 Disconnecting AC and DC Power

302-l Shutdown Procedures

CAUTION!

Before switching an external make-before-break (MBB) BYPASS switch, the BYPASS light on the UPS front panel **must** be lit. If you operate an external MBB BYPASS switch while the UPS is operating on line power or on battery power, equipment damage may result. Refer to BEST publication "TIP 410" for proper BWASS switch operating instructions.

1. If the unit has an external BYPASS switch, you may use it to bypass the UPS See TIP 410, in Section 700. Otherwise, shut down the load equipment.
2. Open the front door of the UPS. Turn the key switch to "OFF'."
3. Remove AC input to the UPS. (Turning the key switch to "OFF" is **not sufficient**.)
4. If the unit has one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

NOTE: If you are servicing the unit, you must **perform the following steps to disconnect** internal DC and discharge the **inverter** capacitors.

5. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit. Remove the narrow front panels (see Section 800 for location).
6. Remove the bolt from the top DC connector (see Section 800 for location).
7. Disconnect the top DC connector. Make sure that the DC connector does not contact the pre-charge switch after it is disconnected.

CAUTION!

The UPS still has power! To reduce the risk of personal injury or equipment damage, do not service the unit until you have discharged the capacitors as instructed in Section 302-2.

302-2 Discharging the Capacitors

1. Remove the seven screws From the side covers. Three screws are found on top of the unit, and two on each side panel.
2. Lift each side **cover straight up,** then off.
3. Remove the two screws in the upper comers of the side door assembly. Open the side door assembly.

   NOTE: Steps 4 and 5 are for units with internal batteries. If your **unit has** no **internal** batteries, **skip** steps 4 and **5** and **wait five minutes** for **capacitors** to **discharge** through the **fuse** board before continuing with step 6.

4. ***With*** AC and ***DC power disconnected*** (see Section **302-1),** turn the UPS key switch to "AUTO" for at least five seconds.
5. Turn the key switch back to "OFF."
6. Verify that the capacitors are discharged. Use a DC voltmeter to measure the DC voltage between the DC bus bar (-) and the **outside heatsink** on the inverter board (+) as shown in Figure 302-2A. **(Measure** both inverter heatsinks in the UT8K.)
7. If the **reading** in step 6 is greater than five **volts, wait five minutes to allow** the capacitors to discharge. Then, repeat steps 6 and 7 before continuing.
8. Remove the fast-on connector **from** ES in the **upper** right comer of the **fuse** board. **(See Section** 800 for the location of the **fuse board.)**

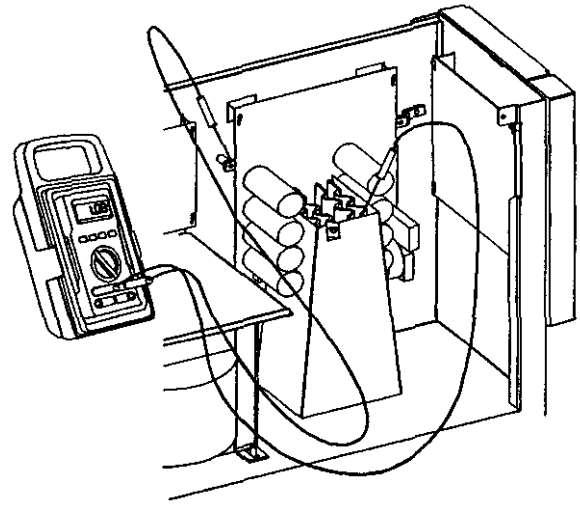


Figure 302-2A: Measuring Charge in Capacitors

303 Front Panel Key Switch

The UPS **key** switch is found inside the **front** door of the **UNITY/I.** The key switch allows you to place the **UPS** into "AUTO" mode, shut the **UPS** off, or place the **UPS** into internal bypass mode.

- AUTO: When the key switch is turned to "AUTO," the UPS provides computer-grade power to your equipment. Usually the UPS operates on AC line power, filtering and regulating utility power. When necessary, the UPS switches to battery Rower.
- OFF: When the key switch is turned to "OFF," the **UPS** is off and does not provide power to the connected equipment.

> ⚠ CAUTION!
>
> Live AC, DC, and charged capacitors are still inside the unit. If you intend to perform service, maintenance, or repair, see Section 302 for complete shutdown instructions.

- BYPASS: When the key switch is turned to "BYPASS" the unit powers the connected equipment, but it does not regulate the AC power going to the connected equipment and cannot provide battery backup power or charge the batteries. The unit does provide lightning protection, noise protection, isolated output, and over-voltage protection.

304 Emergency Power Off (EPO) Reset Button

- **EPO Reset:** The EPO reset button is found on the front panel of the unit near the key switch (see Figure 301-IA). If a remote EPO shutdown has been activated, use the EPO reset button to reset the unit. Before resetting the unit, verify that no actual emergency has occurred, or that the emergency is over. The EPO reset button does not serve as a reset button for any other purpose.

NOTE: The remote EPO feature allows you to connect your UPS to a remote Emergency Power Off switch, or "panic button." For proper installation see the User *Manual.* If the EPO is installed, the UPS will shut down when an EPO signal is sent to its communication port. When an EPO shutdown occurs, the unit's four-digit display scrolls "EPO." The EPO reset button will reset the UPS to normal system operation.

305 Front Panel LEDs

The four LEDs at the top of the Front panel give information about the operating status of the UPS (see Figure 305-A). They are explained below. (The *nine* LEDs located by the front panel keys are discussed in Section 306.)

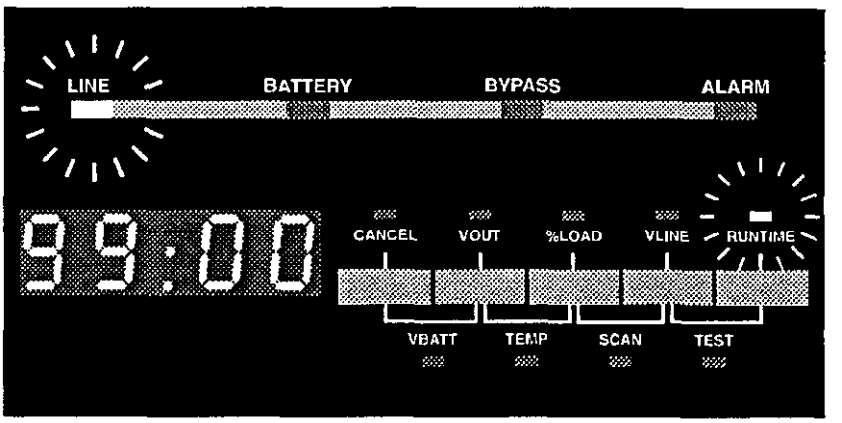


Figure 305-A: Front Panel LEDs

- **Line LED (Green)**

When the LINE LED is on, the unit is receiving AC input line. The UPS is filtering and regulating AC line power to provide computer-grade power to your equipment,

When the LINE LED is off, the UPS is not receiving adequate AC input power to run on line (i.e., if there is a power outage). Usually, when the LINE LED is off, the BATTERY LED will be on.

- Battery **LED (Yellow)**

When the BATTERY LED is *on,* the UPS is providing power from its batteries.

- **BYPASS LED (Yellow)**

The unit is in internal bypass mode when the BYPASS LED is on. Either the front key switch has been turned to "BYPASS" or Parameter 63 has been enabled (see Table 308-4). When the unit is in bypass mode it continues to power the connected equipment, but it does not regulate the AC power going to the connected equipment and **will not provide battery backup power.** The unit does continue to provide lightning protection, noise protection, and isolated output. If the logic board is powered, it will shut down the unit if an over-voltage condition occurs,

NOTE: If the BYPASS LED is on, the UPS key switch is turned to "AUTO," and the unit is not showing an A-16 alarm or advisory condition, the unit may have automatically placed itself in BYPASS mode (see table 501-1 for alarm information, and Section 20 3-5.2 for information on the watchdog signal).

- Alarm LED (Bed)

When the ALARM LED is on, the UPS is alerting you to an alarm condition (see Section 503).

306 Front Panel Keys and Display

Information about the UPS is easily accessed via front panel keys and a four-digit display. The word above each key tells you what information the UPS will display if you press that key. The words below the keys tell you what information the UPS will display if you simultaneously press the two keys indicated. A small green LED illuminates to tell you what information is currently displayed. The information remains on the display until you press another key. Table 306-1 explains what happens when you press each key or pair of keys. (See Sections 308 and 309 for more information about the front panel key functions when the unit is in parameter mode, and when viewing alarm and system logs.)

Table 306-1: Front Panel Keys

Key(s) Pressed	Result
CANCEL	• Silences an audible alarm if one is present. If the UPS subsequently recognizes a new alarm condition, it will reactivate the audible alarm. NOTE: Silencing an alarm does not correct the alarm condition. • Cancels a battery test if one is in progress. • Holding the key down for two seconds clears an alarm. NOTE: The alarm will recur if the condition that caused it still exists. • If the unit has shut down due to an alarm condition, holding the key down for hvo seconds resets the unit, providing that the alarm condition has been corrected and the unit is not in internal bypass mode.
VOUT	Displays the UPS output voltage.
%LOAD	Displays the percentage of the unit's total power capacity that the load is using.
VLINE	Displays the AC input line voltage.
RUNTIME	Displays the estimated runtime remaining (in minutes and seconds). **NOTE:** The runtime display is most accurate when the UPS is running on battery power.
VBATT	Displays the present battery voltage. Nominal is 48V.
TEMP	Displays the internal ambient temperature of the UPS (in degrees Celsius).
SCAN	Starts the scan mode. In scan mode, the UPS scrolls through a display of VBATT, VOUT, TEMP, %LOAD, VLINE and RUNTIMEEach value is displayed for two seconds, and the small green LED illuminates to tell you which value is currently displayed. To stop scanning, press Cancel.
TEST	Holding this pair of keys down for two seconds starts a test of the unit's front panel LEDs (except BYPASS) and four-digit display. NOTE: If Parameter 77 (Test on Demand) is enabled, the unit will also test the batteries, If Parameter 77 is enabled and Parameter 62 (Nominal Input Voltage) is set, the unit will also test the BYPASS LED by briefly switching to internal bypass mode.

307 Communication via the DB9S Communication Port

BEST publication UTY 501, in Section 700, gives instructions on communication via the DB9S port.

308 System Parameters

Parameter values are set at the factory and some may be changed in the field by qualified field service personnel. The UPS uses the parameters for meters, counters, alarm set points, acceptable power quality limits, operation limits, or communication. The system parameters provide comparison set points that the software compares with values acquired in real time.

308-l Passwords

A **password** is required to program many parameters. *The password must be entered in Parameter* 00. See Table 308-l for passwords. See Table 308-4 for the password level required to program specific parameters.

Table 308-l: Passwords for the UNITY/I

Password Level	Password
Level 1: User	377
Level 2: Service	2639
Level 3: Factory	8473
Display only	Parameter cannot be changed in the field.

308-2 Key Functions: Parameter Mode

The table below explains what each key does when a parameter number or parameter value is displayed. Alternative key names are on the programming template inside the unit's front door.

able 308-2: Key functions - Parameter mode

Key	When a Parameter *Number* is Displayed	When a Parameter *Value* is Displayed
%LOAD	Steps to the next parameternumber.	Increases the setting of the parameter.
VOUT	Steps to the previous parameter number.	Decreases the setting of the parameter.
CANCEL	Toggles to the parameter value display.	Toggles to the parameter number display.
VLINE	Escapes parameter mode.	Returns to the parameter number display without saving any changes made to the parameter setting.
RUNTIME	Key has no function.	Enters new parameter setting.

308-3 Viewing Parameters via Front Panel Keys

This section explains how to view parameters using the front panel keys and four-digit display on the front of the UPS. To view parameters via a terminal connected to the DB9 port, see BEST Publication UTY 501 in Section 700 of this manual. For more information about each parameter, see Table 308-4. **NOTE:** An alternative "programming template" is found on a label inside the UPS's front door. This template provides alternative key names that correspond to the parameter key functions.

1. To access the parameters, simultaneously hold down the [CANCEL] and [RUNTIME] keys for two seconds. Release the keys when the four-digit display shows "P-00."

   "P-00" is a parameter number. (The first column of the parameter table, Table 308-4, shows each parameter number.)

2. Whenever a parameter number (P-xx) is displayed, you can use the following keys to step to the parameter you wish to view.

   - Step to the next parameter number by pressing [%LOAD].
   - Step to the previous parameter number by pressing [VOUT].

3. Press [CANCEL] to view the parameter value. For example, with "P-07" on the display, press [CANCEL] to view the UPS's Low Runtime Alarm Setpoint.

4. Press [CANCEL] to return to the parameter number (P-xx). Note that the [CANCEL] key allows you to toggle between the parameter number and actual parameter value.

5. If you wish to view additionai parameters, repeat steps 2 - 4.

6. To escape parameter mode, press [VLINE] twice.

308-4 Changing a Parameter Value and PARAMETER TABLE

You can set many of the unit's parameter values to program certain UPS features. Table 308-4 describes the parameters. **Make sure that you FULLY understand a parameter before attempting to change it!** Improper setting of certain parameters may cause the UPS to function differently than expected.

1. Hold down the [CANCEL] and [RUNTIME] for two seconds, Release the keys when the display shows "P-00." Then press [CANCEL], The display should read "0."

2. Use the [%LOAD] (increase setting) or the [VOUT] (decrease setting) keys to change the display reading to the desired password (see Section 308-I). To scroll through the setting quickly, hold down the [%LOAD] or the [VOUT] key.

3. Press [RUNTIME] to enter the password. The display should read "1," "2," or "3" for service or factory password. If the display reads "0," the unit did not accept the password-repeat step 2.

   NOTE: If the display is left unattended (no keys are pressed) for five minutes, the password reverts to level "0" and you must reenter the password. (In software v. 1.00, if the display is left unattended for one minute the password must be reentered.)

4. Press [CANCEL] to set the parameter number (P-xx).

5. Press the [%LOAD] or [VOUT] key to scroll to the number of the parameter that you wish to change. Press [CANCEL] to view the parameter value. Note that the [CANCEL] key allows you to toggle between the parameter number and parameter value.

6. Whenever a parameter value is displayed, use these keys to change the setting:

   - To increase the setting press [%LOAD].
   - To decrease the setting press [VOUT].
   - To set and enter the parameter at its factory default setting (see the fifth column of the parameter table), simultaneously hold down the [%LOAD] and [VOUT] keys for two seconds.

   NOTE: The UPS will not allow you to change a parameter if it requires a password level higher than the password entered in step 2.

7. To enter the new value, press [RUNTIME]. The UPS beeps to indicate that the new value has been entered. If you wish *not* to save a change that you have made, press [VLINE] and the value will remain at its original setting.

8. If you wish to change additional parameters, repeat steps 4 - 7.

9. To escape parameter mode, press [VLINE] twice.

The parameter table (Table 308-4) includes the parameter number, parameter names, the password required to change the parameter, the default setting, and a description that includes the adjustable range. A password of "Display only" means that the parameter value is not programmable in the field.

able 308-4: Single:-Phase UNITY/I Parameters

#	Parameter Name	Parameter Name Software Code	Password	Default	Description
00	Password	password	None	0	Allows you to enter a password. Password levels: Level 0: No password Level 1: User Password (377) Level 2: Service Password (2639) Level 3: Factory Password (8473) Password time out is five minutes; if there is no user input for five minutes, the unit reverts to password level "0" (no password). Note: In software v1.00 only, the password time out is one minute.
01	Serial Number Low	SerialNumLow	Factory	0	The UNITY/I serial number is formatted as follows: UtxKyzzzz where x is the model number (KW/KVA rating) of the UPS and yzzzz is a unique five-digit unit serial number. Parameter 01 reports y. Parameter 02 reports zzzz. Note: On the UPS front panel, parameter 02 does not display leading zeroes. For example, for the serial number UT3K10025, parameter 01 would be "1" and Parameter 02 would be "25." *Range (software v1.00 to v1.03):* 0 - FFFF hex. *Range (software v1.04 to v1.06): 0 - 9999.*
02	Serial Number High	SerialNumHigh	Factory	0	
03	Auto Restart	AutoRestartMode	User	1	If the UPS shuts down because of a non-latching alarm or an "OFF" or "TOFF" command from a terminal connected to the DB9 port, this parameter determines whether the unit will automatically restart. If set to "1," the UPS restarts itself when conditions allow. If set to "0," the UPS must be manually restarted. *Choices:* 0 (Disable) or 1 (Enable).
04	Model Number	ModelNumber	Factory	0	Reports the model number (KW/KVA rating) of the UPS. Setting does not affect unit operation. *Range:* 0 - 9999.
05	output Voltage Reference	NominalVOUT	User	240	This parameter setting determines the voltages present at the output terminals on the UPS DIN rail. The output voltage regulation range will be ±3% (with v1.00 to 1.08 software), or ±5% (with v1.09 software) steady state (default) of this value. *Range:* 180 - 260 VAC. Notes: (1) This value will be the nominal output between UPS DIN rail terminals Xl to X4 or Xl to X5, depending on the configuration. (2) The output to the loads depends upon which output terminals the output wires are connected to. (3) See the "Voltage and Phase Check" section in the *Installation* Manual for more information on setting this parameter and for information on output voltage/wiring configurations.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
06	Full Load Set Point	FullLoadSetpoint	Service	4.00	Unit KW/KVA rating. Maximum steady state KW/KVA output. Used in the calculation of the set point for the Overload alarm (A-01). *Range: 2.00 - 17.00* KVA.
07	Low Runtime Alarm Set Point	LowRuntimeSetpoint	User	2	When running on battery power, the UPS indicates a Low Runtime alarm (A-00) when the estimated runtime is equal to or less than this value. *Range:* 1 - 99 minutes.
08	Glitch Limit	GlitchLimit	Service	12	Number of glitches that must accumulate for the UPS to switch to exclusive inverter operation. *Range:* 1 - 36 glitches.
09	Frequency Slew Rate	FreqSlewRate	user	347	Sets the rate at which the phase-locked-loop (PLL) tracks changes in input frequency. Greater value = faster tracking. Default of 347 is about 30Hz/second. *Range:* 10 - 780.
10	Line Full Load Current	LineFullLoadCurrent	*Service*	17.2	Maximum steady state output current in amperes. *If* the output current exceeds this value, an accumulator will activate a Circuit Breaker Warning alarm (A-02). If the accumulator reaches the trip point CircuitBreakerTrip1 (parameter 11), the UPS activates a Circuit Breaker Shutdown alarm (A-02) and the UPS output shuts down. Range: 1.0 - 350.0 amps. Note: A new value is computed automatically if parameter 05 (NominalVOUT) or parameter 06 (FullLoadSetpoint) is changed.
11	Circuit Breaker Trip 1	CircuitBreakerTrip1	Service	40	Sets the limit for maximum allowable overload, trip time depends on amount of overload. See also parameter 10 (LineFullLoadCurrent). *Range:* 1 - 9999.
12	High Ambient Temperature Alarm Set Point	HighAmbientSetpoint	*Service*	40.0	The UPS activates a High Ambient Temperature alarm (A-03) if the UPS internal ambient temperature is equal to or greater than this value. The ambient temperature sensor is located on the logic board. *Range:* 1.0 - 100.0 degrees Celsius.
13	Frequency	Frequency	Display only	0	Displays the frequency of the phase-locked-loop (the UPS output frequency).

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
14	Frequency Mode (VI.00 - v1.05)	FrequencyMode	User	2	***Software v1.00 - v1.05:*** Specifies the PLL center frequency (i.e. nominal frequency). The UPS outputs this frequency ±0.15Hz when running on battery power. If this parameter is set to "2" (auto select), the UPS automatically selects the PLL center frequency based upon the input frequency. ***Choices: 0*** (50Hz), 1 (60Hz) ***or 2*** (Auto select). Note: If no input line is present when the UPS is powered up, it will revert to its most recent setting. If the UPS auto select frequency mode, it will revert to the most recently auto-selected frequency.
	Nominal Frequency (v1.06-09)	FrequencyMode	User	1	*Software* ***v1.06:*** If Parameter 15 (AutoFrequencyMode) is set to "1", this parameter reports the PLL center frequency (i.e. nominal frequency) that the UPS has auto-selected. If Parameter 15 (AutoFrequencyMode) is set to "0", this parameter is used to specify the PLL center frequency. Choicest 0 = 50 Hz, 1 = 60 Hz.
15	Auto Frequency Mode (v1.00 - v1.05)	AutoFrequencyMode	Display only	1	***Software v.1.00*** - 1.05: When FrequencyMode (parameter 14) is set to auto select, this parameter reports the PLL center frequency presently selected. 0 = 50Hz, 1 = 60Hz.
	Auto Frequency Mode (v1.06-09)	AutoFrequencyMode	User	1	***Software v1.06:*** Enables or disables auto frequency mode. In auto frequency mode, the UPS automatically selects the nominal frequency based upon the input frequency. See also Parameter 14. ***Choices: 0 (Disable) or I (Enable).***
16	Maximum Frequency*	MaxFrequency	User	65.0*	Maximum line frequency to which the PLL will lock. If the frequency exceeds this value, the UPS switches to battery operation. This value must be greater than the PLL center frequency (see Parameters 14 and 15). *Range*: 50.5 - 65.0 Hz.
17	Minimum Frequency*	MinFrequency	User	45.0*	Minimum frequency to which the PLL will lock. If the frequency drops below this value, the UPS switches to battery operation. This value most be less than the PLL center frequency (see parameters 14 and 15). ***Range: 45.0*** - 59.5Hz.

* Note for units with v.1.04 or v.1.06 software: If the UPS is in auto frequency mode (see Parameter 14 in v.1.04-1.05 or Parameter 15 in v.1.06) the unit selects a nominal frequency of 50 or 60 Hz. The UPS then automatically sets ±3 Hz frequency rails-in other words, it sets MaxFrequency (Parameter 16) to the nominal frequency plus 3 Hz, and it sets MinFrequency (Parameter 17) to the nominal frequency minus 3 Hz. Important: If the unit is in auto frequency mode and the user programs frequency rails into Parameters 16 and 17, the user-programmed frequency rails ***will be overridden*** if the unit is shut down and re-started (i.e. the unit will again auto-select the frequency and set frequency rails of ● 3 Hz). To prevent this, if you program frequency rails in Parameters 16 and 17, you should also disable the auto frequency mode (see Parameter 14 in v.1.04 - 1.05 or Parameter 15 in v.1.06).

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
18	Installation Equalization	InstallEqualization	Service	1	If set to "1," causes equalization charge of the batteries at installation or when ROMs are changed. Choices: 0 (Disable) or 1 (Enable). Notes: (1) The duration of the installation equalization charge is determined by parameter 67 (CHRGDURHOURS). (2) Once the equalization charge is complete, the unit automatically resets this parameter to "0." (3) If the unit is shut off before the install equalization charge is completed, the installation charge will begin over again at the next start-up because this parameter will still be set to "1."
19	Phase Offset	phase_offset	Service	111	Used to compensate for the reference phase lag of the zero cross discriminator. Calculated only at system start-up (i.e. if this parameter is changed, the unit must be re-started for the change to become effective). *Range: 0 - 359* degrees.
20	Transformer Resistance	XfmrRes	Service	4	*Scaling factor used* to *compensate* for impedance drops in the UPS system. Used in the calculation of a tap setting when transferring from battery to line power. *Range: 0 - 16.*
1	Set Metering for 380/400/415V Input	SetVINRange400	user	0	Scales the UPS metering for systems with optional 380/400/415 volt input. This setting does not affect UPS output voltage. Choices: 0 (Disable) or 1 (Enable).
22	Communication Mode	ComSetup	User	10	Selects communication mode and sets baud rate or reaction delay. *Range: 0 - 50* hex. See BEST publication UTY 501 for more information.
23	Programmable contact 0	PgmContact0	User	1307	Used to program contact 0 @in 5) on the communication port. *Range: 0 - 3F24* hex. See BEST publication UTY 501 for more information
24	Programmable Contact 1	PgmContact1	User	1317	Used to program contact 1 (pin 3) on the communication port. *Range: 0 - 3F24* hex. See BEST publication UTY 501 for more information.
25	Programmable contact2	PgmContact2	User	3317	Used to program contact 2 (pin 6) on the communication port. *Range: 0 - 3F24* hex. See BEST publication UTY 501 for more information.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
26	Reserved (*v1.00* to I. 03)				*Software v1.00* to *v1.03:* Reserved.
	PhonTek Copies (VI.04 to *v1.06*)	Copies	User	0	*Software v1.04* IO *v1.06:* Begins PhonTek transmission and specifies how many copies of the message to transmit. *Range:* 0 - 98 copies. 99 = continuous transmission. **Note:** BEST publication UTY 628 contains user instructions for PhonTek.
27	Input Voltage	CalibratedVIN	Service	0	Directly metered input voltage. *Range: 65 - 300* VAC.
28	output Voltage	CalibratedVOUT	Service	0	Directly metered output voltage. The unit monitors the high voltage output (UPS output terminals Xl tc X5) and extrapolates the nominal output voltage for the display based on the setting of parameter 5. *Range:* 10 - 1000 VAC (RMS). **Caution:** Before calibrating parameter 28, remove loads and set parameter 05 (NominalVOUT) to 240. Then, program parameter 28 based on the measured voltage from UPS output terminals Xl to X5. Parameter **28 will not calibrate properly unless parameter 05 is set to 240.** **(Note:** After calibrating parameter 28, remember to reset parameter 05 to its previous setting.) See BEST publication UTY 501 for instructions on calibrating parameter 28.
29	output Current	CalibratedIOUT	Service	0.0	Directly metered RMS output current. *Range:* 1.0 - *350.0* amperes (RMS).
30	Battery Voltage	CalibratedVBAT	Service	0.00	Directly metered battery voltage. *Range:* 1.00 - 99.99 V.
31	Internal Ambient Temperature	CalibratedAMBTMP	Service	0.0	UPS internal ambient temperahue. The internal ambient temperature sensor is located on the logic board: *Range:* 0 - 150.0 degrees Celsius.
32	Battery Temperature	CalibratedBATTMP	Service	0 . 0	UPS battery compartment temperature. The battery temperature sensor is located on the fbsc board. *Range: 0* - 150.0 degrees Celsius.
33	Runtime	Runtime	Display only	00:00	The estimated runtime in minutes and seconds. Notes: (1) The estimated runtime is most accurate when the UPS is running on battery. (2) In software v1.00 tov1.03, a terminal connected to the DB9 port displays the runtime in *seconds only.*
34	Percent Load	PercentLoad	Display only	0	The percentage of the unit's total capacity that the load equipment is using. Percent Load = (VA Load ÷ Max VA Load) x 100.
35	Power Factor	PowerFactor	Display only	0.00	Ratio of system real power to system VA. Power Factor = KW Out ÷ KVA Out.
36	KW Out	DisplayWOUT	Display only	0.00	Calculated KW of load.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
37	KVA Out	DisplayVAOUT	Display only	0.00	Calculated KVA of load.
38	Input Voltage Calibration Factor	CalFactorVIN	Service	DC4	A/D conversion factor for determining CalibratedVIN (parameter 27). Differs in each unit. *Range:* 03E8 - FOOO hex.
39	Output Voltage Calibration Factor	CalFactorVOUT	Service	1A9C	A/D conversion factor for determining CalibratedVOUT (parameter 28). Each unit differs. *Range:* 03E8-FOOO hex.
40	Output Current Calibration Factor	CalFactorIOUT	Service	1309	A/D conversion factor for determining CalibratedIOUT (parameter 29). Differs in each unit. *Range:* 03E8 - FOOO hex.
41	Battery Voltage Calibration Factor	CalFactorVBAT	Service	1775	A/D conversion factor for determining CalibratedVBAT (parameter 30). Each unit differs. *Range:* 03E8-F000 hex.
42	Internal Temperature Calibration Factor	CalFactorAMBTMP	Service	1C9	A/D conversion factor for determining CalibratedAMBTMP (parameter 31). Each unit differs. *Range:* 0 - F000 hex.
43	Zero Internal Ambient Temperature	ZeroAMBTMP	Service	1DF	Offset correction for determining CalibratedAMBTMP (parameter 3 1). Each unit differs. *Range:* 0-F000 hex.
44	Battery Temperature Calibration Factor	CalFactorBATTMP	Service	1C9	A/D conversion factor for determining CalibratedBATTMP (parameter 32). Each unit differs. *Range:* 0 - FOOO hex.
45	Zero Battery Temperature	ZeroBATTMP	Service	1DF	Offset correction for determining CalibratedBATTMP (parameter 32). Each unit differs. *Range:* 0 - FOOO hex.
46	Alarm Status + 0	AlarmStatus+0	Display only t	0	When an alarm condition exists, a bit is set in the 32-bit alarm status register. This parameter displays the hexadecimal representation of the lower alarm status register, which is bits 0 - 15. See BEST publication UTY 501 for more information.
47	Alarm Status + 1	AlarmStatus+1	Display only	0	When an alarm condition exists, a bit is set in the 32-bit alarm status register. This parameter displays the hexadecimal representation of the upper alarm status register, which is bits 16 - 31. See BEST publication UTY 501 for more information.
48	Alarm Mask + 0 (v1.00 to v1.05)	AlarmMask+0	Display only	0	*Software v1.00 to v1.05:* Causes selected alarms to be ignored. *Range:* 0 - FFFF.
	Alarm Mask + 0 (v1.06)	AlarmMask+0	Factory	0	*Software v1.06:* Causes selected alarms to be ignored. *Range:* 0 - FFFF.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
49	Alarm Mask + 1 (VI.00 to v1.05)	AlarmMask+1	Display only	0	*Software* VI.00 to VI.05 causes selected alarms to be ignored. *Range: 0 - FFFF.*
	Alarm Mask + 1 (v1.06)	AlarmMask+1	Factory	0	*Software v1.06:* Causes selected alarms to be ignored. *Range: 0 - FFFF.*
50	Beeper Enable	BeeperEnable	User	1	If set to "0," silences the beeper in all cases except PhonTek operation. Choices: 0 (Silence), 1 (Enable).
51	Low Battery Alarm Set Point	LowBatterySetpoint	Display only	40.08	Battery voltage at which a Low Battery Alarm or advisory condition (A-OS) and shutdown occur. Automatically adapts based on BatteryCapacity (parameter 55) and either VAOUT (in *software v.1.00 - v1.05*) or WOUT *(software v1.06)*. Note: As load increases, LowBatterySetpoint voltage decreases. As BatteryCapacity increases, LowBatterySetpoint voltage increases.
52	High Battery Alarm Set Point	HighBatterySetpoint	Service	60.00	Battery voltage set point for High Battery alarm (A-07) *Range:* 10.00 - 90.00 V. **Note: A High Battery alarm causes the battery charger to shut off via software.**
53	Vllo	Vllo	Service	1068	Used to calculate LowBatterySetpoint (parameter 51) based on load. *Range: 03E8 - 4E20 hex.*
54	Kll	Kll	Service	EA0	Used to calculate LowBatterySetpoint (parameter 51) based on load. *Range:* 0EA0 - 2814 hex.
55	Battery Capacity	BatteryCapacity	User	33.0	Amp-Hour capacity of battery string(s). *Range (software v1.00 to v1.03):* 15.0 - 120.0. *Range (v1.04 to v1.06):* 15.0 - 999.9.
56	Full Charge Open Circuit Voltage	FullChrgOCVolts	Service	52.50	The full charge open circuit battery string voltage. Used in Runtime calculation. *Range:* 10.00 - 99.99V. **Note: Default for UT8K is 51.5.**
57	Runtime K1	RuntimeK1	Service	0.50	Constant used in adaptive Runtime calculation. *Range:* 0 - 99.99.
58	Runtime K2	RuntimeK2	Service	1720 or 0x6B8	Constant used in adaptive Runtime calculation. *Range (software v1.00 to v1.03):* 0 - 9999. *Range (software v1.04 to v1.06):* 0 - FFFF hex.
59	Runtime K4	RuntimeK4	Service	1333	Constant used in adaptive Runtime calculation. *Range:* 0 - 9999.
60	Charger Rating	ChargerRating	User	4.7 or 5.0	Ampere rating of system battery charger(s). *Range:* 1.0 - 50.0 amps. **Note:** Default for software v1.00 to v1.03 = 4.7, default for v1.04 - v1.06 = 5.0.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
61	Low Battery Shutdown Flag (v1.00 to v1.05)	LBattShutDFlag	Display only	0	*Software v1.00* to *v1.05:* Flag for determining operating mode at start-up following a low battery shutdown. 0 = Not in shutdown mode.
	Bypass Flag (v1.06)	BypassFlag	Display only	0	*Software v1.06:* Indicates which bypass condition is active (HotSwap, LowBattery, EPO) and the bypass tap chosen. (Bit 0 = Last tap - 1, bit 1 = HotSwap on, bit 2 = LowBatt on, bit 3 = EPO on).
62	Nominal Input Voltage	HSNominalVIN	User	0	Used to set the nominal input voltage before using parameter 63 (HotSwap). *Range: 200 - 240* VAC. Note: If this parameter is set *and* parameter 77 (TestOnDemand) is enabled, during a front panel key TEST the UPS will test the BYPASS light by briefly switching to internal bypass mode.
63	Battery Maintenance Mode	HotSwap (v.1.00 - v1.05) HotSwapAcess (v. 1.06)	User	0	When this parameter is enabled, the internal bypass relay is used to bypass the static switch. The UPS continues to power the connected equipment but does not regulate voltage and will not provide battery backup power. To enable parameter 63, you must first set parameter 62 (HSNominalVIN). *Choices:* 0 (Disable), 1 (Enable). Notes: (1) When parameter 63 is enabled, the unit continues to provide noise protection, lightning protection, and isolated output. (2) As long as the logic board is energized, the unit will indicate an Auto Bypass (A-16) alarm or advisory condition when parameter 63 is enabled. (3) As long as the logic board is energized, the UPS alarms will be functional. **WARNING!** Parameter 63 allows a qualified technician to service or replace the batteries without shutting down the unit/loads. Parameter 63 is for use during battery maintenance only and must not be used during any other type of unit service or maintenance because the unit remains energized.

Note for parameters 64 - 72: The UNITY/I battery charger has four charging modes: Periodic, Constant Current, Constant Voltage, and Maintenance. For more information, see Section 203-4.4 "Charger Modes."

64	Constant Current Charge Duration	CCMINUTES	User	4	If the duration of the "constant current" charging mode exceeds CCMINUTES, the unit does a "constant voltage" charge before returning to the "maintenance" charging mode. If the duration of the "constant current" mode is CCMINUTES or less, the unit proceeds directly to the "maintenance" charging mode. *Range:* 1 - 10 minutes.

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
65	Constant Voltage Charge Duration	CVHOURS	User	4	Duration of "constant voltage" charge before switching to "maintenance" charge. *Range:* 0 - 20 hours.
66	Periodic Charge Interval	CHRGINTDAYS	User	30	Interval between periodic float charges. *Range:* 1 - 90 days.
67	Periodic Charge Duration	CHRGDURHOURS	User	8	Duration of periodic float charge. *Range:* 0 - 50 hours. **Note:** This parameter also determines the duration of the InstallEqualization charge. See parameter 18.
68	Maintenance Voltage	MaintVoltage	User	53.30	When the charger is in "maintenance" mode, it maintains the battery string at this voltage. *Range: 48.00 - 56.00* V.
69	Normal Float Voltage	NormChrgVolts	User	57.60	If CalibratedBATTMP (parameter 32) is greater than ColdAmbient (parameter 71), this is the charger float voltage. *Range:* 55.00 - 60.00 V.
70	Cold Float Voltage	ColdChrgVolts	User	58.00	If CalibratedBATTMP (parameter 32) is less than or equal to ColdAmbient (parameter 71), this is the charger float voltage. *Range:* 55.00 - 60.00 V.
71	Cold Ambient	ColdAmbient	User	10.0	If CalibratedBATTMP (parameter 32) is at or below this set point, ColdChrgVolts (parameter 70) is used as the charger float voltage. If CalibratedBATTMP is greater than this set point, NormChrgVolts (parameter 69) is used as the charger float voltage. *Range: 0 - 20.0* degrees Celsius. Note: In units with software v1.06, there is a 3" C hysteresis. The unit will use ColdChrgVolts (Parameter 70) when CalibratedBATTMP (Parameter 32) drops to or below the ColdAmbient setting. The unit will resume use of the NormChrgVolts (Parameter 69) when CalibratedBATTMP rises to (ColdAmbient + 3)° C.
72	Charger Mode	ChargerMode	Display only	2	Indicates the present mode of the multi-mode battery charger. 1 = Periodic 2 = Constant Current, 3 = Constant Voltage, 4 = Maintenance.
73	Battery Test Time (v1.00 to v1.05)	BatteryTestTime	User	00:00	***Software v1.00 to v1.05:*** If the periodic battery test is enabled (see Parameter 76), the battery test begins when HoursMinutes (Parameter 90) = this value. *Range:* 00:00 - 23:59 (24-hour time). **Note:** The battery charger must be in maintenance mode and at least one periodic battery charge must have occurred for the unit to perform a battery test.
	Battery Test Time (v1.06)	BatteryTestTime	User	00:00	***Software v1.06:*** If the periodic battery test is enabled (see Parameter 76), the battery test begins when Time (Parameter 89) equals this value. *Range:* 00:00 - 23:59. Note: The battery charger must be in maintenance mode for the battery test to occur.

#	Parameter Name	Parameter Name in Software Code	Password	Defau	Description
74	Battery Test Interval	BatteryTestInterval	User	7	If the periodic battery test is enabled (see parameter 76), this is the interval between battery tests, *Range:* 1 - 28 days.
75	Battery Test Length	BatTestLength	User	15	If the periodic battery test is enabled (see parameter 76), this is the length of time the UPS runs on battery power during the battery test, expressed as a percentage of the LowRuntimeSetpoint (parameter *07).* ***Range: 5 - 25%.*** **Note:** The default BatTestLength = 15% of 2 minutes (LowRuntimeSetpoint default), which equals *0.3* minutes (18 seconds).
76	First Day of Battery Test (v1.00 to v1.04)	FirstDateOfTest	User	30:oo	***Software v1.00 to v1.04: The first*** battery test will take place on the day that WeeksDays (parameter 91) equals this value. **Disables the periodic battery test if set to "0".** *Range:* 00:00 (Disable test) or 01:01 - 04:07 (Week/Day of first test).
	First Date of Battery Test (v1.05 - v1.06)	FirstDateOfTest	User	30.00	***Software v1.05 to 1.06:*** The first battery test will take place on this Date (Parameter 90), formatted month/day (mm/dd). **Disables the periodic battery test if set to "0".** *Range: 00.00* (Disable test) or 01.01 - 12.31 (Date of first test). **See note at bottom of page.
77	Test On Demand	TestOnDemand	User	0	If set to "1," the UPS performs a battery test when the front panel TEST keys are pressed or when the B command is sent via a terminal connected to the DB9 communication port. *Choices: 0* (Disable) or 1 (Enable). Note: See the Note for parameter 62.
78	Line Delta Mode	LineDeltaMode	User	3	Used to determine sensitivity to AC line faults. *Choices:* 1 (Normal mode-uses LINEDELTA value in parameter 81), 2 (Poor line mode—uses least sensitive fault detection), 3 (Adaptive mode—UPS adapts sensitivity based on line quality history).

** In software version 1.05 - 1.06, if the battery test time and date (Parameters 73, 76) fall prior to the current time and date (Parameters 89, 90), the UPS will add the value of BatteryTestInterval (parameter 74) to the FirstDayOf Test (Parameter 76) until the battery test time and date fall after the current time and date.
Example: The Current Time (Parameter 89) = 13:07, Date (Parameter 90) = 04.28 (i.e. current time/date = 1:07 p.m., April 28).
The BatteryTestTime (Parameter 74) is programmed to 1:00 and the FirstDateOfTest (Parameter 76) to 04.22 (i.e. battery test time/date = 1:00 a.m., April 22). Because the battery test date (April 22) precedes the current date (April 28), the UPS will add the value of BatteryTestInterval (Parameter 74, default = 7 days) to the value for FirstDayOfTest. Thus, the first battery test will occur on 04.29 at 1:00 (04.22 + 7 days = 04.29).

#	Parameter Name	Parameter Name in Software Code	Password	Default	Description
79	Glitch Sensitivity	GlitchSensitivity	User	10	When LineDeltaMode (parameter 78) is set to adaptive mode, this is the number of glitches allowed to occur per quarter second before line delta is increased (sensitivity to disturbances is decreased). *Range:* 1 - 34.
80	Less Delta	LessDelta	User	500	When LineDeltaMode (parameter 78) is set to adaptive mode, this is the number of quarter-second intervals without a glitch before line delta is decreased (sensitivity to disturbances is increased). *Range:* 4 - 9999.
81	Line Delta	LINEDELTA	User	FFDD	When LineDeltaMode (parameter 78) is set to normal mode, this parameter programs the delta level. A higher value increases sensitivity to disturbances (decreases delta). *Range:* FF82 - FFFE hex.
82	Low output Voltage Trip Point	Votriplo	User	228	The low output voltage tap regulation trip point. A steady-state calibrated VOUT (parameter 28) lower than this value causes a tap change. This parameter and Votriphi parameter 83 set the steady-state output voltage regulation window. *Range:* 100 - 300 VAC. Notes: (1) If nominal VOUT (parameter 05) is change4 Votriplo is automatically recalculated to -3% (v1.00-1.08 software) or -5% (v1.09 software) of nominal. (Nominal VOUT x 0.97) for v1.00-1.08, or (Nominal VOUT x .95) for v1.09. (2) Default value = NominalVOUT x 0.97 (v1.00-1.08), which is -3% of NominalVOUT. Default value = NominalVOUT x 0.95 (v1.09), which is -5% of NominalVOUT.
83	High Output Voltage Trip Point	Votriphi	user	252	The high output voltage tap regulation trip point A steady-state CalibratedVOUT (parameter 28) higher than this value causes a tap change. This parameter and Votriplo (parameter 82) set the steady-state output voltage regulation window. *Range:* 100 - 300VAC. Notes: (1) If nominal VOUT (parameter 05) is changed, Votriphi is automatically recalculated to +3% (v1.00-1.08 software) or +5% (v1.09 software) of nominal. (Nominal VOUT x 1.03) (2) Default = NominalVOUT x 1.03 (v1.00-1.08), which is +3% of NominalVOUT. Default = NominalVOUT x 1.05 (v1.09), which is +5% of NominalVOUT.

400 Scheduled Maintenance

For years of UPS reliability, follow proper maintenance procedures. Scheduled maintenance. should be performed every sir months. A qualified service technician should clean and inspect the unit; check alarm and system logs and parameters for abnormal indications; perform a unit self-test; and perform a battery load test. It may be necessary to calibrate the AC and DC meter functions when batteries, parts, or other components have been replaced.

⚠ CAUTION

UPS maintenance must be performed by a qualified service technician only.

BEST publication UTY 604 provides written step-by-step instructions for scheduled maintenance. It includes important questions about the system and provides space for you to record the results for future reference.

BEST publication UTY 605 is an abbreviated version of UTY 604 provided for experienced technicians already familiar with UNITY/I maintenance procedures.

BEST publications UTY 604 and 605 include a simulated power outage and load test to make sure the UPS can provide power to the loads during a power outage. This test also helps the service technician identify batteries that may need replacing. It is important that the customer is informed that if there are low or faulty batteries in the system, the loads could lose power.

BEST publication UTY 601 contains calibration procedures.

These publications are found in Section 700 of this manual.

500 Troubleshooting

The following sections provide information for troubleshooting conditions external to the UPS and internal alarm conditions. This information can be used to diagnose external factors such as installation errors, uneven load distribution, or equipment overload. Information is also provided to assist in diagnosing alarm conditions such as low batteries or high ambient temperature. A list of alarm codes can be found inside the front panel of each unit for quick reference.

> If, after following the troubleshooting tables in this section, you still cannot operate your UPS, contact BEST Power Worldwide Service at l-800-356-5737 or l-608-565-2100, or your local BEST **office. Please have your unit's model number and serial number available when you call.**

501 Getting Started

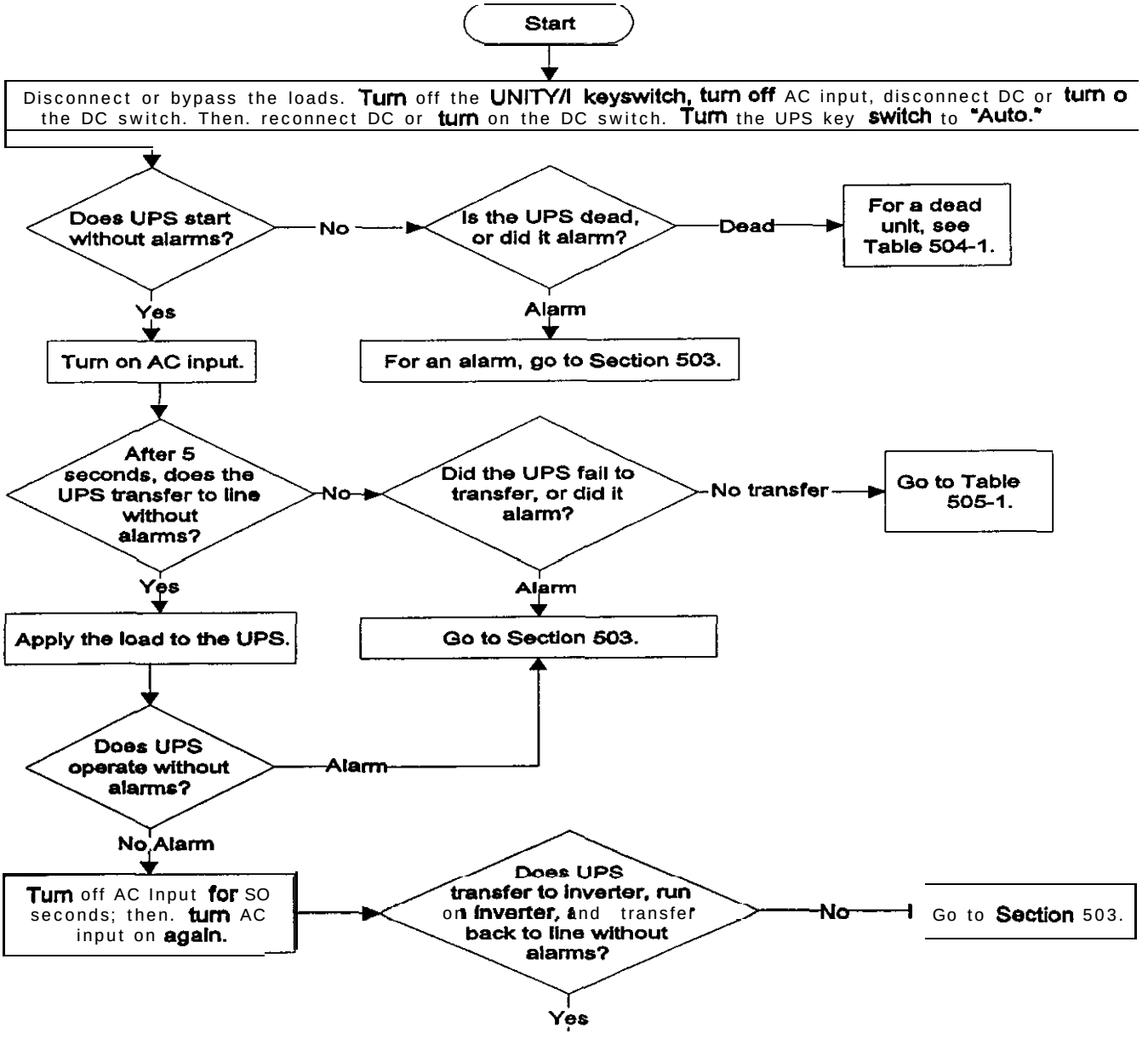
Based on BEST's field experience, a majority of service calls are caused by problems **outside** the UPS cabinet, Improper UPS sizing, improper installation wiring, neglected maintenance, and load equipment failure are common external problems. These problems may start months or years after the UPS has been operating and protecting vital equipment, See Section 502, "Troubleshooting Problems External to the UPS," for more information.

If the UPS is alarming or shows alarms in the alarm log, refer to the troubleshooting tables in Section SO3 of this manual.

If the system is experiencing problems, but the UPS is not alarming and does not show any alarms in the alarm log, refer to Table 501-l.

To begin troubleshooting, see the following "Basic Troubleshooting" chart

• Basic Troubleshooting



UPS operation seems normal. The problem ma,' be intermittent. Display the alarm log to determine whethe the problem caused an alarm. If it did, go to the table for that alarm in Section 503. If not, the problem ma be in loads or the installation; see Sections 501 and 502.

Table 501-l: Troubleshooting - Without Alarms

Symptom	Possible cause	Suggested Action
UPS is dead.	• See Table 504-l.	• See Table 504-l.
UPS is not dead, but some or all of the load equipment is not receiving power.	• Load equipment is switched off. . Equipment formerly connected to UPS is no longer connected. • A tripped breaker on back of unit. • "Emergency Power Off" has been activated. • Software activated shutdown.	. Turn load equipment on. • Check load equipment connections. • Reset breaker. • After verifying there is not an actual emergency, or if the emergency is over, press the EPO Reset Button.
UPS switches to battery power for "no reason" or in a predictable sequence (i.e., at the same time every day).	• Au automatic battery test is being done. • Input AC is being drawn away by equipment on the same input power circuit as the UPS. • Unstable input power (i.e., generator).	• Have an electrician check the input wiring circuit • Monitor input voltage to find the pattern of disturbance to help in isolation of the problem. . Check source of unstable input power.
There are power interruptions to the load equipment	• External bypass switch is in LINE rather than UPS position. • Equipment formerly connected to UPS is no longer connected. • Equipment shutdown was software activated.	• Put bypass switch in UPS position. • Make sure loads are connected to UPS. . Turn key switch to "Off" and then to "Auto." Watch display for alarm codes.
Bypass LED is lit although the key switch is in "Auto" position and no alarm is present	• F4 on Fuse Board open or wire connections on circuit boards open.	• Power down equipment, check F4 and circuit board connections.
Excessive tap changing (lots of clicking).	• Unstable input power (i.e., generator).	• Track dowuthe source of unstable input power. • Change parameters 82 and 83 to set a wider output voltage regulation window. This should result in fewer tap changes.

Communication: Much of the troubleshooting information in this manual assumes that you can communicate with the UPS. Although communication is not required, it greatly improves your ability to find the cause of a problem in the unit. You can communicate with your UPS by using:

- **Front Panel Keys:** You can use the keys on the front panel of the UNITY/l to communicate with the UPS. See Section 306 and BEST's UTY 501 in Section 700 for more information.
- **Terminal/Computer:** By connecting a terminal or computer to the unit's communication port, you can send commands to the UPS to display and change **parameters.** See BEST publication

UTY 501 in Section 700 for information about communicating via the DB9 communication port.

- **CheckUPS Software:** If your computer or network is running optional CheckUPS software, you can communicate with the UPS.

502 Troubleshooting Problems External to the UPS

UPS problems are often caused by factors external to the UPS. Such problems can begin at any time, and may occur at the UPS AC input or at the loads,

> **CAUTION**
>
> Only a qualified service technician should disconnect any cables or connections that may contain voltage or current.

The UPS should be installed on a dedicated circuit. The circuit should provide power to the UPS only. Even if the UPS was initially installed on a dedicated circuit, you may discover that other equipment (such as a copier or a laser printer) was installed later, on the same circuit. Copiers and laser printers can cause sags in the input power that may cause the UPS to run on battery power more often.

Loads connected to **the UPS can** sometimes cause problems. For example, coffee pots or small electrical heaters can overload the UPS by drawing excessive current. Other UPS loads can have internal **problems that** may cause them to draw excessive current. If you suspect that a load **is** causing the problem, try **disconnecting** or switching off the **loads** one at a time.

As you do this, check to see if the UPS runs properly. If the UPS runs properly when one or more loads are off, the problem is probably the load, not the UPS.

If these solutions do not help you find an external problem, an electrician can use Table 502-I to check the UPS installation.

- **Installation Wiring and Grounding (for Hardwired Units)**

> **CAUTION**
>
> This section is for qualified service personnel only.

Most of the UPS service calls BEST receives are installation-related. These problems could be avoided by using the correct wiring diagram provided by BEST. The National Electrical Code (NEC)

requires that listed equipment be installed according to the instructions furnished by the manufacturer. Failure to comply with this is a violation of NEC Article 110-3(b).

If you suspect that UPS problems are caused by an external condition, begin troubleshooting by reviewing the entire installation. Start from the service entrance panel, to the UPS connection panel, through the bypass switch, and out to the receptacle outlets where the load equipment is connected. Compare the installation with the wiring diagram in the *UNITY/I Installation Manual* shipped with the unit, and note any differences. Make sure all connections are tight and properly secured.

The table below describes common installation errors, ways to correct the errors, and applicable National Electrical Code Articles.

Table 502-l: Common Installation Errors

Installation **Error**	Correction	**NEC Article**
Switchgear, disconnects, and load breakers are not labeled.	Label all disconnects, bypass switches, load breakers, etc.	1 *IO-22*
The UPS is in a cramped or inaccessible area. You cannot fully remove the cover and inspect system components.	Position the UPS so that the clearance conforms to the specifications in the UNITY/I ***Installation Manual.***	110-16
The UPS neutral is not grounded, not used, or not switched at the external bypass switch.	The UNITY/I UPS is a separately-derived power source, and must be installed as such.	250-5(d) 250-26 250-23
The UPS neutral is fused at the bypass switch.	Use a bypass switch that is not fused.	230-90(b) 240-22
Local ground to the UPS is missing or supplied by conduit only.	Supply a continuous conductor from the nearest available effectively grounded electrode (i.e., building structural steel, or re-bar in concrete).	250-26(c) 250-91(a) 250-92(a) 250-92(b)
The UPS 208VAC output is fed to the loads with a neutral. As a result, the loads are fed 208/120/88VAC, and loads on the 88VAC leg malfunction or are damaged,	Never use the 88 VAC leg on the UPS output. Call BEST for instructions on properly installing the 120/208 VAC output combination.	110-3(b)

503 Troubleshooting Alarm Conditions

The following sections **describe** most internal UPS problems. If these sections do not describe your UPS problem, use the schematic diagrams in Section 800 to troubleshoot the problem. If **you** still cannot find the cause of the problem, call BEST Power Worldwide Service for assistance.

Alarms alert you to UPS conditions that require immediate attention. While some alarms are warnings, other alarms indicate that the UPS has shut down to protect the UPS and/or the load equipment from potential damage, Alarm codes are found inside the unit's front panel for quick identification.

Alarms may register immediately, or a short debounce may occur. Debounce is the time period that a fault condition exists before an alarm circuit is triggered. Debounce prevents false alarms caused by transient conditions. If you wish to silence an existing audible alarm, press the [CANCEL] key. **Silencing the audible alarm does not correct the condition that caused it.** The ALARM LED remains lit to show that the alarm condition still exists, If a new alarm condition arises, the audible alarm reactivates, **If the** UPS **has shut down** and the alarm condition no longer exists, restart the UPS by turning the key switch to "Off" and back to "Auto."

There are two **types of alarms. Non-latching alarms** clear automatically when an alarm condition is gone. **Latching alarms** must be cleared manually, even though the alarm condition **no longer exists.** If a latching alarm is active and the alarm condition no longer exists, first clear the audible alarm by holding down the [CANCEL] key for two seconds.

Then, if the loads are not connected, you must reset the alarm by turning the key switch to "Off and back to "Auto."

If the loads are still connected and your unit is **equipped** with an external bypass switch, check to see **if it** is labeled Make-Before-Break **(MBB). If so, switch to** external **bypass** to avoid losing power to the loads. Then turn the key switch to **"Off"** and back to "Auto." This will reset the latching **alarm.**

NOTE: Never turn the external bypass switch while the unit is on inverter. The BYPASS LED on the front panel of the UPS must be lit. If it is not lit, battery and line current will not be in phase.

Refer to the table on the next page.

To diagnose an alarm condition, look at the alarm code(s) displayed on the UPS front panel and turn to the description on the page number(s) below.

[1] See Table 503-9AA

[2] See Table 503-16AA

503-I: Low Runtime Alarm (A-00)

Table 503-1A: Low Runtime Alarm General Information

Alarm code:	A-00
Latching?	NO
Debounce:	None
Cause:	UPS on inverter AND Runtime ≤ LowRuntimeSetpoint (default is two minutes); The UPS is on battery power and the estimated runtime remaining is low.
UPS Action:	Activates A-00 alarm, records event in alarm log

Table 503-1B: Low Runtime Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Normal Operation (Extended power outage)	-If there is a power outage, shut down load equipment. -If there is not a power outage, check the input voltage by pressing the [VLINE] key. If the voltage is 0, verify the unit is plugged in and the circuit breaker is on.	A Low Runtime alarm is intended to warn the user to do an orderly shutdown of the load equipment before the UPS exhausts the batteries and shuts down.
2	Incorrect calibration of CalibratedVOUT (P-28), CalibratedIOUT (P- 29), or CalibratedVBAT (P- 30)	Calibrate parameters 28, 29, and 30.	Use a true RMS voltmeter. See Section 700 (UTY 601) for calibration procedure.
3	The LowRuntimeSetpoint (parameter 07) setting *incorrect*	Set parameter 07 to the proper setting.	Default setting = 2 minutes. The parameter may be set to a higher value for use with automatic shutdown software or so that ample warning is given to shut down load equipment.
4	Incorrect setting of BatteryCapacity (parameter 55)	Set parameter 55 to the proper setting. The setting should reflect the amp-hour rating of the batteries.	Default for standard units: UT3K = 17, UT4K or UT5K = 33, UT8K = 90. See Section 700 (UTY 601).
5	Battery cabinet fuse failure	Check fuse(s) in each battery cabinet.	Use a true RMS voltmeter.
6	Battery failure	Allow the batteries to recharge. Perform a load test and/or replace any failed batteries.	See Section 700 (UTY 604) for load test. See Section 700 (UTY 618) on changing batteries.
7	Battery charger failure	**Battery voltage≤52.5VDC.** With unit running on line, press the [VBATT] key. The battery voltage on the display should be increasing. If it is not, replace the inverter board. **Battery voltage≥52.5VDC.** Run the unit on battery by removing AC for 2-3 seconds. After a short time with AC reapplied the battery voltage should increase to 57.6VDC. If not, replace inverter board.	See Section 700 (UTY 643) for instructions on replacing the inverter board.

Set For 2 min
Default

503-2: Overload Alarm (A-01)

Table 503-2A: Overload Alarm General Information

Alarm code:	A-01
Latching?	No
Debounce:	1 second
Cause:	PercentLoad > 115 There is more than 115% load on the unit.
UPS Action:	Activates A-01 alarm, records event in alarm log.

Table 503-2B: Overload Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Too much load equipment	Press the [%LOAD] key to check the percent load. If the percent load is more than 100, remove the load equipment one piece at a time until the %LOAD display reads 100 or less.	More loads may have recently been added to the UPS. Check especially for coffee pots, laser printers, copiers, or other load equipment with internal heating elements. This type of load draws substantial current and could overload the UPS.
2	Incorrect calibration of CalibratedIOUT (parameter 29)	Calibrate parameter 29.	Use a true RMS ammeter. See Section. 700, (UTY 601) for calibration procedures.
3	Incorrect setting of FullLoadSetpoint (parameter 06)	Set parameter 06 to the proper setting.	Setting should match KW/KVA rating of UPS (UT3K = 3.00, UT4K = 4.00, UT5K = 5.00, UT8K = 8.00).
4	Logic board failure	With no load on the unit, parameter 29 (CalibratedIOUT) should read 0.0. If it does not, replace the logic board.	See Section 700, (UTY 641).

503-3: Circuit Breaker Warning/Shutdown Alarm (A-02)

'able 503-3A: Circuit Breaker Warning/Shutdown Alarm General Information

Alarm code:	A-02.
Latching?	Warning: No. Shutdown: Yes.
Debounce:	Warning: 2 seconds. Shutdown: 2 seconds.
Cause:	Warning: Thermal Accumulator > 5 * 256. Shutdown: Thermal-Accumulator > (CircuitBreakerTrip1 * 256). Excessive output current triggers "Warning." Subsequent "Shutdown" may occur, depending on severity and duration of high output current condition.
UPS Action:	Warning: Activates A-02 alarm, records event in alarm log. Shutdown: Activates A-02 alarm, records event in alarm log, and puts UPS into "sleep" mode (unit shuts down, but the logic board remains active).

Table 503-3B: Circuit Breaker Warm ing/Shutdown Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Too much load equipment connected to the UPS.	Press the [%LOAD] key. If the display reading is more than 100, remove the load equipment one piece at time until the %LOAD display reads 100 or less. If the unit shut down, after reducing loads, restart the unit by turning the UPS key switch to "Off' and back to "Auto."	More loads may have recently been added to the UPS. Especially check for coffee pots, laser printers, copiers, or other load equipment with internal heating elements. This type of load draws substantial current and could overload the UPS.
2	Incorrect calibration of CalibratedIOUT (parameter 29).	Calibrate parameter 29.	Use a true RMS ammeter. See Section 700, (UTY 601) for calibration procedure.
3	Incorrect setting of LineFullLoadCurrent (parameter 10). Nominal VOUT (parameter 5) and/or FullLoadSetpoint (parameter 6)	Set parameter 10 to the proper setting. Set parameter 5 and 6 to the proper setting, then check parameter 10 to ensure it has the proper reading.	Refer to Specifications table (Section 106) for proper reading of parameter 10.
4	Logic board failure	With no load on the unit parameter 29 (CalibratedIOUT) should read "0." If not, replace the logic board.	See Section 700, (UTY 641).

503-4: High Ambient Temperature Alarm (A-03)

Table 503-4A: High Ambient Temperature Alarm General Information

Alarm code:	A-03
Latching?	NO
Debounce:	1 second
Cause:	CalibratedAMBTMP > HighAmbientSetpoint The UPS internal temperature is too high.
UPS Action:	Activates A-07 alarm, records event in alarm log.

Default setting set At 40°C

ıble 503-4B: High Ambient Temperature Alarm Troubleshooting Procedure

tep	Possible Cause	What to do	Notes
l	UPS vents blocked	Make sure that the vents at the front and back of the unit are not blocked.	Requires a minimum 4" ventilation clearance at top and rear of the unit.
2	Room temperature too high	Reduce the temperature of the room where the UPS is located.	Ambient temperature is 0 ▪ 40' C or 32 -104' F Batteries last longer at room temp of less than 77° F.
3	Fan failure	See the Check Fan alarm (A-09) troubleshooting procedure.	An A-09 alarm should also be active.
4	Incorrect setting of HighAmbientSetpoint (parameter 12)	Set parameter 12 to the proper setting.	Default = 40.
5	Incorrect calibration of CalibratedAMBTMP (parameter 3 1)	Calibrate parameter 31. Insert a nonmetallic thermometer inside the unit near the logic board for two minutes and set parameter 3 1 for that temperature in Celsius.	
6	Logic board failure	Replace logic board.	If all other possible causes are eliminated, replace the logic board. See Section 700 (UTY 64 1) for logic board replacement instructions.

503-5: Check Battery Alarm (A-04)

Table 503-5A: Check Battery Alarm General Information

Alarm code:	A-04
Latching?	Yes
Debounce:	1.25 seconds for Cal V BAT to be less than FloatV
cause:	Failed battery test OR Cal V BAT < FloatV after [BatteryCapacity * 3600/ChargerRating] seconds elapsed with charger on. Unit fails battery test or batteries do not reach float voltage quickly enough with the charger on.
UPS Action:	Activates A-04 alarm, records event in alarm log.

Table 503-5B: Check Battery Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	DC switch turned to "Off' or DC fuse blown on external battery cabinet	If there is an external battery cabinet, verify that the DC switch is "On" and fuses are good.	Use a true RMS voltmeter to check fuses. For plug-n-play models, there is one fuse in the cabinet, and one in the connection box to the UPS.
2	Incorrect calibration of CalibratedVBAT (parameter 30)	Calibrate parameter 30.	Use a true RMS voltmeter. See Section 700 (UTY 601) for calibration procedures.
3	Incorrect setting of BatteryCapacity (parameter 55)	Set parameter 55 to the proper setting. The setting should reflect the amp-how rating of the batteries.	Default settings for standard units: UT3K = 17, UT4K or UT5K = 33, and UT8K = 90. See Section 700 (UTY 601), and (FSS-393) for instructions on setting battery capacity.
4	Incorrect setting of ChargerRating (parameter 60)	Set parameter 60 to the proper setting. The setting should reflect the total ampere rating of the battery charger(s).	Parameter 60 settings: UT3K, UT4K, or UT5K (standard charger only): 5 UT3K, UT4K, or UT5K (w/auxiliary charger): 20 UT8K (standard charger only): 10 UT8K (w/auxiliary charger): 25
5	Battery failure	Allow the batteries to recharge. Do a battery load test. Replace any failed batteries.	See Section 700 (UTY 604) for instructions on performing a load test. See Section 700 (UTY 618) for battery replacement instructions.
6	Battery charger failure (Inverter board)	Battery voltage≤52.5VDC. With unit running on line, press the [VBATT] key. The battery voltage on the display should be increasing. If not, replace the inverter board. Battery voltage≥52.5VDC. Run the unit momentarily on battery by removing AC for 2-3 seconds. Then, with AC reapplied the battery voltage should be increasing to 57.6VDC. If it is not, replace inverter board.	See Section 700 (UTY 643 or 647) for inverter board replacement instructions.

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503-6: Check Inverter Alarm (A-05)

Table 503-6A: Check Inverter Alarm General Information

Alarm code:	A-OS
Latching?	Yes
Debounce:	1 second
Cause:	InvFlt High UPS detects a possible problem with the inverter.
UPS Action:	Activates A-OS alarm, records event in alarm log.

Table 503-6B: Check Inverter Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Inverter board failure	Measure resistance between one of the outer and one of the inner heatsink fins on the inverter board. (Check both boards on UT8K.) The resistance should be approximately 2 ohms. If shorted, replace inverter board(s). There is a red LED on the inverter board. If the LED is lit, the inverter board failed. (However, if the LED is not lit, the inverter board still may have failed). If there is SVDC on the LED leads, replace the inverter board. On the 8K unit (two inverter boards) the faulty board is the one with the highest voltage on the LED leads.	See Section 700 (UTY 643 or 647) for inverter ward replacement instructions.
2	Logic board failure	If there is 0.0 VDC on the LED leads, on the inverter board, replace the logic board.	See Section 700 (UTY 641) for logic board replacement instructions.

503-7: Memory Error Alarm (A-06)

Table 503-7A: Memory Error Alarm General Information

Alarm code:	A-06
Latching?	NO
Debounce:	None
Cause:	EEWord does not match between software end EPROM.
UPS Action:	Activates A-06 alarm, records event in alarm log, defaults all parameters.

Table 503-7B: Memory Error Alarm Troubleshoothe Procedure

Step	Possible Cause	What to do	Notes
1	Software has been newly replaced	If you have just replaced the software on the logic board, turn the UPS key switch to "Off" and back to "Auto," or reset by holding down the [CANCEL] key for 2 seconds. Then calibrate the unit as instructed in UTY 641.	See Section 700 (UTY64 1) for calibration procedures.
2	Parameter 128 set incorrectly	Check to see if the label on the logic board EPROM chip matches P128 setting.	None
3	Logic board failure	Replace logic board.	See Section 700 (UTY 641).

503-S: High Battery Alarm (A-07)

Table 503-8A: High Battery Alarm General Information

Alarm code:	A-07
Latching?	NO
Debounce:	1 second
Cause:	CalibratedVBAT > HighBatterySetpoint The battery voltage is too high
UPS Action:	Activates A-07 alarm, records event in alarm log, turns battery charger off.

Has 2 charge to 57V

Table 503-8B: High Battery Alarm Troubleshooting Procedure

Step	Possible Cause	Whnttodo	Notes
1	HighBatterySetpoint (parameter 52) is set incorrectly	Set parameter 52 to the proper setting.	Default = 60
2	Incorrect calibration of CalibratedVBAT (parameter 30)	Calibrate parameter 30.	Use a true RMS voltmeter. See Section 700 (UTY 601).
3	Battery charger failure (Inverter board failure)	Measure battery voltage with a DC voltmeter. If battery voltage is more than 60 VDC, measure anode of CR.53 to DC GND on inverter board. If greater than 1 volt, replace the inverter board, if less than 1 volt, replace the logic board.	See Section 700 (UTY 643 or 647) for inverter board replacement procedures. See Section 700 (UTY641) for logic board replacement procedures.
4	Logic board failure	If the measured battery voltage is less than 60 volts and parameter 30 is properly calibrated but the alarm still occurs, replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedures.

503-9: Low Battery Alarm (A-08)

Table 503-9A: Low Battery Alarm (or Advisory Condition) General Information

Alarm code:	A-08
Latching?	Yes (until unit returns to line-interactive operation)
Debounce:	I second
Cause:	CalibratedVBAT < LowBatterySetpoint
JPS Action:	Activates A-08 Alarm or Advisory Condition, records event in alarm log, switches to a non-regulating mode (which activates A-16 alarm or advisory condition), and goes into "sleep" mode (i.e., unit shuts down, but logic board remains active; logic will shut down if battery voltage drops to 33.00 volts). If AutoRestartMode (parameter 03) is enabled, when acceptable AC line power returns the UPS will automatically restart in a non-regulating mode-the static switch turns ON and the inverter and tap changer are inhibited. The unit runs in this mode (and A-08 and A-16 remain active) until the battery voltage reaches 48 volts. The unit stays in non-regulating mode for an additional two minutes before automatically resuming normal line-interactive operation. If AC is lost before batteries recharge to 48 volts, the loads will lose power.

Table 503-9AA: A-08 Alarm Status Table

UNITY/I Model	Serial Number	ALARM LED State when in Low Battery (A-08) or Battery Maintenance Mode (A-16)	
3K	25098 and below	ON	
	25099 and above		OFF
4K	25097 and below	ON	
	25098 and above		OFF
5K	20778 and below	ON	
	20779 and above		OFF
SK	25097 and below	ON	
	25098 and above		OFF

able 5..-9B: Low Battery Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Normal operation (Extended power outage))	**If AutoRestartMode (parameter 03) is enabled: When the** unit restarts, allow the batteries to recharge. **If AutoRestartMode (parameter 03) is disabled: When** acceptable AC power returns, manually restart the "nit by turning the key switch to "Off" and back to "Auto." Allow the batteries to recharge. **If you anticipate an extended power outage:** Switch off all load equipment. Turn the UPS key switch to "Off' and manually restart the "nit when power returns.	**Auto** Bypass **alarm (A-16) should also be present.** The A-08 and A-16 alarms automatically clear when the unit returns to normal line-interactive operation. This alarm and shutdown occur when the unit has run on battery power for its full runtime and the batteries have been exhausted. The UPS shuts down to prevent damage to the batteries. You may wish to switch off all of the load equipment and switch it back on when the UPS returns to normal line-interactive operation (i.e., when the A-08 and A- 16 alarms are no longer active).
2	Incorrect calibration of CalibratedVBAT (parameter 30)	Verify the calibration of parameter 30.	Use a true RMS Voltmeter. See Section 700, (UTY 601).
3	Incorrect setting of Vllo (parameter 53), Kll (parameter 54), or BatteryCapacity (parameter 55)	Verify the settings of parameters 53. 54. and 55. The parameter 55 setting should reflect the amp-hour rating of the batteries.	Parameter 53 default = 1068 hex Parameter 54 default = EAO hex Parameter 55 defaults for standard "nits: UT3K = 17, UT4K or UT5K = 33, and UT8K = 90
4	Battery cabinet fuse failure	Check fuse(s) in each battery cabinet. (2 for plug-n-play models.)	Use a true RMS voltmeter.
5	Battery failure	Allow the batteries to charge. then do a battery load test. Replace any failed batteries.	See Section 700 (UTY 604) for battery load test procedures, and (UTY 618) for battery replacemen procedures.
6	Battery charger failure (Inverter board)	**Battery voltage≤52.5VDC.** With unit running on line, press the [VBATT] key. The battery voltage on the display should be increasing. If it is not, replace the inverter board. **Battery voltage≥52.5VDC.** Run the unit momentarily on battery by removing AC for 2-3 seconds. After a short time with AC reapplied the battery voltage should be increasing to 57.6VDC. If it is not, replace inverter board.	See Section 700 (UTY 643 or 647) for inverter board replacement procedures.

503-10: Check Fan (A-09)

Table 503-10A: Check Fan Alarm General Information

Alarm code:	A-09
Latching?	No
Debounce:	1 second
Cause:	FanTach signal missing OR CalibratedAMBTMP > (CalibratedBATTMP + 40)
UPS Action:	Activates A-09 alarm, records event in alarm log.

Table 503-10B: Check Fan Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Fan blades obstructed	Make sure that fan blades are clear of obstructions.	None
2	Fan disconnected or connected backwards on inverter board.	Check J3 on inverter board to make sure fan lead is properly connected.	None
3	Fan failure	With the unit running, see if the fan is turning (2 fans on UT8K). **Fan not turning:** Check for a 15 VDC or 24 WC signal on pin 2 of J3 on the inverter board. 1. Signal present: Replace the fan. 2. Signal not present: Replace the inverter board. **Fan turning:** Check for >5V on pin 3 of J3 on the inverter board. 1: Voltage not present: Replace the fan. 2. Voltage present: Check for 5V on pin 14 of US on the inverter board. a. Voltage not present: Replace the inverter board. b. Voltage present: Check for 5V on the right side of R200 on the logic board. i. Voltage not present: Replace the ribbon cable. ii. Voltage present: Replace the logic board.	See Section 700 (UTY 644) for fan replacement instructions.
4	Inverter board failure		See Section 700 (UTY 643 or 647) for inverter board replacement instructions.
5	Ribbon cable failure		None
6	Logic board failure		See Section 700 (UTY 641) for logic board replacement procedures.

503-l 1. Batteries Disconnected Alarm (A-11)

Table 503-11A: Batteries Disconnected Alarm General Information

Alarm code:	A-11
Latching?	NO
Debounce:	None
Cause:	At system start-up, CalibratedVBAT < 32.23V
UPS Action:	Activates A-11 alarm, turns battery charger off, and records event in alarm log.

Table 503-11B: Batteries Disconnected Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	*Notes*
1	Loose or missing battery connection	Check all battery cables, DC connector, and connectors on fuse board.	This will give an A-13 and A-17 alarm.
2	F1 on fuse board is open.	Check F1 on the fuse board.	Will also give A-8, A-13, and A-16 alarms.
3	Batteries Disconnected Alarm, External battery cabinet DC switches turned "Off," or the fuse blown at external DC connection point to the UPS.	Check DC switches and fuses.	This will only occur if the UPS has no internal batteries.
4	Batteries deeply discharged	Turn the key switch to "Auto" to allow the batteries to charge for 24 hours or until the batteries reach float voltage (57.6V default) set by parameter 69. Loads may be connected, but runtime will be reduced if there is a power outage.	This may happen if the unit was stored for an extended period of time without recharging or after an extended power outage.
5	Battery failure	Disconnect the positive battery cable from the fuse board. Then, use a voltmeter to measure the battery voltage. a. If battery voltage is < 32.23 VDC, replace the batteries. b. If battery voltage is > 32.23 VDC, replace the logic board.	See Section 700 (UTY *618)* for battery replacement procedure.
6	Logic board failure		See Section 700 (UTY 641) for logic board replacement procedure.

503-12: Tap Regulator Alarm (A-12)

Table 503-12A: Tap Regulator Alarm General Information

Alarm code:	A-12
Latching?	Yes • if welded contact
Debounce:	None
Cause:	TAP_STATUS "on-zero Unit detected a possible failure in the tap changer (open or welded relay, etc.).
UPS Action:	Activates A- 12 alarm, and records event in alarm log. If parameter 88 ≠ I, unit clears alarm every two minutes and repeats diagnostics. Stores results of diagnostic tests of the tap regulator in TAP-STATUS (parameter 124) and OPEN-TAPS (parameter 126). If the detected failure is a static switch failure, bypass relay failure, or a welded major tap relay, the unit switches to exclusive inverter operation. Otherwise, the unit continues line-interactive voltage regulation using the taps that are still functional. The voltage regulation window is widened to +3%, -6% of NominalVOUT plus 1 volt (unless Votriplo has been programmed by the user, in which case the user-programmed low voltage trip point will he used). Set parameter 88 to 1 if a welded tap is detected.

Table 503-12B: Tat, Regulator Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Open DC fuse (Fuse board)	If a Check Fuse Board alarm (A-17) is also present, check the DC fuse(s) on the fuse board. Replace any open fuses.	None
2	Open fuse on AC board	Display parameter 88 (WeldedContact). If parameter 88 reads "1": Set Parameter 88 to "0." Turn the key switch to "Off' and back to "'Auto." If the A-12 alarm recurs, replace the AC board. If parameter 88 reads "0": Display parameter 124 (TapStatus). a. Parameter 124 reads "120": On the AC board, check fuse F3 (UT3K, 4K, or 5K) or fuse F4 (UT8K). Replace the fuse if open. If alarm recurs, replace AC board. b. Parameter 124 does *not* read "120" or "0": Replace AC board.	If parameter 88 reads "1," it must be reset to "0" after the unit is repaired.
3	AC board failure		See Section 700 (UTY 642) for AC board replacement procedure.
4	Logic board failure.	If parameter 88 and 124 read "0" and alarm is still present, replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedures.
5	Very poor input line stability (16 tap changes in 2 seconds)	Determine cause of poor line. Open or widen parameters (i.e., lime delta, frequency rails, glitch limit, glitch sensitivity, or generator).	None

503-13: Low AC Out Alarm (A-13)

Table 503-13A: Low AC Out Alarm General Information

Alarm code:	A-13
Latching?	No
Debounce:	Default = 1 second (Software v.1.06, variable set by parameter 94; no debounce for software v.1.00 - 1.05)
Cause:	CalibratedVOUT < (0.75 * NominalVOUT) AND inverter enabled AND static switch disabled. Low UPS output voltage.
UPS Action:	Activates A-13 alarm, and records event in alarm log (software v.1.06 shuts down UPS if in Hotswap).

Table 503-13B: Low AC Out Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Unit is in bypass mode.	If Low Battery Shutdown (A-08) alarm is active, refer to Section 503-9. If (A-16) alarm is active and parameter 63 (Hotswap) is set to 1, set parameter 63 to zero. Turn unit to "Off," then "Auto."	
2	If another alarm is active, go to that alarm's troubleshooting procedure.		
3	Inverter board failure	If the alarm occurs only while the unit is on battery power, replace the inverter board.	See Section 700 (UTY 643 and 647) Inverter board replacement orocedure.
4	AC board failure	If the alarm occurs only while on line, replace the AC board	See Section 700 (UTY 642) for AC board replacement procedure
5	Incorrect calibration of Calibrated VOUT (parameter 28)	Calibrate parameter 28.	See Section 700 (UTY 601).
6	Filter caps failed or have loose wire connections	Check wire connections to filter capacitors. Measure voltage across filter capacitors. Voltage should measure ZOO-260VAC.	Use a true RMS voltmeter.
7	Load equipment	Disconnect loads. Does alarm clear? If so, reconnect loads one at a time until unit alarms. The last load connected is faulty or overloads UPS.	
8	Logic board failure	If all other possibilities have been eliminated, replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedure.

503-14: High AC Out Warning/Shutdown Alarm (A-14)

Table 503-14A: High AC Out Warning/Shutdown Alarm General Information

Alarm code:	A-14
Latching?	Yes
Debounce:	8 line cycles
Cause:	VOUT > 1.08 * NominalVOUT
UPS Action:	Activates A-14 alarm, records event in alarm log, and goes into "sleep" mode (i.e., unit shuts down, but logic board remains active).

Table 503-14B: High AC Out Warning/Shutdown Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Unit is in Bypass mode.	Set parameter 63 to zero, then turn keyswitch to "Off," then to "Auto."	Alarm occurs because the unit is in bypass and line voltage is too high.
2	Incorrect calibration of CalibratedVOUT (parameter 28)	Calibrate parameter 28.	Parameter 28, Use a true RMS voltmeter. See Section 700 (UTY 601).
3	Inverter board failure	If the alarm occurs only while the unit is running on battery power, replace the inverter board.	See Section 700 (UTY 643 or 647) for inverter board replacement procedure.
4	AC board failure	If the alarm occurs only while the unit is running on line, replace the AC line board.	See Section 700 (UTY 642) for AC board replacement procedure.
5	Logic board failure	Replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedure.

503-15: Check MOVs Alarm (A-15)

Table 503-15A: Check MOVs Alarm General Information

Alarm code:	A-15
Latching?	NO
Debounce:	1 second
Cause:	MOVStatus non-zero One or more failed MOVs on the EMI board and/or AC board
UPS Action:	Activates A-15 alarm, records event in alarm log.

Table 503-15B: *Check MOVs Alarm* Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Blown MOV on EMI board	Visually check the MOVs on the EMI board. If any MOV is blown, replace the EMI board.	See Section 700 (UTY 640) for EMI board replacement procedures.
2	Blown MOV on AC board	Visually check the MOVs on the AC board. If any MOV is blown, replace the AC board.	See Section 700 (UTY 642) for AC board replacement procedures.
3	Blown fuse on EMI board	Check fuses F1, F2, F3 and F4 on the EMI board. If any fuse is blown, replace the EMI board.	See Section 700 (UTY 640) for EMI board replacement procedures.
4	*Blown* fuse on the AC board	Check fuses F1 and F2 (UT3K, 4K, and 5K) or fixes F1, F2 and F3 (UT8K) on the AC board. If any fuse is blown, replace the AC board.	See Section 700 (UTY 640) for EMI board replacement procedures.
5	EMI board failure	1. With alarm displayed - power down the UPS. 2. Disconnect J3 from AC line board - power up the UPS. a. If alarm disappears, replace the EM1 board. b. If alarm remains, replace the AC board.	See Section 700 (UTY 640 or 642).
6	AC board failure		
7	Ribbon cable failure	Inspect the ribbon cable between the AC board and the logic board for any cracks, bare spots or worn areas. If any damage is found, replace the ribbon cable.	
8	Logic board failure	If all other possibilities have been eliminated, replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedure.

503-16 Auto Bypass Alarm (A-16)

Table 503-16A: Auto Bvoass Alarm (or Advisory Condition) General Information

Alarm code:	A-16
Latching?	No
Debounce:	None
Cause:	BYPASS-PWM or HotSwap or LbattShutDFlag enabled Parameter 63 (HotSwap) is enabled or a Low Battery alarm (or advisory Condition), A-OS, and shutdown has occurred.
UPS Action:	Activates A-16 alarm (or advisory condition), and records event in alarm log. Refer to Table 503-9AA for information on A-16 and A-08 status as an alarm or advisory condition, based upon the serial number of the UNITY/l unit.

Table 503-16B: *Auto Bypass Alarm Troubleshooting Procedure*

Step	Possible Cause	What to do	Notes
1	Normal operation Low batteries	See Step 1 of the troubleshooting procedure for A-08, Low Battery Alarm (or Advisory Condition).	The Low Battery alarm (or advisory condition), A-08, places the unit into a special bypass mode. This special bypass mode does not use the bypass relay; instead, it inhibits the static switch from switching off. In this mode, the AC input travels to the main transformer AC line primary via the static switch. Inverter activity is prohibited, so the unit will not regulate voltage or provide backup power. However, the unit provides lightning protection, noise protection, and isolated output.
2	Parameter 63 is set to "1."	Set parameter 63 to "0."	Parameter 63 to "1" is HotSwap mode.
3	Fuse is open.	Check F1 and F4 on fuse board (Ph I & II). For Phase III, check F1 and F2.	F1 open will also give A-8, A-l 1, and A-13 alarm.
4	Lost watchdog signal.	Other alarms should be present. Refer to that alarm's troubleshooting procedure. If there are no other alarms, replace tbe logic board.	None

503-17. Check Fuse Board Alarm (A-17)

Table 503-17A: Check Fuse Board Alarm Information

Alarm code:	A-17
Latching?	NO
Debounce:	1 second
Cause:	FUSEBAD = 0. Open fuse
UPS Action:	Activates A-17 alarm, and records event in alarm log.

Table 503-17B: Check Fuse Board Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Blown fuse on fuse board	Check the fuses on the fuse board. Replace any open fuses.	The UT3K and UT4K have one fuse. The UTSK and UT8K have two fuses.
2	DC connector disconnected	Check that the DC connector to the right of the fuse board is properly connected.	
3	Inverter board failure	Measure both sides of the inverter heatsinks (from outside heatsink- to inside heatsink). If they are shorted, replace inverter board.	See Section 700 (UTY 643 or 647) for inverter board replacement procedures.
4	Fuse board or logic board failure	Check voltage on J1 pin 3 of the fuse board. If zero, replace fuse board. Any other voltage, replace logic board.	See Section 700 (UTY 639) for fuse board replacement procedure. See Section 100 (UTY 641) for logic board replacement procedures.

503-18: Check Power Supply Alarm (A-19)

Table 503-18A: Check Power Supply Alarm General Information

Alarm code:	A-19
Latching?	Yes
Debounce:	13ms
Cause:	Internal +24VDC or +15VDC attenuated or missing
UPS Action:	Activates A-19 alarm, disables inverter, records events in alarm log.

Table 503-18B: Check Power Supply Alarm Troubleshooting Procedure

Step	Possible Cause	What to do	Notes
1	Normal operation	In units with software v.1.00-1.04, if tbe alarm is not active but appears in the alarm log, check the duration, If the recorded duration is "---.-" (less than 6 seconds), the alarm is probably in the log because the unit was shut off.	The unit may briefly display or log an A-1Y alarm when it is shut off. The unit senses the drop in power supply voltage before the logic board loses power.
2	Ribbon cable disconnected or damaged	Visually inspect the ribbon cable between J8 on the logic board and J4 on the AC board. Look for any loose connections, pinches, exposed wires or damage to the cable. If necessary, reconnect or replace.	
3	Logic board failure	On the AC board J2, pin 11 should measure 24V, and pin 12 should measure 15V (pin 10 and pin 13 are ground). a. If the voltages are present, replace the logic board. b. If either voltage is not present, disconnect J2 on the inverter board and remeasure AC board J2 pins IO and 11. 1. If voltages are present, replace the inverter board. 2. If either voltage is not present, replace the AC board.	See Section 700 (UTY 641) for logic board replacement procedure.
4	Inverter board failure		See Section 700 (UTY 643 or 647) for inverter board replacement procedure.
5	AC board failure		See Section 700 (UTY 642) for AC board replacement procedure.

504 Dead Unit Diagnostic Procedure

Dead Unit: Dead Unit Diagnostic Procedure that will not

Step	Possible Cause	What to do
1	The UPS key switch turned to "Off	Turn the UPS key switch to "Auto."
2	Internal power supply failure	If the UPS key switch is in the "Auto" position and the BYPASS LED is on and there is no visual display, follow the troubleshooting procedure for the A-19 alarm.
3	Loose connection or disconnected lead	Visually inspect the unit for loose connections or disconnected leads. Specifically check E-5, J2, and J3 on fuse board and 11, J2, and J4 of AC board, and J8 of the logic board.
4	Key switch failure	With the key switch in auto, measure for 48 VDC at E5 of fuse board. 1. Voltage missing at ES of fuse board. a. check F4 on fuse board and check for battery voltage present at stud 5. b. Voltage missing at stud 5 - check and tighten battery cable connections. 2. Voltage present at ES of fuse board. Measure for 48 VDC at J1 pin 1 of AC board. a. Voltage missing - replace AC board. b. Voltage present - measure for 48 VDC at J1 pin 2 of AC board. i. Voltage missing at J1 pin 2 - replace front panel key switch. ii. Voltage present at Jl pin 2 - if J3-6 is less than 15V, replace AC board; if J3-5 is less than J3-6, replace key switch.
5	Normal operation	Use a voltmeter to check for AC input voltage; measure from L1 to L2 on the input terminal blocks. If AC input voltage is not present: a. Is there a utility power failure? If so, the unit may have exhausted its batteries and completely shut itself down. Wait for AC power to return. b. Check the main circuit breaker that provides AC to the UPS. c. Check the battery voltage. If the battery voltage is less than 32.23VDC, replace the batteries. If AC input voltage is present: Check for AC voltage across the static switch; measure between the two outside heatsinks on the AC board. a. If no voltage is present, replace the EMI board. b. If voltage is present, replace the AC board.
6	Battery failure	
7	Improper installation	
8	EMI board failure	
9	AC board failure	

505 AC Line Diagnostic Procedure - (UPS has AC line voltage but will not accept it.)

Table 505-l: AC Line Diagnostic Procedure

step	Possible Cause	Repair Procedure	Notes
1	Low or high AC power to the UPS	Verify that adequate AC power is reaching the UPS.	Measure at L1 and L2 on input terminal block. The AC line voltage must be 147-255VAC for the tap changing circuitry to compensate for the low or high input to keep the output at ±3% (sotware v1.00-1.08) or ±5% (software v1.09) of desired output.
2	The UPS will not accept AC line.	Check tbe frequency of the AC line signal and tbe incoming frequency rails (parameter 14-17).	The default setting for frequency rails is ±3Hz from center frequency.
3	Poor quality AC line	Set parameter 78 to "2" (poor line mode); if tbe unit works, input line voltage is poor. Set parameter 78 back to "1" and repair input power problem.	None
4	Parameter 125 (Control flags) showing a fault	Examine contents of parameter 125. Check for active flags. See Section 308-5 for a detailed interpretation of parameter 125.	Parameter 125 can aid in fault detection.
5	Incorrect calibration of CalibratedVIN (parameter 27)	Calibrate parameter 27.	Use a true RMS voltmeter. See Section 700 (UTY 601).
6	The logic board failed	Replace the logic board.	See Section 700 (UTY 641) for logic board replacement procedures.

600 Parts Lists

The following tables list the major parts and BEST part numbers for each UNITY/I model. BEST part numbers are generally formatted as PPP-nnnnX, where PPP is a three-letter prefix identifying the type of part, and nnnn is a specific part number.

To order parts, call BEST Power Worldwide Service at 1-800-356-5737 (U.S.A. and Canada) or 1-608-565-2100 (Worldwide). For warranty information, see the *UNITY/I User Manual.*

Note: This is not a full parts list.

601 Parts List for Model UT3K

UNITY/I 3K

Part Description	Part #	wt
AC Board	PCP-0395	3
EMI Board	PCS-0030	1
Fuse Board (for units with serial number less than 20,000) (includes DC fuses for model number ordered)	PCP-0185	1
Fuse Board (for units with serial number more than 20,000) (must order DC fuses separately)	PCP-03 14	1
Fuse, DC, (1 per unit); (2 per kit); (125 Let. 125A, 240V); (for units with serial number less than 25,000)	FUS-0203	1
Fuse, DC, (1 per unit); (2 per kit); (125 Let. 125A, 130V); (for units with serial number more than 25,000)	FUS-0367	1
Inverter Board	PCP-0178	3
Logic Board; FRW-0014 (HV EPROM) FRW-0015 (LV EPROM)	PCL-0165	2
User Interface Board	PCI-0017	1
Aux Charger Upgrade Kit UT3-5K (for serial number 20,000 and above only)	SSBCGUT3-5	13

Part Description	Part #	w t
Battery (12V,17AH) Qty 4	BAT-0058[1]	17
Battery (12V, 33AH) Qty 4	BAT-0065[1]	27
Bracket (tip stabilizer)	BKT-0594	2
Breaker (main 15A)	BRC-0261	1
Cable, Ribbon (7 in, 34 pin, Jl inverter board to J2 logic board)	BAA-0433	1
Cable, Ribbon (37 in, 9 pin. Jl logic board to DB9 port)	BAA-0436	1
Cable, Ribbon (33 in, 34 pin. J4 AC board to J8 logic board)	BAA-0459	1
Capacitor, filter (45uF, 280VAC)	CPR-0481	1
Casters (back)	HWR-0117	1
Casters (front swivel)	HWR-0118	1
Cover (left side black)	CAB-1005	12
Cover (left side)	CAB-0800	12
Cover (right side black)	CAB-1003	12
Cover (right side)	CAB-080 1	12
Din Rail	DRA-0013	3
Fan (24VDC w/tach output; secured with four FAS-0228)	FAN-0043	2
Fastener (nylon snap rivet)	FAS-0228	I
Fuse (with external battery cabinets only 125A, 130V)	Fus-0351	1
Grommet (for line cords)	CNF-0034	1
Label (alarm code; attaches to front door panel; PAN-O 189)	LAB-1170	1
Label (user interface board label for front panel keys and LEDs; attaches to user interface board holder; PAN-0187)	LAB-1146	1
Line Cord (L6-30)	LCA-0257	3
Line Cord (L6-20)	LCA-0256	3

[1]**Ordering Nate:** BAT-0058 are used in units with serial numbers less than 20,000. BAT-0065 are used in units with serial numbers greater than 20,000.

Part Description	Part #	Wt
Line Cord (IEC-309 32A)	SSLCA-0164	3
Monitor Torroid	MTN-0005	1
Panel (front door)	PAN-0189	1
Panel (front door black)	PAN-0222	1
Panel (front narrow)	PAN-0190	1
Panel (front narrow black)	PAN-0221	1
Panel (user interface board frame)	PAN-0188	1
Panel (user interface board frame black)	PAN-0223	1
Panel (user interface board holder)	PAN-0187	1
Panel (user interface board holder black)	PAN-0224	1
Panel (ventilation)	PAN-0186	1
Panel (ventilation black)	PAN-0225	1
Receptacle Panel (blank)	PNL-0226	1
Side Door Assembly	CAB-0803	8
Switch (EPO reset harness)	HRS-0264	1
Switch (main keyswitch, three-position Auto/Off/Bypass)	HRS-0260	1
Switch (pre-charge harness)	HRS-0258	1
Transformer	TRN-0771	70
Wire harness (DB9 port and wire harness)	BAA-0436	1
Wire harness (EMI to AC board)	BAA-0453	1
Wire harness (input EMI)	BAA-0454	1
Wire harness (logic to fuse board)	BAA-0451	1
Wire (pre-charge)	BAA-0452	1

602 Parts List for Model UT4K

UNITY/I 4K

Part Description	Part #	Wt
AC Board	PCP-0395	3
EMI Board	PCS-0030	1
Fuse Board (for units with serial number less than 20,000; includes DC fuses for model number ordered)	PCP-0185	1
Fuse Board (for units with serial numbers greater than 20,000; must order DC fuses separately)	PCP-03 14	1
Fuse, DC (1 per unit; 2 per kit, 160A, 240V; for units with serial numbers less than 25,000)	FUS-0213	1
Fuse, DC (1 per unit; 2 per kit, 150A, 125V; for units with serial numbers greater than 25,000)	FUS-0368	1
Inverter Board	PCP-0178	3
Logic Board; FRW-0014 (HI EPROM); FRW-0015 (LO EPROM)	PCL-0165	2
User Interface Board	PCI-0017	1
Aux Charger Upgrade Kit UT3-5K (for serial number 20,000 and above only)	SSBCGUT3-5 1	5
Battery (12V, 33AH) Qty 4	BAT-0065	27
Bracket (tip stabilizer)	BKT-0594	2
Breaker (main 20 A)	BRC-0262	1
Cable, Ribbon (7 in, 34 pin. Jl inverter board to J2 logic board)	BAA-0433	1
Cable, Ribbon (37 in, 9 pin. J1 logic board to DB9 port)	BAA-0436	1
Cable, Ribbon (33 in, 34 pin. J4 AC board to J8 logic board)	BAA-0459	1
Capacitor, filter (45uF, 280VAC)	CPR-048 1	1
Casters (back)	HWR-0117	1
Casters (front swivel)	HWR-0118	1
Cover (left side)	CAB-0800	12
Cover (right side)	CAB-0801	12

Part Description	Pal-#	Wt
Din Rail	DRA-0013	3
Fan (24VDC w/tach output; secured with four FAS-0228)	FAN-0043	2
Fastener (nylon snap rivet)	FAS-0228	1
Fuse (with external battery cabinets only 200A, 130V)	Fus-0004	1
Fuse (with external battery cabinets only 150A, 130V)	FUS-0165	1
Grommet (for line cords)	CNF-0034	1
Label (alarm code; attaches to front door panel; (PAN-01 89)	LAB-l 170	1
Label (user interface board label for front panel keys and LEDs; attaches to user interface board holder; PAN-0187)	LAB-l 146	1
Line Cord (L6-30P)	LCA-0257	3
Line Cord (L6-20)	LCA-0256	3
Line Cord (IEC-309 32A)	SSLCA-0164	3
Monitor Torroid	MTN-0005	1
Panel (front door)	PAN-0189	1
Panel (front door black)	PAN-0222	1
Panel (front narrow)	PAN-0190	1
Panel (front narrow black)	PAN-022 1	1
Panel (kickplate)	BKT-0485	2
Panel (user interface board frame)	PAN-0188	1
Panel (user interface board frame black)	PAN-0223	1
Panel (user interface board holder)	PAN-0187	1
Panel (user interface board holder black)	PAN-0224	1
Panel (ventilation)	PAN-0186	2
Panel (ventilation black)	PAN-0225	2
Receptacle Panel (blank)	PNL-0226	2
Side Door Assembly	CAB-0803	8

Part Description	Part #	w t
Switch (EPO reset harness)	HRS-0264	1
Switch (main keyswitch, three-position Auto/Off/Bypass)	HRS-0260	1
Switch (pre-charge harness)	HRS-0258	1
Transformer	TRN-0771	70
Wire harness (DB9 port and wire harness)	BAA-0436	1
Wire harness (EMI to AC board)	BAA-0453	1
Wire harness (input EMI)	BAA-0454	1
Wire harness (logic to fuse board)	BAA-0451	1
Wire (pre-charge)	BAA-0452	1

603 Parts List for Model UT5K

UNITY/I 5K

Part Description	Part #	Wt
AC Board	PCP-0 175	3
EMI Board	PCS-0030	1
Fuse Board (for units with serial number less than 20,090) (includes DC fuses for model number ordered)	PCP-0185	
Fuse Board (for units with serial number greater than 20,000) (must order DC fuses separately)	PCP-03 14	
Fuse, DC (2 per unit, 4 per kit 100 Let, 100A, 240V; for units with ser # less than 25,000).	FUS-0212	1
Fuse, DC (1 per unit, 2 per kit 200A, 125V; for units with ser # greater thar 25,000).	FUS-0362	
Inverter Board	PCP-0193	
Logic Board; FRW-00 14 (HI EPROM) FRW-00 15 (LO EPROM)	PCL-0165	2
User Interface Board	PCI-0017	
Aux Charger Upgrade Kit UT3-5K (for serial number 20,000 and above only)	SSBCGUT3-5	15
Battery (12V, 33AH) Qty 4	BAT-0065	27
Bracket (tip stabilizer)	BKT-0594	2
Breaker (main 25A)	BRC-0263	1
Cable, Ribbon (7 in, 34 pin. J1 inverter board to J2 logic board)	BAA-0433	1
Cable, Ribbon (37 in, 9 pin. J1 logic board to DB9 port)	BAA-0436	1
Cable, Ribbon (33 in, 34 pin. J4 AC board to J8 logic hoard)	BAA-0459	
Capacitor, filter (55uF, 370VAC)	CPR-0628	
Casters (back)	HWR-0117	
Casters (front swivel)	HWR-0118	
Cover (left side black)	CAB-1005	12
Cover (left side)	CAB-0800	12

Cover (right side black)	CAB-1003	12
Cover (right side)	CAB-0801	12
Din Rail	DRA-0013	3
Fan (24VDC w/tach output; secured with four FAS-0228)	FAN-0043	2
Fastener (nylon snap rivet)	FAS-0228	1
Fuse (with external battery cabinets only 200A, 130V)	FUS-0351	1
Fuse (with external battery cabinets only 150A, 130V)	FUS-0165	1
Grommet (for line cords)	CNF-0034	1
Label (alarm code; attaches to front door panel; (PAN-0189)	LAB-1170	1
Label (user interface board label for front panel keys and LEDs; attaches to user interface board holder; PAN-0187)	LAB-1 146	1
Line Cord (L6-30P)	LCA-0257	3
Line Cord (L6-20)	LCA-0256	3
Line Cord (IEC-309 32 A)	SSLCA-0164	3
Monitor Torroid	MTN-0005	1
Panel (front door)	PAN-0189	1
Panel (front door black)	PAN-0222	1
Panel (front narrow)	PAN-0190	1
Panel (front narrow black)	PAN-0221	1
Panel (user interface board frame)	PAN-0188	1
Panel (user interface board frame black)	PAN-0223	1
Panel (user interface board holder)	PAN-0187	1
Panel (user interface board holder black)	PAN-0224	1
Panel (ventilation)	PAN-0186	1
Panel (ventilation black)	PAN-0225	1
Receptacle Panel (blank)	PNL-0226	1
Side Door Assembly	CAB-0803	8

Switch (EPO reset harness)	HRS-0264	1
Switch (main keyswitch, three-position Auto/Off/Bypass)	HRS-0260	1
Switch (pre-charge harness)	HRS-0258	1
Transformer	TRN-0778	92
Wire harness (DB9 port and wire harness)	BAA-0436	1
Wire harness (EMI to AC board)	BAA-0453	1
Wire harness (input EMI)	BAA-0454	1
Wire harness (logic to fuse board)	BAA-0451	1
Wire (me-charge)	BAA-0452	1

604 Parts List for Model UT8K

UNITY/I 8K

Part Description	Part #	wt
AC Board (for serial number below 25,OOOO send BAA-0565 ribbon cable also)	PCP-0176	4
EMI Board	PCS-0029	1
Fuse Board (units with serial number less than 25,000) (includes DC fuses for model number ordered)	PCP-0185	1
Fuse Board (units with serial numbers greater than 25,0001) (must order DC fuses seperately)	PCP-0314	1
Fuse, DC (2 per unit)(4 per kit) (160A, 240V) (for units with serial number under 25000.)	FUS-0213	1
Fuse, DC (2 per unit); (4 per kit); (150A, 125V); (for units with serial number greater than 25000.)	FUS-0368	1
Inverter Board (2 per unit)	PCP-0178	3
Logic Board; FRW-0014 (HI EPROM); FRW-0015 (LO EPROM)	PCL-0165	2
User Interface Board	PCI-0017	1
Aux Charger Upgrade Kit (for serial number 25,000 and above only)	SSBCGUT8	15
Battery (12V, 75AH) Qty 4	BAT-0103	57
Bracket (tip stabilizer)	BKT-0492	2

Breaker (main 40A)	BRC-0201	1
Cable, Ribbon (17 in, 34 pin. J1 inverter board to J2 logic board)	BAA-0435	1
Cable. Ribbon (37 in, 9 pin. J1 logic board to DB9 port)	BAA-0437	1
Cable, Ribbon (33 in, 34 pin. J4 AC board to J8 logic board) for serial number below 25.000	BAA-0459	1
Cable, Ribbon (33 in, 34 pin. J4 AC board to J8 logic board) for serial number above 25,000	BAA-0565	1
Capacitor, filter (70uF, 370VAC)	CPR-0629	1
Casters (back fixed)	HWR-0117	1
Casters (front swivel)	HWR-0118	1
Cover (left side)	CAB-0780	16
Cover (right side)	CAB-0781	16
Din Rail	TRB-0399	4
Fan; Qty 2 (24VDC w/tach output; secured with four FAS-0228)	FAN-0043	2
Fastener (nylon snap rivet) Qty 4 per fan	FAS-0228	1
Fuse (with external battery cabinets only 350A, 130V) Qty 2	FUS-0249	1
Label (alarm code; attaches to front door panel; (PAN-0189)	LAB-1170	1
Label (user interface board label for front panel keys and LEDs. Attaches to user interface board holder; PAN-O 187)	LAB-1146	1
Monitor Torroid	MTN-0005	1
Panel (front door)	PAN-0189	1
Panel (front narrow)	PAN-0190	1
Panel (kickplate)	BKT-0485	2
Panel (user interface board frame)	PAN-0188	1
Panel (user interface board holder)	PAN-0187	1
Panel (ventilation)	PAN-0186	1
Receptical Panel (blank)	PNL-0226	1
Side Door Assembly	CAB-0783	11

Switch (EPO reset harness)	HRS-0264	1
Switch (main keyswitch, three-position Auto/Off/Bypass)	HRS-0257	1
Switch (pre-charge harness)	HRS-0258	1
Transformer	TRN-0779	137
Wire harness (DB9 port and wire harness)	BAA-0437	1
Wire harness (EMI to AC board)	BAA-043 1	1
Wire harness (input EMI)	BAA-0430	1
Wire harness (logic to fuse board)	BAA-0443	1
Wire (pre-charge)	HRS-0259	I

700 Technical Information Publications

The UNITY/I technical information publications (UTYs) listed below provide further information about the unit. For additional or updated copies of the following publications, call BEST Power at I-800-356-5737 (U.S.A. and Canada), or 1-608-565-2100 (Worldwide).

UTY Number	UTY Title
w 501	Communicating with the UNITY/I via the DB9S Communication Port
UTY 601	Verifying the Basic Operation of the Single-Phase UNITY/I
UTY 604	Scheduled Maintenance for UNITY/I Single-Phase Models
UTY 605	Scheduled Maintenance and Service Call Report Form for UNITY/I Single-Phase Models
UTY608	Generator Setup for UNITY/I UT3K, UT4K, UT5K, and UT8K
UTY 618	Replacing the Internal Batteries in UNITY/I Models UT3K, UT4K, UT5K, and UT8K
UTY619	Replacing the Internal Batteries in UNITY/I UT3K, UT4K, UT5K, and UT8K (Internal Fuse Board)
UTY620	Replacing the External Batteries for UNITY/I UT3K, UT4K, UT5K, and UT8K
UTY 627	Replacing the User Interface Board in UNITY/I Models UT3K, UT4K, UT5K, and UT8K
UTY628	Using the PhonTek Interface in the Single-Phase UNITY/I
W 639	Replacing the Fuse Board on UNITY/I Models UT3K, UT4K, UT5K, and UT8K
UTY 640	Replacing the EMI Board in UNITY/I Models UT3K, UT4K, UT5K, and UT8K
UTY 641	Replacing the Logic Board in UNITY/I Models UT3K, UT4K, UT5K, and UT8K
UTY 642	Replacing the AC Board in UNITY/I Models UT3K, UT4K, and UT5K
UTY 643	Replacing the Inverter Board in UNITY/I Models UT3K, UT4K, and UT5K
uTY644	Replacing the Fan in UNITY/I Models UT3K, UT4K, UT5K and UT8K
UTY 646	Replacing the AC Board in UNITY/I Model UT8K
UTY 647	Replacing the Inverter Board in UNITY/I Model UT8K
TIP410	Operating the Make-Before-Break Bypass Switch on FERRUPS, FORTRESS, and UNITY/I (single-phase) UPS Installation
FSS 393	Connecting External Battery Packs to the UNITY/I Single-Phase UPS, Models UT3K, UT4K, UT5K, and UT8K
UTY 320	Connecting Customer Supplied External Battery Packs to the UNITY/I Single-Phase UT8K

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LJTY 501
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Communicating with the Single-Phase UNITY/I™ UPS via the DB9 Communication Port

This document provides information about communicating with the single-phase **UNITY/I** UPS via the communication port. This document applies to all UNITY/I single-phase models with software versions up to and including 2.01.

You can use the communication port in two ways:

- Choose **contact mode** to use the available shutdown and inverter contacts
- Choose RS232 **mode** to access full duplex communication with the UPS and use the programmable contacts available. In RS232 mode, you can send commands to the UPS, view and change parameters, or use optional CheckUPS® software or interface kits.

Contents

UTY-0501D

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

Section 100: Choosing a Communication Mode

Two communication modes are available at the UPS communication port: contact mode and RS232 mode. Section 101 describes contact mode, Section 102 describes RS232 mode, and Section 103 explains how to program the UPS communication mode.

Table 1 contains the DB9 communication port pin outs for the single-phase UNITY/I. The functions of pins 1 and 2 are determined by the communication mode. The functions of all other pins are the same in either mode.

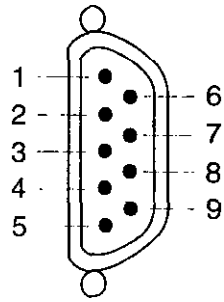

Figure 1: DB9 Port

Table 1: UNITY/I Communication Port Pin Outs

Pin	Contact mode function	RS232 mode function
Pin 1	*Shutdown -A* +12 VDC signal held for 5 seconds on this pin while the UPS is on battery power shuts down the UPS 20 seconds later. The UPS will restart after a 15-second delay once normal input power is restored.	***RS232 RD*** - The UNITY/I receives data at the programmed baud rate (default 1200), 8 bits, no , parity, 1 stop bit, and no handshaking.
Pin2	***Inverter Status*** - Produces a +12 VDC signal whenever the UPS is on battery power. When the UPS is not on battery power, the pin produces a -8 VDC signal.	***RS232 TD*** - The UNITY/I transmits data at the programmed baud rate (default 1200), 8 bits, no parity, 1 stop bit, and no handshaking.
Pin 3	***Inverter Normally*** Open ***Contact*** - Closes* to indicate that the UPS is on battery power (default). Programmable via Parameter 24 (see Appendix B).	
Pin 4	Common - Signal ground for all interface signals and contacts.	
Pin 5	***Low Runtime Normally*** Open ***Contact*** - Closes* to indicate that battery runtime is low (default). Programmable via Parameter 23 (see Appendix B).	
Pin 6	***Inverter*** Normally ***Closed* Contact*** - Opens to indicate that the UPS is on battery power (default). Programmable via Parameter 25 (see Appendix B).	
Pin 7	*Remote* Emergency *Power Off (EPO)* - Short to pin 4 to shut down the UPS output. See the Appendix to the *UNITY/I* User *Manual* for information on connecting a remote EPO switch.	
Pin 8	*Unregulated +18 VDC Nominal Source* - An unregulated +18 VDC nominal source protected by a 1000 ohm source impedance.	
Pin 9	Internal Bypass ***Normally*** Open - Closes* to indicate that the UPS is in internal bypass mode. **(Note:** Does not close for the Auto Bypass alarm condition that occurs after a low battery shutdown.)	

* Internally tied to pin 4 when closed.

101: Contact Mode

Contact mode gives you access to shutdown and inverter status. This mode does not allow RS232 communication.

- **Selecting Contact Mode**

To select contact mode, program Parameter 22 to a **one-digit** value from 0 - F hexadecimal. This one-digit value sets the delay (in seconds) before changing the status of pin 2 (inverter status).

For example, if you programmed Parameter 22 to "5," the UPS would be in contact mode and would operate on battery power for at least 5 seconds before changing the status of pin 2 (inverter status).

See Section 103 for instructions on programming Parameter 22.

102: RS232 Mode

RS232 mode allows full duplex (two-way) communication with the UPS. This mode allows you to send commands to the UPS, receive messages about UPS operating status, view UPS parameters, change UPS parameters, and view UPS status logs and alarm logs.

- **UPS RS232 Technical Specification Summary**

As shipped, the UPS is set up for serial communication at 1200 baud using 8 data bits per character, one stop bit, and no parity.

The UPS echoes all characters sent to it (default), so the computer or terminal should be operated full duplex. The UPS is not case sensitive, so commands may be sent in either uppercase or lowercase.

Connector:	9 pin D (female) wired as DCE.
Format:	ASCII 8 data bits, 1 stop bit.
Baud Rate:	1200, 2400, 4800 or 9600 (programmable)
Parity:	None.
Duplex:	Full.

- **Selecting RS232 Mode**

To select RS232 mode, use the UPS front panel keys to program Parameter 22 to "10" for 1200 baud, "20" for 2400 baud, "30" for 4800 baud, or "40" for 9600 baud. Set the baud rate to match the baud rate of the computer, terminal, or modem that you will connect to the UPS. See Section 103 for instructions on programming Parameter 22.

103: Programming the Communication Mode

To program the UPS communication mode, use the UPS front panel keys and follow the instructions below to set Parameter 22 (Communication Mode).

1. Simultaneously hold down the **[CANCEL]** and **[RUNTIME]** keys for two seconds. Release the keys when the display shows P - 0 0.

2. Press **[CANCEL].** The display should show 0.

3. Press [%LOAD] until the display shows 3 7 7. If you inadvertently scroll past 3 7 7, press **[VOUT] to** decrease the display value.

4. Once the display reads 3 7 7, press [RUNTIME]. The display should show 1.

5. Press **[CANCEL].** The display should show P- 0 0.

6. Press [%LOAD] until the display reads P- 2 2. If you inadvertently go past P - 2 2, use the **[VOUT]** key to step back.

7. Once you reach P- 2 2, press **[CANCEL].**

8. **Use** the [%LOAD] key **or** the [VOUT] key to change the display to the correct setting. Use the list below to determine the correct setting.

Parameter 22 Setting*	Communication Mode
O - F	**Contact mode. Sets the delay (in seconds) on pin 2.**
10	RS232 mode, 1200 baud.
20	RS232 **mode, 2400 baud.**
30	RS232 **mode, 4800 baud.**
40	RS232 **mode, 9600 baud.**

* **Parameter** 22 settings are in hexadecimal.

9. To enter the new setting, press **[RUNTIME].**

NOTE: To escape *without* saving, press the **[VLINE] or** the **[CANCEL] key.**

10. To **escape** parameter mode, press [VLINE] **twice.**

Section 200: Connecting a Terminal, Computer, or Modem to the DB9 Port

This section explains how to connect a terminal, computer, or modem to the UPS communication port.

The standard RS232 connection points are as follows:

Pin 1: RS232 Receive Data. The UPS receives data on this pin.
Pin 2: RS232 Transmit Data. The UPS transmits data on this pin.
Pin 4: Common (signal ground).

Pins 3, 5, 6, 7, 8 and 9 have the same functions in RS232 mode as they have in contact mode. See Section 100.

201: Connecting a Terminal or Computer to the DB9 Port

To communicate with the UPS, your terminal or computer must be capable of serial communication. A computer must be capable of terminal emulation. Whether you are using a PC and a modem or directly connecting the PC, you may use any standard communication package (such as Smartcom®, CROSSTALK®, or ProComm™).

To connect a **terminal or computer** to the UPS communication port, follow the steps below.

1. Set the UPS to the proper baud rate if you have not already done so. See Section 103.

2. Plug the terminal or computer into **an outlet protected by the UNITY/I UPS.**

3. Construct your own high-quality shielded cable (see Figure 2 or 3 on page 6), or call Best Power to order one. Connect the cable between the UNITY/I and the terminal or computer.

4. Switch on the terminal or computer. If you are using a computer, start the terminal emulation program.

You should now be able to communicate with the UPS. If you cannot communicate, verify that the baud rate of the UPS matches the baud rate of the connected terminal or computer (see Section 103), and check the cabling and connections (see Figures 2 and 3).

See Section 300 for commands and other information about RS232 communication.

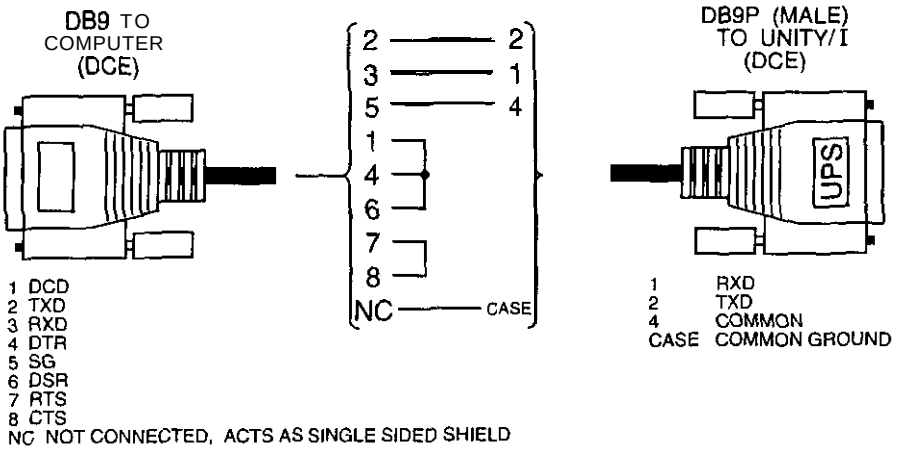

Figure 2: Computer DB9 to UNITY/I DB9

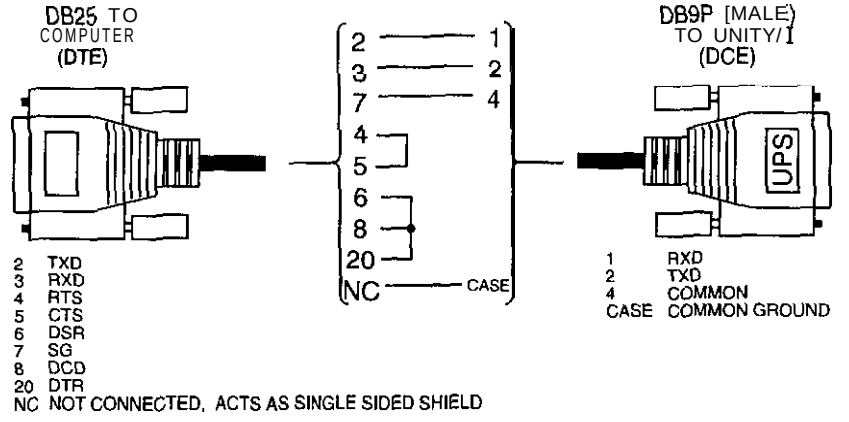

Figure 3: Computer DB25 to UNITY/I DB9

202: Connecting a Modem to the DB9 Port

Before connecting a modem to the UPS communication port, configure the modem to ignore the state of all RS232 lines except RxD and TxD. Many modems use Pin 20 as a reset (DTR). Consult your modem documentation.

NOTE: When using a modem, you must disable the sending of result codes-consult your modem documentation. If you do not disable result codes, communication may be inconsistent.

1. Set the UPS to the proper baud rate if you have not already done so (see Section 103).

2. Construct your own high-quality shielded cable (see Figure 4), or call Best Power to order one. Connect the cable between the **UNITY/I** UPS and the modem.

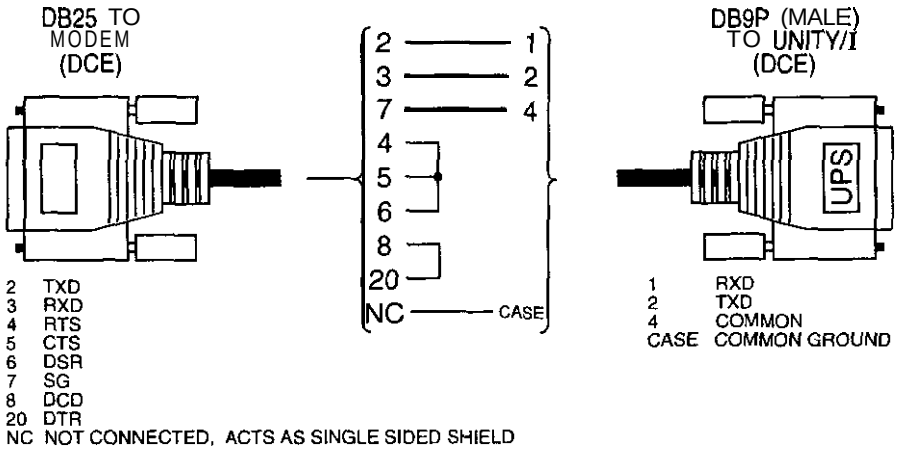

Figure 4: Modem DB25 to UNITY/I DB9

Section 300: RS232 Communication

This section describes RS232 communication.

301: Entering Commands

From a terminal connected to the UPS DB9 port, you can send the commands listed in Table 2 on page 8.

- Commands may be typed in either uppercase or lowercase. End each command with a carriage return.
- Spaces between commands and values are ignored. For example, **D12?** and D 12 ? cause the same action.
- If a command is valid, the UPS responds with **OK =>** (OK, carriage return, line feed, prompt).
- If a command is invalid, the data is out of range, or the password level is too low, the UPS responds with ? **=>** (?, carriage return, line feed, prompt) and no action is performed.

Table 2: UNITY/I Commands

Command	Description
B	Initiates an immediate battery test unless the unit is running on battery power. If the UPS detects a possible battery problem, it gives a Check Battery alarm. A Check Battery alarm is indicated by an A - 0 'I on the unit's front display and the unsolicited message [00000100] on a terminal connected to the UPS communication port (for v1.00-1.03 the message reads [00000200]).
D <number> **?**	Displays a given piece of information (see Table 3), where <number> is the display number.
E <value>	Enables or disables character echo, where <value> is 0 (disable echo) or 1 (enable echo, default). When echo is enabled, you can see characters on screen as you type them.
F	Displays a formatted string of data. See Appendix A.
I	Displays a unit identification message, including the UPS model number, serial number, and software version (v1.06 - 2.01 only).
L <number> ?	Displays the contents of the selected log, where <number> is 0 (alarm log) or 1 (system log). See Section 303 for information on reading the logs.
L <number>= *	Clears the contents of the selected log, where <number> is 0 (alarm log) or 1 (system log).
OFF <value>	Automatically puts the unit into "sleep" mode (shuts the unit down) <value> seconds after the command is entered. This command is intended for use when the UPS is running on battery power and you want to shut it down. If Parameter 03 (Auto Restart) is enabled, the UPS will restart automatically when AC line returns. If Parameter 03 is disabled, you must restart the UPS by turning the UPS key switch to "Off' and back to "Auto."
OFFC	Cancels the OFF command. ***For software v1.00 - v1.03†***, the OFFC command works only if you enter it ***before*** the OFF command is executed. ***For software v1.04 - v2.01†***, the OFFC command works ***before and after*** the OFF command is executed-if the OFF command has already been executed, the UPS restarts when the OFFC command is entered.
P <number> **?**	Displays the value of a parameter, where <number> is the parameter number. See Section 302 for more information about parameters.
P <number> = <value>	Sets a parameter to a specified value, where <number> is the parameter number and <value> is the new setting. To change a parameter setting, the correct password must be entered. Do **not change a parameter setting unless you *fully* understand what the parameter means and how the change will affect the operation of the UPS. See** Section 302 for more information about parameters.
P <number> **= ***	Sets a parameter to its default value, where <number> is the parameter number. The correct password must be entered. **Do not default a parameter unless you *fully* understand what the parameter means, know what the default setting is, and know how the change will affect the operation of the UPS.** See Section 302 for more information about parameters.
TOFF <value 1> <value 2>	Automatically puts the unit into "sleep" mode (shuts the unit down) <value 1> seconds after the command is entered and restarts the unit <value 2> seconds after the command is entered. The acceptable range for each value is 0 to 16,383 seconds, and <value 2> must be greater than <value I>.
TOFFC	Cancels the TOFF command. If the UPS has already shut down, it will restart when the TOFFC command is entered.

† To view the software version, enter the command **P128?**.

Some information can be displayed using the command **D <number> ?,** where <number> is the display number. Table 3 lists the information that can be displayed using the **D <number>** ? command.

Table 3: The Display Command

Display Number	Description
0	AC input voltage.
1	AC output voltage.
2	Battery voltage (xx.xx). **Example:** 4850 indicates 48.50 volts.
3	Output current in amps (xxx.x). **Example:** 0119 indicates 11.9 amps.
4	Output KW (xxx). Example: 0391 indicates 3.91 KW.
5	UPS internal ambient temperature in degrees Celsius (xxx.x). Example: 0256 indicates 25.6 *degrees.*
6	Output frequency (xxx.x). Example: 0603 indicates 60.3 Hz.
7	Percent of full load presently applied to the UPS.
8	System hours: number of hours the unit has been in operation.
9	Reason for the most recent transfer to battery power. 1 = Line Glitch; 2 = High/Low Line Voltage; 4 = The system called for an attempt to transfer from battery to line, but a suitable tap was not available that would allow the system to regulate the output voltage within ±3% ofnominal (default), thus the transfer did not occur; 8= PLL Unlocked (frequency).
10	Maximum input voltage since the unit was placed into operation or since Parameter 107 was reset.
11	Minimum input voltage since the unit was placed into operation or since Parameter 106 was reset.
12	Runtime remaining in seconds (software v1.OO - 1.03) or in minutes and seconds (software v1.04 - 2.01). Example (software v1.00 - 1.03): 0235 indicates 235 seconds. Example (software v1.04 - 2.01): 0235 indicates 2 minutes, 35 seconds. Note: Estimated runtime is most accurate when the unit is on battery power.
13	Output KVA (xx.xx). Example: 0391 indicates 3.91 KVA.
14	Battery temperature in degrees Celsius (xxx.x). Example: 0253 indicates 25.3 degrees.

302: Viewing and Changing Parameters via a Terminal Connected to the DB9 Port

☞IMPORTANT!

Before attempting to change a parameter, make sure that you *fully* understand what the parameter means and how the change will affect the operation of the UPS.
Improper setting of certain parameters may cause the UPS to function other than expected. If the "Password Required to Change" in Table 4 says "Phone Best Power," or if you have a question, phone Best Power's Worldwide Service or your local Best Power office for assistance.

To view or change parameters via a terminal, use the commands below:

P <number> ? Displays a parameter setting, where <number> is the parameter number.

P <number> = <value> Changes a parameter setting, where <number> is the parameter number and <value> is the new setting. The correct password must be entered in Parameter 00 before you can change a parameter value. The user password is 377.

Table 4 lists the UNITY/I parameters. Some parameters vary depending upon the UPS software version; for these parameters, software versions are specified. To view the software version of your UPS, enter the command **P128?**.

NOTE: On a terminal connected to the UPS DB9 port, decimal points are **not** displayed. Where applicable, the "Front Panel" sample display in Table 4 shows the number of decimal places.

Table4: Parameter Table

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
00	Password	None	0	0000	Allows you to enter a password. Password levels: Level 0 = No Password Level 1 = User Password (377).
01	Serial Number Low	Phone Best Power	1	0001	The UNITY/I serial number is formatted as follows: **UTxKyzzzz** where x is the model number (KW/KVA rating) of the UPS and yzzzz is a unique five-digit unit serial number. Parameter 01 reports y. Parameter 02 reports zzzz. Note: On the UPS front panel, Parameter 02 does not display leading zeroes. *Range (software v1.00 - 1.03):* 0 - FFFF hex. *Range (software v1.04 - 2.01):* 0 - 9999.
02	Serial Number High	Phone Best Power	367	0367	

Param. #	Parameter Name	Password Required to Change	Sample Display Front Panel	Sample Display Terminal Screen	Parameter Description
03	Auto Restart	User	1	0001	If the UPS shuts itself down, this parameter determines whether the UPS restarts automatically. If set to "1," the UPS restarts itself when conditions allow. If set to "0," the UPS must be manually restarted. ***Choices: 0*** (Disable) or 1 (Enable).
04	Model Number	Phone Best Power	4	0004	Reports the model number (KVAIKW rating) of the UPS. *Range:* 0 - ***q999.***
05	Output Voltage Reference	User	240	0240	**Phone BEST before attempting to change this parameter.** This parameter setting determines the nominal voltage present ***at the output terminals blocks.*** The output ***to the loads*** also depends upon how the factory or the installing electrician wired the output. See the ***UNITY/I Installation Manual*** for more information. *Range:* 180 - 260 VAC.
06	Full Load Set Point	Phone Best Power	4.00	0400	Unit KW/KVA rating. Maximum steady state KW/KVA output. ***Range:*** 2.00 - 17.00 KVA.
07	Low Runtime Alarm Set Point	User	2	0002	When running on battery power, the UPS activates a Low Runtime alarm (A-00) when the estimated runtime remaining is equal to or less than this value. ***Range:*** 1 - 99 minutes.
08	Glitch Limit	Phone Best Power	12	0012	Number of glitches that must accumulate for the UPS to switch to exclusive battery operation. ***Range:*** 1 - 36 glitches.
09	Frequency Slew Rate	user	347	***0347***	Rate at which the UPS tracks changes in input frequency. The greater the value, the faster the tracking. The default of 347 is about 30 Hz/second. ***Range: IO - 780.***
10	Line Full Load ***Current***	Phone Best Power	17.2	***0172***	Maximum steady state output current. *Range:* ***1.0 - 350.0*** amps.
11	Circuit Breaker Trip l	Phone Best Power	***. 40***	***0040***	Sets the limit for maximum allowable overload. Used in determining when the unit shuts down. *Range:* 1 9999.
12	High Ambient Temperature Alarm Set Point	Phone Best Power	***40.0***	***0400***	The UPS sounds a High Ambient Temperature alarm (A-03) if the UPS internal ambient temperature is equal to or greater than this value. *Range:* 1.O - 100.0 degrees Celsius.
13	Frequency	Display Only	60.0	0600	Displays the present UPS output frequency (Hz).
14'	Frequency Mode (v1.00 - 1.05)	User	***2***	***0002***	*Software* ***v1.00 - 1.05:*** Sets the nominal frequency. If this parameter is set to "2" (Auto select), the UPS automatically selects the nominal frequency based upon input frequency. Choices: 0 (50 Hz), 1 (60 Hz) or 2 (Auto select).
	Nominal Frequency (v1.06 -2.01)	User	1	0001	*Software* ***v1.06*** - 2.01: If auto frequency mode is enabled (see Parameter 15), this parameter reports the nominal frequency that the UPS has auto-selected. If auto frequency mode is disabled (see Parameter 15), you can use this parameter to set tbe nominal frequency. ***Choices: 0*** (50 Hz) or 1 (60 Hz).

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
15	Auto Frequency Mode (v1.00 - 1.05)	Display Only	1	0001	***Software v1.00*** - 1.05: When Parameter 14 is set to auto select, this parameter reports the nominal frequency presently selected: 0 = 50 Hz, 1 = 60 Hz.
	Auto Frequency Mode (v1.06 - 2.01)	User	1	0001	***Software v1.06*** - 2.01: Enables or disables auto frequency mode. In auto frequency mode, the UPS automatically selects the nominal frequency based upon the input frequency. See also P-14. *Choices: 0 (Disable) or I (Enable).*
16	Maximum Frequency	User	65.0	0650	Sets the maximum frequency for operation on AC line. If the input frequency exceeds this value, the UPS switches to battery operation. This value must be greater than the nominal frequency (see Parameters 14 and 15). *Range: 50.5 - 65.0* Hz.
-17	Minimum Frequency	User	45.0	0450	Sets the minimum frequency for operation on AC line. If the input frequency drops below this value, the UPS switches to battery operation. This value must be less than the nominal frequency (see Parameters 14 and 15). *Range: 45.0 - 59.5* Hz.
18	Installation Equalization	Phone Best Power	0	0000	If set to "I", causes equalization charge of the batteries at installation or when ROMs are changed. *Choices: 0* (Disable) or 1 (Enable),
19	Phase Offset	Phone Best Power	111	0111	Used to compensate for the reference phase lag of the zero cross discriminator. *Range: 0 - 359* degrees.
20	Transformer Resistance	Phone Best Power	4	0004	Scaling factor used to compensate for impedance drops in the UPS system. Used in the calculation of the tap setting when transferring from battery power to line power. *Range: 0 - 16.*
21	Set Metering for 380/400/415V Input	User	0	0000	Scales UPS metering for systems with optional 380/400/415 volt input. **Note:** This setting does not affect UPS output voltage. *Choices:* 0 (Disable) or 1 (Enable).
22	Communication Mode	User	10	0010	Selects contact or RS232 mode, sets baud rate or reaction delay. See Section 100. *Range:* 0 - 50 hex.
23	Programmable Contact 0	User	1007	1307	Programs contact 0 (pin 5) *on* the communication port. See Appendix B. *Range:* 0 - 3F24 hexadecimal.
24	Programmable Contact 1	User	1017	1317	Programs contact 1 (pin 3) on the communication port. See Appendix B. *Range: 0* - 3F24 hexadecimal.
25	Programmable Contact 2	User	3017	3317	Programs contact 2 (pin 6) on the communication port. See Appendix B. *Range:* 0 - 3F24 hexadecimal.
26	Reserved (v1.00 - 1.03, 2.01)				***Software v1.00 - 1.03, 2.01:*** Reserved.
	PhonTek® Copies (v1.04 - 1.09)	User	0	0000	Software ***v1.04*** - 1.09: Begins PhonTek transmission , and specifies how many copies of the message to transmit. *Range:* 0 - 98 copies, 99 = continuous.
27	Input Voltage	Phone Best Power	235	0235	Directly metered RMS input voltage. *Range:* 65 - 1000 VAC.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
28	Output Voltage	Phone Best Power	240	0240	Directly metered RMS output voltage. *Range:* IO - 1000 VAC.
29	output Current	Phone Best Power	11.9	0119	Directly metered RMS output current. *Range:* 1.0 - 350.0 amperes.
30	Battery Voltage	Phone Best Power	48.00	4800	Directly metered battery voltage. *Range:* 1.00 - 99.99 V.
31	Internal Ambient Temperature	Phone Best Power	25.0	0250	UPS internal ambient temperature. *Range: 0* - 150.0 degrees Celsius.
32	Battery Temperature	Phone Best Power	25.1	0251	UPS battery compartment temperature. *Range: 0* - 150.0 degrees Celsius.
33	Runtime --	Display Only	15:00	1500	The estimated runtime in minutes and seconds. Notes: (I) Estimated runtime is most accurate when the UPS is running on battery power. (2) In units with software v1.00 - 1.03, a terminal connected to the DB9 port displays the runtime in *seconds only*.
34	Percent Load	Display Only	70	0070	The percentage of the UPS's total capacity that the load equipment is using.
35	Power Factor	Display Only	1.00	0100	The difference in the way the load equipment draws voltage and current. Power factor is equal to KW Out divided by KVA Out.
36	KW Out	Display Only	4.00	0400	The total power in kilowatts (KW) that the load equipment is drawing from the UPS.
37	KVA Out	Display Only	4.00	0400	The total apparent power in kilovolt-amperes (KVA) that the load equipment is drawing from the UPS.
38	Input Voltage Calibration Factor	Phone Best Power	dC4	ODC4	AID conversion factor. Do not change. *Range:* 03E8 FOOO hexadecimal.
39	Output Voltage Calibration Factor	Phone Best Power	1A9C	1A9C	AID conversion factor. Do not change. *Range:* 03E8 - FOOO hexadecimal.
40	Output Current Calibration Factor	Phone Best Power	1309	1309	AID conversion factor. Do not change. *Range:* 03E8 FOOO hexadecimal.
41	Battery Voltage Calibration Factor	Phone Best Power	1775	1775	AID conversion factor. Do not change. *Range:* 03E8 - FOOO hexadecimal.
42	Internal Temperature Calibration Factor	Phone Best Power	1C9	01C9	AID conversion factor. Do not change. *Range:* 0 - FOOO hexadecimal.
43	Zero Internal Ambient Temperature	Phone Best Power	1dF	01DF	Offset correction. Do not change. *Range:* 0 - FOOO hexadecimal.
44	Battery Temperature Calibration Factor	Phone Best Power	1C9	01C9	AID conversion factor. Do not change. *Range:* 0 - FOOO hexadecimal.

Param. #	Parameter Name	Password Required to Change	Sample Display Front Panel	Sample Display Terminal Screen	Parameter Description
45	Zero Battery Temperature	Phone Best Power	1dF	01DF	Offset correction. Do not change. *Range:* 0 - FOOO hexadecimal.
4 6	Alarm Status + 0	Display Only	0	0000	Hexadecimal representation of the bit-mapped alarm status register. This parameter displays the lower alarm status register (bits 0 - 15). See Appendix C.
41	Alarm Status + 1	Display Only	0	0000	Hexadecimal representation of the bit-mapped alarm status register. This parameter displays the upper alarm status register (bits 16 - 3 1). See Appendix C.
48	Alarm Mask + 0	Phone Best Power	0	'0000	Causes selected alarms to be ignored. *Range: 0* - FFFF
49	Alarm Mask + I	Phone Best Power	0	0000	Causes selected alarms to be ignored. *Range:* 0 - FFFF.
50	Beeper Enable	User	1	0001	If set to "0," silences *all* present and future audible alarms and the "on battery power" beep. Choices: 0 (Silence) and 1 (Enable).
51	Low Battery Shutdown Set Point	Display Only	40.08	4008	Battery voltage set point for Low Battery alarm (A-08) and shutdown. Automatically adapts based on load and battery capacity (Parameter 55).
52	High Battery Alarm Set Point	Phone Best Power	60.00	6000	Battery voltage set point for High Battery alarm (A-07). *Range:* 10.00 - 90.00 V.
53	Vllo	Phone Best Power	1068	1068	Used in calculation of low battery shutdown set point based on load. *Range:* 03E8 - 4E20 hexadecimal.
54	Kll	Phone Best Power	EAO	0EA0	Used in calculation of low battery shutdown set point based on load. *Range:* OEAO - 2814 hexadecimal.
55	Battery Capacity	User	33.0	0330	Amp-Hour capacity of battery string(s). *Range (software v1.00* - 1.03): 15.0 - 120.0. *Range (software v1.04* - 2.01): 15.0 - 999.9.
56	Full Charge Open Circuit Voltage	Phone Best Power	51.80	5180	The full charge open circuit battery voltage. *Range:* 10.00 - 99.99 V.
57	Runtime KI	Phone Best Power	0.50	0050	Constant used in adaptive runtime calculation. *Range: 0 - 99.99.*
58	Runtime K2	Phone Best Power	6B8	06B8	Constant used in adaptive runtime calculation. *Range (software v1.00* - 1.03): 0 - 9999. *Range (software v1.04* - 2.01): 0 - FFFF hex.
59	Runtime K4	Phone Best Power	1333	1333	Constant used in adaptive runtime calculation. *Range: 0 - 9999.*
60	Charger Rating	User	5.0	0050	Ampere rating of system battery charger(s). *Range:* 1.0 - 50.0 amps.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
61	Low Battery Shutdown Flag (v1.00 - 1.04)	Display Only	0	0000	Software *v1.00* - 1.04: Flag used by UPS to determine operating mode at start-up following a low battery shutdown.
	Bypass Flag (VI.05 - 2.01)	Display Only	0	0000	Software *v1.05 - 2.01:* Indicates which bypass condition is active and the bypass tap chosen. Bit 0 = Tap -1 is active, Bit I = HotSwap (Parameter 63) enabled, Bit 2 = Low Battery alarm/Auto Bypass, Bit 3 = EPO on.
62	Nominal Input Voltage	User	'0	0000	Used to set the nominal input voltage before "sing Parameter 63. **(Note:** If Parameter 62 is set and Parameter 77 is enabled, during a front panel key TEST the UPS will test the BYPASS light by briefly switching to internal bypass mode). *Range:* 200 - 240 VAC.
63	Battery Maintenance Mode	User	0	0000	If set to "1." activates battery maintenance mode. In battery maintenance mode, the unit continues to power the load equipment but *does not regulate power and will not provide battery backup power.* The unit continues to provide noise protection, lightning protection, and isolated output. In order to enable Parameter 63, you must first set Parameter 62. Choices: 0 (Disable) and 1 (Enable). This parameter is intended to be used during battery maintenance. **Battery maintenance must he performed by qualified service personnel only.** Phone BEST's Worldwide Service center for assistance.
64	Constant Current Charge Duration	User	4	0004	If the "constant current" charging mode lasts more than *x* minutes (default 4), the unit does a "constant voltage" charge before returning to the "maintenance" charging mode. If the constant current charge duration is equal to or less than *x*, the unit proceeds directly to the maintenance charging mode. *Range:* 1 - 10 minutes.
65	Constant Voltage Charge Duration	user	4	0004	Duration of constant voltage charge. *Range:* 0 - 20 hours.
66	Periodic Charge Interval	User	30	0030	Interval between periodic float charges. *Range:* 1 - 90 days.
67	Periodic Charge Duration	User	18	0018	Duration of periodic float charge. *Range:* 0 - 50 hours.
68	Maintenance Charge Voltage	User	53.30	5330	When the charger is in maintenance charge mode, it maintains the battery string at this voltage. *Range:* 48.00 - 56.00 V.
69	Normal Float Voltage	User	57.60	5760	If the battery temperature is greater than the set point in Parameter 71, this is the charger float voltage. *Range:* 55.00 - 60.00 V.
70	Cold Float Voltage	User	58.00	5800	If the battery temperature is less than or equal to the set point in Parameter 71, this is the charger float voltage. *Range:* 55.00 - 60.00 V.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
71	**Cold Ambient**	**User**	**10.0**	**0100**	Battery temperature set point at or below which the Cold Float Voltage (Parameter 70) is used. *Range: 0 - 20.0* degrees Celsius.
72	Charger Mode	Phone Best Power	*4*	*0004*	Indicates the mode of the multi-mode battery charger, 1 = Periodic, 2 = Constant Current, 3 = Constant Voltage, 4 = Maintenance.
73	Battery Test Time *(VI.00 - 1.05)*	User	00:00	0000	***Software v1.00*** - 1.05: If the periodic battery test is enabled (see Parameter 76), the battery test begins when Time (Parameter 90) equals this value. Range: 00:00 - 23:59 (24-hour time).
	Battery Test Time (v1.06 - *2.01)*	User	00.00	0000	*Software* ***v1.06*** - *2.01:* If the periodic battery test is enabled (see Parameter 76), the battery test begins when Time (Parameter 89) equals this value. *Range:* 00:00 - 23:59 (24-hour time).
74	Battery Test Interval	User	*7*	*0007*	If the periodic battery test is enabled (see Parameter 76), this is the interval between battery tests. *Range:* 1 - *28* days.
75	Battery Test Length	User	15	0015	If the periodic battery test is enabled (see Parameter 76), this is the length of time the UPS runs on battery power during the battery test, expressed as a percentage of the Low Runtime Alarm Set Point (Parameter 07). The default Battery Test Length is 15% of two minutes (Parameter 07 default), which equals 0.3 minutes (18 seconds). *Range: 5 25 %*
76	First Day of Battery Test (VI.00 - 1.05)	User	00:00	0000	*Software* ***v1.00*** - 1.05: The first battery test will take place when the Week/Day (Parameter 91) equals this **value. Disables the periodic battery test if set to "00:00."** *Range:* 00:00 (Disable test), 01:01 - 04:07.
	First Day of Battery Test (v1.06 - 2.01)	**User**	**00.00**	**0000**	*Software* ***v1.06*** - 2.01: The first battery test will take place on this Date (Parameter 90), formatted as month.day (mm.dd). **Disables the periodic battery** test if set to **"0."** *Range:* 00.00 (Disable test), 01.01 - *12.31.*
77	Test On Demand	User	*0*	0000	If set to "I", the UPS performs a battery test when the front panel TEST keys are pressed. Choices: 0 (Disable) or 1 (Enable).
78	Line Delta Mode	User	*3*	*0003*	Used to determine sensitivity to AC line faults. *Choices:* 1 (Normal mode; see also Parameter 81), 2 (Poor line mode-uses the least sensitive fault detection), 3 (Adaptive mode-UPS adapts sensitivity based on line quality history).
79	Glitch Sensitivity	User	10	0010	When in adaptive line delta mode (see Parameter 78), the number of glitches which can occur per quarter second before line delta is increased (i.e., sensitivity to disturbances is decreased). *Range:* 1 - 34.
80	Less Delta	User	500	0500	When in adaptive line delta mode (see Parameter 78), the number of quarter-second intervals without a glitch before line delta is decreased (i.e., sensitivity to disturbances is increased). *Range: 4 - 9999.*

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
81	Line Delta	User	Ffdd	FFDD	When in normal line delta mode (see Parameter 78), this parameter programs the delta level. A higher value increases sensitivity to disturbances (decreases delta). *Range:* FF82 - FFFE hex.
82	Low output Voltage Trip Point	User	233	0233	The low output voltage tap regulation trip point. This parameter and Parameter 83 set the steady-state output voltage regulation window. Default = Parameter 05 x 0.97. *Range:* 10 - 1000 VAC.
83	High Output Voltage Trip Point	User	247	0247	The high output voltage tap regulation trip point. This parameter and Parameter 82 set the steady-state output voltage regulation window. Default = Parameter 05 x 1.03. *Range:* 10 - 1000 VAC.
84	Voltage Limit (V1.00 - v.1.05)	Phone Best Power	233	0233	Software *v1.00* - 1.05: Used in calculation of tap changes. Default = Parameter 05 x 0.97. *Range:* 10 - 1000.
	Tap Integration Limit (v1.06 - 2.01)	Phone Best Power	122	0122	*Software v1.06* - 2.01: Controls the amount of weighting to each under/over voltage sample. Lowering this will decrease the time until tap selection.
85	Tap Delay Count	Phone Best Power	2	0002	The number of line cycles of delay after a lap activation to allow for tap relay operating time. Setting varies depending on the size of the unit. *Range:* 1 - 5 cycles.
86	Generator	Phone Best Power	0	0000	Enables Inverter Lock Out (see P-87). Use with poor line sources. *Choices:* 0 (Disable), 1 (Enable).
87	Inverter Lock Out	Phone Best Power	3	0003	Following a transfer to line power, the number of cycles during which transfers to battery power are prohibited. Parameter 86 must be enabled. *Range:* 0 - 10 cycles.
88	Welded Contact Flag	Phone Best Power	0	0000	A non-zero display indicates a welded contact or shunted static switch. Phone BEST Power Worldwide Service if Parameter 88 contains a non-zero value. See also Parameter 124.
89	Minutes and Seconds (v1.00 - 1.05)	User	00:00	0000	*Software v1.00* - 1.05: Minutes and seconds clock. The UPS takes the minutes from Parameter 90. *Range (seconds setting): 00 - 59.*
	Time (v1 .06 2.01)	User	0:00	0000	*Software v1.06* - 2.01: Time of day (in 24-hour time). *Range:* 00:00 - 23:59.
90	Time (v1.00 - 1.05)	User	00:00	0000	*Software v1.00* - 1.05: Time of day (in 24-hour time). *Range:* 00:00 - 23:59.*
	Date (v1.06 - 2.01)	User	1.01	0101	*Software v1.06* - 2.01: Date, formatted as month.day (mm.dd). *Range: 1.01* - 12.31.

* **In units** with software versions **1.00 to 1.05:** When setting Parameters 90 and 91—or any parameter which involves entering a time or week/day-the values on the UPS display will scroll beyond the allowed range of values However, once you have entered a value, the UPS will track the value properly.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
91	Week/Day (v1.00 - 1.05)	User	1.01	0'0'	***Software v1.00*** - 1.05: The first digit (front panel display) indicates the week of the month (1 - 4) and the last two digits indicate the day of the week (01 - 07). *Range:* 1.0' - 4.07.*
	Year (v1.06 - 2.01)	User	1994	'994	*Software* ***v1.06*** - 2.01: The year. *Range:* '994 - 2'30.
92	System Hours	Phone Best Power	1	0001	Number of hours the unit has been in operation. Rolls to "0" every 8760 hours (one year). See also Parameter 93.
93	System Years	Phone Best Power	0	0000	Number of years the unit has been in operation. See also Parameter 92.
94	Reserved (v1.00 - 1.04)				***Software v1.00 - 1.04:*** Reserved.
	Low AC Out Alarm Delay (VI.05 - 2.0')	Phone Best Power	1	000'	***Software v1.05*** - 2.01: Debounce for Low AC Out alarm (A- 13). *Range: 0* - '0 seconds.
95	Low AC Percent (v1.06 - 2.01)	Phone Best Power	85	0085	Percentage of nominal AC output voltage at which unit will shut down. (i.e., 85% of 240 = 204). *Range: 50 - 90.*
96 - '0'	Reserved				(v1.00-1.05 Reserved) Reserved
102	Minimum Output Current	Phone Best Power	0.0	0000	The lowest UPS output current (RMS), in amperes, since the UPS was placed into operation or since this parameter was last reset.
103	Maximum Output Current	Phone Best Power	'1.9	0119	The highest UPS output current (RMS), in amperes, since the UPS was placed into operation or since this parameter was last reset.
104	Minimum Output Voltage	Phone Best Power	236	0236	The lowest UPS output voltage (RMS) since the UPS was placed into operation or since this parameter was last reset.
'05	Maximum Output Voltage	Phone Best Power	243	0243	The highest UPS output voltage (RMS) since the UPS was placed into operation or since this parameter was last reset.
106	Minimum Input Voltage	Phone Best Power	0	0000	The lowest AC input voltage (RMS) since the UPS was placed into operation or since this parameter was last reset.
'07	Maximum Input Voltage	Phone Best Power	247	0247	The highest AC input voltage (RMS) since the UPS was placed into operation or since this parameter was last reset.
108	Minimum Battery Voltage	Phone Best Power	47.87	4787	The lowest battery voltage since the UPS was placed into operation or since this parameter was last reset.
109	Maximum Battery Voltage	Phone Best Power	56.00	5600	The highest battery voltage since the UPS was placed into operation or since this parameter was last reset.
110	Minimum Ambient Temperature	Phone Best Power	24.9	0249	The lowest ambient temperature, in degrees Celsius, since the UPS was placed into operation or since this parameter was last reset.
111	Maximum Ambient Temperature	Phone Best Power	29.0	0290	The highest ambient temperature, in degrees Celsius, since the UPS was placed into operation or since this parameter was last reset.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
112	Minimum Battery Temperature	Phone Best Power	25.1	0251	The lowest battery compartment temperature, in degrees Celsius, since the UPS was placed into operation or since this parameter was last reset.
113	Maximum Battery Temperature	Phone Best Power	27.3	0273	The highest battery compartment temperature, in degrees Celsius, since the UPS was placed into operation or since this parameter was last reset.
114	Minimum Output Frequency	Phone Best Power	58.8	0588	The lowest output frequency, in hertz, since the UPS was placed into operation or since this parameter was last reset.
115	Maximum output Frequency	Phone Best Power	60.5	0605	The highest output frequency, in hertz, since the UPS was placed into operation or since this parameter was last reset.
116	Minimum KW Out	Phone Best Power	1.80	0180	The lowest KW output since the UPS was placed into operation or since this parameter was last reset.
117	Maximum KW Out	Phone Best Power	2.86	0286	The highest KW output since the UPS was placed into operation or since this parameter was last reset.
118	Minimum KVA Out	Phone Best Power	1.80	0180	The lowest KVA output since the UPS was placed into operation or since this parameter was last reset.
119	Maximum KVA Out	Phone Best Power	2.86	0286	The highest KVA output since the UPS was placed into operation or since this parameter was last reset.
120	Minimum Percent Load	Phone Best Power	50	0050	The lowest percent load since the UPS was placed into operation or since this parameter was last reset.
121	Maximum Percent Load	Phone Best Power	75	0075	The highest percent load since the UPS was placed into operation or since this parameter was last reset.
122	Minimum Power Factor	Phone Best Power	0.00	0000	The lowest power factor since the UPS was placed into operation or since this parameter was last reset.
123	Maximum Power Factor	Phone Best Power	1.00	0100	The highest power factor since the UPS was placed into operation or since this parameter was last reset.
124	Tap Status	Display Only	0	0000	Displays the tap status of the literal taps. A non-zero display indicates the location of a suspected shorted or open tap. If this parameter contains a non-zero value, phone BEST Power Worldwide Service. See also Parameter 126.
125	Control Flags	Display Only	1F	001F	Displays UPS status and control flags.
126	Open Taps	Display Only	0	0000	Indicates virtual taps not available. If this parameter contains a non-zero value, phone Best Power Worldwide Service.
127	Transfer Code	Display Only	2	0002	Displays the reason for the last transfer to battery power. 1 = Line glitch; 2 = High/low AC line voltage; 4 = System called for an attempt to transfer from battery to line, but no suitable tap was available, so the transfer did not occur; 8 = PLL unlocked (frequency).
128	Software Version	Phone Best Power	1.04	0104	Indicates ROM version. *Range:* 0 - 9999.

Param. #	Parameter Name	Password Required to Change	Sample Display: Front Panel	Sample Display: Terminal Screen	Parameter Description
129	**Reserved** (v1.00 - 1.03)				*Software* ***v1.00 - 1.03:*** Reserved.
	Optional Charger Set Point (v1.04 - 2.01)	User	55.00	5500	*software* ***v1.04 - 2.01:*** The optional auxiliary battery charger turns on if the battery voltage drops below this set point. *Range: 48.00 - 60.00.*
130	Reserved (v1.00 - 1.03)				*Software* ***v1.00 - 1.03:*** Reserved.
	Contact Select (v1.04 - 2.01)	Display Only 0		0000	*Software* ***v1.04 - 2.01:*** Indicates the taps currently selected and the contacts on.
131	Reserved				Reserved.
132	EE Word (VI.00 - 1.03)	Phone Best Power	5A0C	5 A O C	***Software v1.00 - 1.03:*** EPROM verification check. **DO NOT CHANGE.**
	Reserved (v1.04 - 2.01)				***Software v1.04 - 2.01:*** Reserved.
133	Not Used (v1.00 - 1.03)				***Software v1.00 - 1.03:*** Parameter 133 does not exist.
	Reserved (v1.04 - 2.01)				***Software v1.04 - 2.01:*** Reserved.
134	Not Used (v1.00 - 1.03)				***Software v1.00 - 1.03:*** Parameter 134 does not exist.
	EE Word (v1.04 - 2.01)	Phone Best Power	5A0C	5A0C	***Software v1.04 - 2.01:*** EPROM verification check. **DO NOT CHANGE.**

For a more detailed list of parameters and service procedures see the *UNITY/I* Service *Manual*. To order a copy of the Service Manual, call Best Power's Worldwide Service at l-800-356-5737 (U.S. and Canada), or l-608-565-2100, or call your local Best Power office.

303: Reading the Alarm and System Logs

The UNITY/I UPS stores information in two sets of logs: the alarm log and the system log. The alarm log stores information about alarm events, and the system log stores information about certain UPS system events. This section explains how to access and read these logs using a terminal connected to the unit's DB9 port. The format of the alarm and system logs varies depending upon the unit's software version (to view the software version, type the command **P128?**).

To access the alarm or system log, enter one of the commands below.

L 0 ? displays the alarm log.
L 1 ? displays the system log

- **Units with Software Versions 1.00 to 1.05**

A list of log entries will appear on the screen. Each entry contains four pieces of information:

- ***Log Number:*** The most recent event is stored in log 01. In units with software v1.00 to 1.03, the unit stores 10 alarm log entries and 40 system log entries. In units with software v1.04 to 1 .05, the unit stores 20 alarm log entries and 30 system log entries.
- Event ***Code:*** A four-digit code indicating the system or alarm event. See Appendix D.
- ***System Hour:*** The system hour during which the event began, taken from Parameter 92 (System Hours).
- ***Duration:*** The duration of the event, in minutes (with one decimal place), A display of "----" indicates that the UPS was unable to record the duration,

Log Entry Examples (for units with software versions 1.00 to 1.05):

- **Alarm log entry:**

```
AL01  A000  0134  0016
```

"Alarm **Log 01:** The UPS had an A-00 (Low Runtime) alarm during the 134th system hour which lasted 1.6 minutes."

- **System log entry:**

```
SL20  IN 0134  0196
```

"System **Log** 20: The UPS ran on inverter (battery power) during the 134th system hour. The event lasted 19.6 minutes."

- **Units with Software Versions 1.06-2.01**

A list of log entries will appear on the screen. Each entry contains five pieces of information in columns labeled A, B, C, D, and E. An asterisk (*) shows that the event is still active.

- Column A, Log ***Number:*** The unit stores 16 alarm log entries and 20 system log entries. The most recent event is stored in log number 0 1.
- ***Column B, Event Code:*** A four-digit code indicating the system or alarm event. See Appendix D.
- ***Column C, Date:*** The date that the event occurred, taken from Parameter 90 (Date) and Parameter 91 (Year). Formatted as mm/dd/yyyy (month, day, year).
- ***Column D, Time:*** The time that the event occurred, taken from Parameter 89 (Time). Formatted as hh:mm:ss (hour, minute, second).
- ***Column E, Duration:*** The duration of the event. Formatted as hh:mm:ss (hour, minute, second). An asterisk (*) indicates that the event is currently active. A display of "----" indicates that the duration was greater than 18 hours, 12 minutes, 14 seconds.

Log Entry Examples (for units with software versions 1.06-2.01):

- **Alarm log entry:**

A	B	C	D	E	
AL01	A015	04/25/1994	04:20:46	00:00:38	*
AL02	A017	04/25/1994	04:20:44	00:00:40	*
AL03	A000	03/22/1994	19:03:23	00:01:21	
AL04	A000	03/15/1994	19:00:04	00:00:43	

The first row reads as follows: Alarm Log **01:** The UPS has an **A-15** (Check MOVs) alarm which began on April 25, 1994 **(04/25/1994)** at **4:20:46** a.m. The alarm has been active for 38 seconds, and is still active (*).

- **System log entry:**

A	B	C	D	E
SL01	IN	03/22/1994	18:51:23	00:13:21
SL02	IN	03/15/1994	18:48:04	00:12:47
SL03	tESt	03/14/1994	00:01:00	00:00:18

In this example, the first row reads as follows: System **Log 01:** The UPS ran on inverter (battery power) beginning on March 22, 1994 (0312211994) at 6:51:23 p.m. **(18:51:23)**. The unit ran on inverter for 13 minutes, 21 seconds **(00:13:21)**.

304: Unsolicited Messages

In RS232 mode, the UPS sends unsolicited messages to the communication port whenever certain system status or alarm status changes occur. A system status message appears as a four-digit number enclosed in braces { }. An alarm status message appears as an eight-digit number enclosed in brackets [ ]. This section explains how to interpret unsolicited messages.

- **System Status Messages**

The UNITY/I UPS sends the following unsolicited system status messages:

(0001) On AC line or in auto bypass.
(0002) On inverter (battery power).
(0010) "Sleep" mode (UPS shutdown).

- **Alarm Status Messages**

An unsolicited alarm status message is displayed as an eight-digit number enclosed in brackets-for example, **[00000004]**. This eight-digit number is a hexadecimal representation of a 32-bit alarm status register. For information about the alarm status register see Appendix C. For more information about alarms and what they mean, see the *UNITY/I* ***User Manual.***

305: CheckUPS® Software and Interface Kit Options

- **CheckUPS Software**

CheckUPS software runs on your computer and allows it to communicate with your UPS. During an extended power outage, CheckUPS software initiates an orderly, automatic shutdown of the computer, computers on the connected network, and the UPS before the UPS batteries are exhausted. CheckUPS software is available for many kinds of computers and operating systems.

CheckUPS II software has all of the features of CheckUPS software, and it monitors site power quality and has graphic display capabilities. In addition, UNIX-based systems include a resident SNMP agent.

If you did not receive CheckUPS with your UPS, you can download it free of charge from Best Power's World Wide Web site at http://www.bestpower.com.

- **Interface Kits**

If your computer or Local Area Network has its own UPS monitoring or shutdown software, Best Power has interface kits to match your system's requirements. Interface kits may include interface cables, monitoring cards, serial cable adapters, and instructions for interfacing between your UPS and your computer system. Contact the local Best Power office for details.

Appendix A: Reading the F String

The F string is an 80-character data string that the UPS returns when you send the **F** command. The primary purpose of this data string is to communicate with CheckUPS software. The F string header and trailer each consist of a [CR][LF], or (0Dh) (0Ah), sequence. The information contained in the F string is explained in Figure 5 and Table 5.

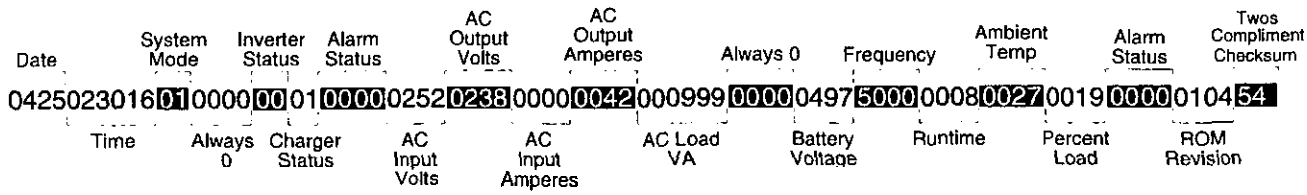

Figure 5: F-String Description

Table 5: The F String

Character Position	Description
0 - 3	*Software* ***v1.00 - 1.05 and 1.07*:*** Always 0. *Software* ***v1.06-2.01*:*** Date, formatted as mm dd (month, day).
4 - 9	***Software v1.00 - 1.05 and 1.07*:*** Always 0. *Software* ***v1.06-2.01*:*** Time, formatted as hh mm ss (hour, minute, second).
10 - 11	System mode. 00 = "Sleep" mode or shutdown, 01= AC line power or Battery power, 02 = Auto bypass mode.
12 - 15	Always 0.
16 - 17	Inverter status. 00 = Off, 01 = On.
18 - 19	Charger status. 00 = Off, 01 = On.
20 - 23	, Lower alarm status register (bits 0 - 15). See Appendix C.
24 - 27	AC input volts.
28 - 31	I AC output volts.
32-35	Always 0.
36-39	AC output amperes (xxx.x). *Example:* 0012 indicates **1.2** amps.
40 - 45	VA load.
46-49	Always 0.
50-53	Battery voltage (xxx.x). *Example: 0497* indicates *49.7* **volts.**
54-57	Frequency (xxx.x or XXX). *Example (software* ***v1.00 - 1.03*):*** *0599* indicates *59.9* Hz. *Example (software* ***v1.04 - 2.01*):*** 5990 indicates *59.90 Hz.*
58-61	**Runtime** remaining in minutes.
62-65	Internal ambient temperature in degrees Celsius.
66-69	Percent load.
70-73	Upper alarm status register (bits I6 - 3 I). See Appendix C.
74 - 77	Software version (xx.xx). *Example: 0104* indicates version *1.04.*
78 - 79	Checksum byte.

* To view the software version, enter the command **P128?** or see characters 74-77 in the F-string.

Appendix B: Programmable Contacts

The UNITY/I has three programmable contacts on the communication port. Each of the programmable contacts has a configuration parameter.

- Use Parameter 23 (Programmable Contact 0) to program pin 5.
- Use Parameter 24 (Programmable Contact 1) to program pin 3.
- Use Parameter 25 (Programmable Contact 2) to program pin 6.

To program the contact, you must enter a four-digit code in the appropriate parameter. To determine what four-digit code to enter, use the information below.

NOTE: You can program the parameter via the front panel or via a terminal. If you need more information about programming parameters, see the *UNITY/I User Manual* and Section 302 in this document,

- **The first digit** (left most) of the parameter determines whether the contact is used and the contact's normal state.

  0 = Normally open, not used.
  1 = Normally open, in use.
  2 = Normally closed, not used.
  3 = Normally closed, in use.

- **The second digit** (from the left) sets the delay in seconds, *Range: 0* - F hexadecimal.

- **The third and fourth digits** (from the left) determine the event that triggers the contact.

00 = Any Alarm
01 = (Reserved)
02 = Check Fan Alarm
03 = Tap Regulator Alarm
04 = Circuit Breaker Warning Alarm
05 = Check Battery Alarm
06 = Check lnverter Alarm
07 = Low Runtime Alarm
08 = Overload Alarm
09 = High Ambient Temperature Alarm
OA = Check MOVs Alarm
OB = Low AC Output Alarm
OC = Testing Battery or Front Panel
OD = High Battery Alarm
OE = Batteries Disconnected Alarm
OF = Low Battery Alarm
10 = Circuit Breaker Shutdown Alarm
1 1 = Check Fuse Board Alarm
12 = Auto Bypass and Low Battery Alarms
13 = Check Power Supply Alarm
14 = UPS in Sleep Mode
15 = EPO Shutdown
16 = Battery Maintenance Mode enabled (see Parameter 63)
17 = lnverter On
18 = lnverter On and Any Alarm
19 = +24 Alarm
IA = lnverter On and Check Fan Alarm
1B = lnverter On and Tap Regulator Alarm
1C = lnverter On and Circuit Breaker Warning
ID = Inverter On and Check Battery Alarm
1E = lnverter On and Check Inverter Alarm
1F = Inverter On and Low Runtime Alarm
20 = lnverter On and Overload Alarm
21 = lnverter On and High Ambient Temperature
22 = Inverter On and Check MOVs Alarm
23 = lnverter On and Low AC Output Alarm
24 = lnverter On and Testing Battery or Front Panel

Example: If Parameter 23 were programmed to **1F00**, pin 5 would be *in use and normally* open **(1).** If any alarm (00) occurred and continued for at least *15* **(F)** seconds, the contact would close.

Appendix C: Bit-Mapped Alarm Status Register

In the 32-bit alarm status register, each bit is assigned to a given alarm. When the alarm is present, the bit is set to "1."

Figure 6 shows the bit assigned to each alarm for units with software v1.00 - 1.03. Figure 7 shows the bit assigned to each alarm for units with software v1.04 - 2.01.

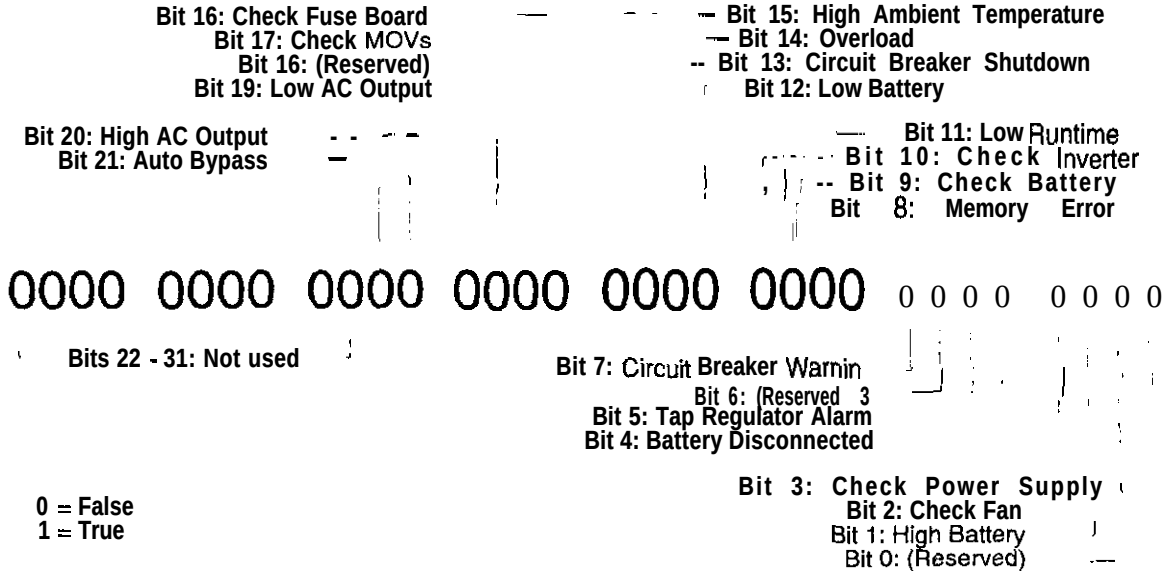

Figure 6: Alarm Status Register for Software v1.00 - 1.03

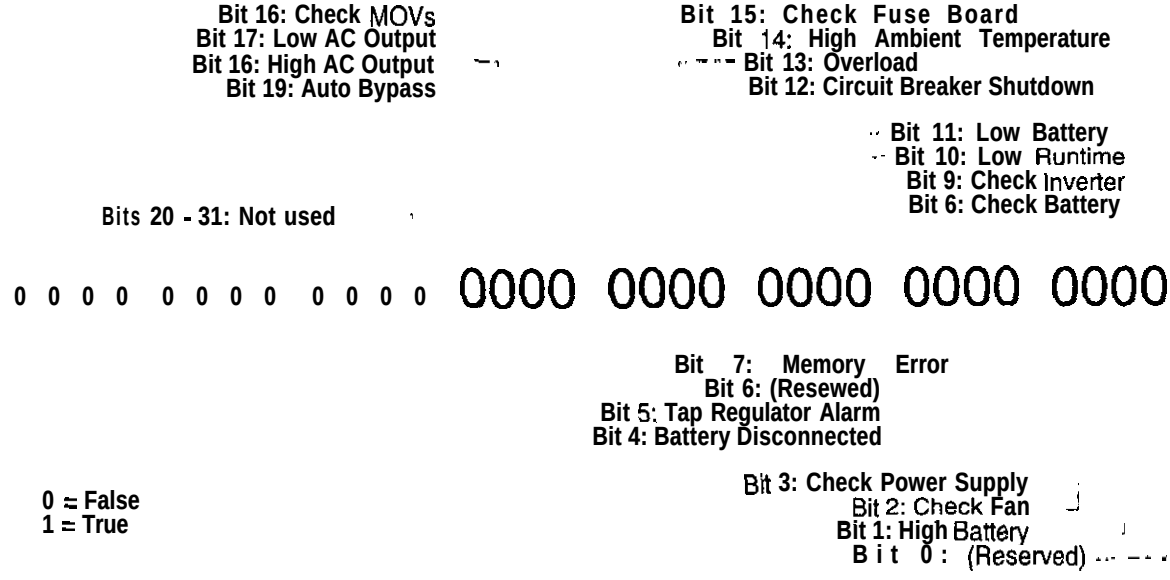

Figure 7: Alarm Status Registerfor **Software** *v1.04 - 2.01*

The 32 bits are grouped into eight groups of four bits. When the alarm status register is displayed (on the UPS front panel, or on a terminal connected to the DB9 port), each four-bit group is converted to a one-digit hexadecimal number. In the example below (Figure 8), bit 2 is set to "1," indicating a Check Fan alarm. The UPS converts the four-bit group "0100" to hexadecimal and displays the hexadecimal number, which in this case is "4."

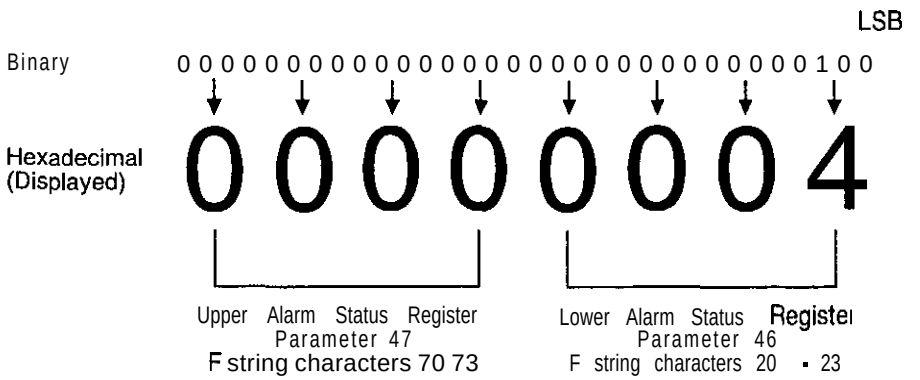

Figure 8: Hexadecimal Representation of 32-Bit Alarm Status Register

To read the alarm status register, first convert each non-zero digit in the hexadecimal display to binary (see Table 6). Then, use Figure 6 or Figure 7 to determine the alarm(s).

Table 6: Hexadecimal-to-Binary Conversion

Hexadecimal (displayed)	Binary	Hexadecimal (displayed)	Binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

Appendix D: System and Alarm Log Event Codes

The system log and alarm log contain event codes. Table 7 describes the system log event codes. Table 8 lists the alarm log event codes. For more information about system and alarm logs, see Section 303. For more information about alarms, see the *UNITY/I User Manual.*

Table 7: System Log Event Codes

Event Code	Description
BadL	Indicates a corrupted log.
EPO	The UPS shut down due to an Emergency Power Off signal received by the unit's DB9 port. For more information about remote Emergency Power Off, see the *UNITY/I User Manual.*
HotS	The unit was placed into battery maintenance mode (see Parameter 63), or the unit tested the BYPASS LED by briefly switching to internal bypass mode during a TEST initiated from the front panel keys.
IN	The UPS ran on inverter (battery power).
NrEG	The unit was not regulating the output voltage (for example, after a low battery shutdown).
SLP	The unit shut down, but the microprocessor remained active.
tESt	The UPS did a battery test.
OFF	Indicates unit shutdown via key switch or due to an A-19 alarm (Software v1.06 - 2.01).

Table 8: Alarm Log Event Codes

Alarm Code	Alarm
A000	Low Runtime
A001	Overload
A002	Circuit Breaker Warning/Shutdown
A003	High Ambient Temperature
A004	Check Battery
A005	Check Inverter
A006	Memory Error
A007	High Battery
A008	Low Battery
A009	Check Fan
A010	Reserved
A011	Batteries Disconnected
A012	Tap Regulator Alarm
A013	Low AC Out
A014	High AC Out Waning/Shutdown
A015	Check MOVs
A016	Auto Bypass
A017	Check Fuse Board
A018	Reserved
A019	Check Power Supply

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UTY 604
September 1995

Scheduled Maintenance for UNITY/I Single-Phase Models

A maintenance check should be performed by a qualified technician every **six months.** This publication provides a detailed description of the scheduled maintenance procedure. It includes cleaning and inspection procedures, an alarm and system log check, a battery load test, and a parameter settings check. Use this as a guide as you fill in BEST publication UTY 605. Each numbered step in this publication corresponds with the same numbered step in BEST publication UTY **605.**

Tools required (use insulated tools):

Phillips screwdriver	7/16" wrench or nutdriver
Nonmetallic brush	Vacuum cleaner with nonmetallic nozzle
Digital multimeter	

CAUTION

1. These procedures must be performed by a **qualified service technician only.**

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

TESTBEFORETOUCHING!

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.

b. Always wear protective clothing and eye protection, and use insulated tools when working near batteries.

c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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

You can find the **UNITY/I** model number and serial number near the key switch inside the front door. If there is an external bypass switch, an identification label on the bypass cabinet will tell you whether it is break-before-make or make-before-break.

1. *Authorization to perform maintenance and test the UPS (Contact Signature).* Write down the contact person's name; then, ask that person to sign in the space provided. Make sure the customer understands that during this procedure you must power down the load equipment if there is a break-before-make bypass switch or no bypass switch. If there is a make-before-break switch, loads may shut down during transfer under some conditions, if possible, shut down loads before switching.

2. *Comments or problems regarding the UPS.* Record any comments or problems the customer has had with the unit since the last scheduled maintenance.

3. *Is the UPS environment clean and free from dust and dirt?* If the unit is not in a safe, clean, dry area, stop and call BEST's Technical Support Center at l-800-456-5737 (U.S.A. and Canada) or l-608-565-2100.

Shut **down** the load equipment or **bypass** the UPS before continuing with steps 4, 5, and 6.

⚠ CAUTION

Before switching an external make-before-break (MBB) bypass switch, the BYPASS light on the UPS front pane1 **must** be lit. If you operate an external MBB bypass switch while the UPS is operating on line power or on battery power, equipment damage may result. Refer to BEST publication "TIP 410" for proper bypass switch operating instructions.

⚠ WARNING

Risk of electric shock! Before removing cover: **shut off** the UPS, **turn off** AC line and DC input power, and **discharge the capacitors** (as instructed below).

Disconnecting AC and DC Power

- ☐ Open the front door of the UPS. Turn the key switch to "Off."
- ☐ Remove AC input to the UPS. (Turning the key switch "Off' is **not sufficient**.)
- ☐ If **you** have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

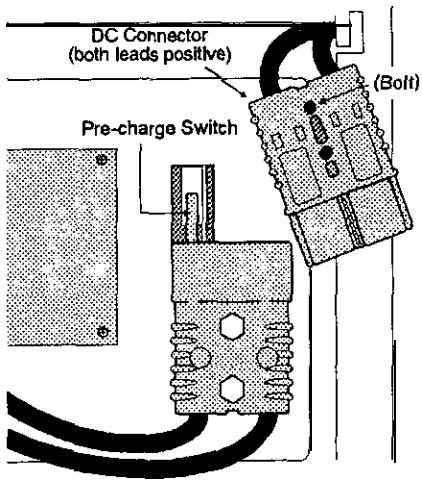

Figure 1

- ☐ Remove the screws at the corners of the front ventilation panel and remove the panel from the unit.
- ❑ Remove the bolt from the top DC connector (see Figure 1).
- ❑ Disconnect the top DC connector (see Figure 1). Make sure that the connector does not contact the pre-charge switch after it is disconnected

⚠ CAUTION

The DC filter capacitors store a charge, even after AC and DC power are disconnected. Do not service the unit until you have discharged the capacitors.

Discharging the Capacitors

- ❑ Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel. Lift each side cover **straight up,** then off.
- ❑ With AC and DC power disconnected, turn the UPS key switch to "Auto" for at least five seconds. **Note:** The fans may come on and A-17 and A-13 alarms may be displayed. This is a normal indication.
- ❑ Turn the UPS key switch back to "Off"
- ❑ To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar (-) and one of the **outside** heatsinks on each inverter board (+), as shown in Figure 2.

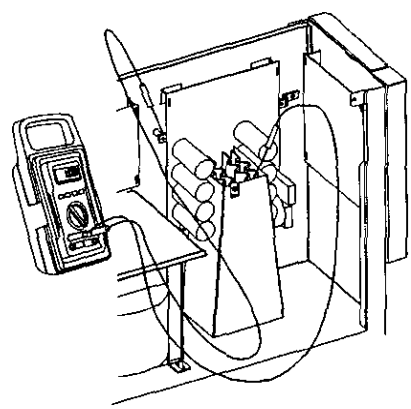

Figure 2

- ❑ If the reading is greater than S volts, **wait five minutes** to allow the capacitors to discharge. Then, repeat the previous step before continuing.

- ☐ Remove the fast-on connector from E5 in the upper right corner of the fuse board. The fuse board is located next to the DC connector at the base of the front panel.

4. *Perform a visual inspection of the UPS.*

- ☐ Look for any damage on the boards or any marks inside the unit. Make sure all terminal connections, including battery, AC input, and AC output connections are in good working order and free of corrosion. If a wire is loose, tighten the connection. Make sure each battery connection is tight. If you find any damage, stop and call BEST's Technical Support Center.

Cleaning Inside the Chassis

- ☐ Using a nonmetallic brush and a vacuum cleaner with a plastic nozzle, vacuum out any dust or dirt found in the unit. Be careful not to dislodge or damage any components or connections while cleaning the unit.

5. *Are there open fuses, blown MOVs or damaged components on any of the boards? Note any repairs in step 13.* If you find any damage or if fuses are open, stop and call BEST's Technical Support Center. If not, continue.

- ☐ Close the door assembly and secure it with the two Phillips screws. Make sure that no wires are pinched between the door and the chassis.

- ☐ Replace the side covers and secure them with the seven screws. Slide each cover straight down to secure it on the notches that hold it in place.

- ☐ At the front of the unit, reconnect the fast-on connector to E5 *on* the fuse board.

- ☐ At the front of the unit, reconnect the top DC connector and secure it with the bolt.

- ☐ Switch on the DC disconnect switches on the external battery cabinets (if applicable).

- ☐ Replace the front ventilation panel and secure it with the screws.

- ☐ Reapply AC line.

- ☐ Turn the key switch inside the unit's front door to "Auto."

- ☐ Apply 50% non-essential load to the unit.

Checking Alarm and System Logs

6. *List the five most recent alarm andsystem* log *events.* Record the log information (i.e., alarm code, time, etc.) for the first five alarm and system log entries in BEST Publication UTY 605. The first entry displayed is the most recent log entry.

- ☐ Hold down the [CANCEL] and [RUNTIMB] keys for two seconds. Release the keys when display shows "P-00."
- ☐ Press [VOUT]. The display should show either "P-134" or "P-132."
- ☐ Press [%LOAD]. The display should show "AL 1." If the UPS has never had an alarm condition, the display will show "SL 1."

Use [%LOAD] and [VOUT] keys to step up and down through the log numbers. The system log entries follow the alarm log entries. If you step past the last system log entry (to "P-00"), repeat the above steps to re-access the logs. When finished viewing the logs, press [VLINE] twice.

Viewing System Parameters

List Parameter 92, *System Hours.* To view parameter 92 follow the instructions below.

- ☐ Hold down the [CANCEL] and [RUNTIMB] for two seconds. Release the keys when the display shows "P-00." Use [%LOAD] and [VOUT] to step up and down through the parameters until you reach "P-92." Then press [CANCEL]. The display will show the parameter value. Use the [CANCEL] key to toggle between parameter number and the parameter value. Record the system hours in the blank provided. When finished viewing the parameters, press [VLINE] twice.

7. *Is there anything in the logs that implies the UPS will not sustain the load equipment during an outage? Notify the customer that you are going to perform a battery load test and that in the unlikely event of a problem, all equipment should be preparedfor a power outage.* Look at the entries you recorded in step 6 to find out if there have been any battery alarms since the last scheduled maintenance that were not caused by a power outage. If yes, do not continue. Service the UPS before proceeding with the *next* step. If necessary, call BEST Service Department for help interpreting log information.

8. *Is customer using the DB9 communication port for a communications link? Take the necessaryprecautions so that this contact closure will not cause apremature shutdown.* If the customer is using a communications link with UPS monitoring software, you must disable the software prior to doing a battery test. If there is no data cable attached to the DB9 port on the back of the UPS, no communications link is being used.

⚠ CAUTION

The UPS must be in an operative mode with at least 50% of the non-essential load applied for the following tests. To avoid equipment damage, do not use critical loads while performing a battery test.

9. *Perform* a *battery test.* Set Parameter 77 to "1." Parameter 77 must be set to 1 for the battery test to be performed. To change this parameter:

- ☐ Hold down the [CANCEL] and [RUNTIME] for two seconds. Release the keys when the display shows "P-00." Then press [CANCEL]. The display will read "0."
- ☐ Use the [%LOAD] (increase setting) and [VOUT] (decrease setting) keys to change the display reading to "377."
- ☐ Press [RUNTIME]. The display should read "1." If the display reads "0," the unit did not accept the password, repeat the previous step.

NOTE: If the display is left unattended (no keys are pressed) for five minutes, the password reverts to level "0" and you must re-enter the password. (In software v. 1 .OO, if the display is left unattended for one minute the password must be reentered.)

- ☐ Press [CANCEL]. The display should read "P-00."
- ☐ Press [%LOAD] until the display shows "P-77." Press [CANCEL] to view the parameter value. Note that the [CANCEL] key allows you to toggle between the parameter number and parameter value.
- ☐ Press [%LOAD] to set the value to "1."
- ☐ Press [RUNTIME]. Then enter the value "1." The UPS beeps to indicate that the new value has been entered.
- ☐ Press [VLINE] twice.

Front Panel LED Test

Press the [TEST] keys and hold down for 2 seconds for the test. Watch the LED status indicators and display to make sure they work. Did each front panel LED (except bypass) and all segments of the LCD display light? If a low battery or battery problem is detected, an alarm will activate. When test is finished, reset parameter 77 to its original value.

Battery Load Test

10. *Battery loud* test. With at least 50% load applied, remove AC power and run on battery power for 10 minutes or half of the system's specified battery nmtime, whichever is less.

After 10 minutes (or half your battery nmtime), use a multimeter to measure the voltage across each individual battery. Average battery voltage should be approximately 11.5 volts. Record the voltages. If any battery is more than 0.5 volt different from the others, that battery has failed. Circle the date code for any failed batteries. If you replace one or more batteries, note this in step 14. When the unit is running on battery, till out the "On Battery" column in step 11. Is there anything in these parameters that indicates the UPS will not sustain loads during a power outage?

When you finish the battery load test, record the time in the "Length of load test" blank, and record the batteries' "BAT" model number in the blank provided.

Reapply AC line. Put the unit in auto mode and fill in the "On Line" readings listed in step 11. Then, reconnect all loads.

Parameter Settings Check

11. *Is there anything in the parameter readings that would indicate the UPS will not sustain the load equipment?* Refer to instructions in step 6 to access parameters. It is not necessary to enter a password to view the parameters. Compare these parameter readings with parameter readings from the last maintenance check. If there was not a previous maintenance check, refer to the Service Manual for parameter settings. Save BEST publication UTY 605 to use as a reference for the next scheduled maintenance procedure.

12. *Record any repairs or changes that you made. Document any wiring problems and any corrective action taken.* Did you change any parameters to a different setting? List any changes made and the reason for the change.

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

14. *For BEST IFSCs:* Fill in the information on the bottom of page two (travel time, time on site, was the unit operational, is a return trip required, does BEST need to contact the customer). Have the form signed by the required individuals and return it to BEST.

File this document so it can be referred to the next time preventive or corrective maintenance is needed.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UTY 605
September 1995

Scheduled Maintenance and Service Call Report Form For UNITY/I Single-Phase Models

Refer to UTY 604 for detailed instructions.

Please check one: ☐ Maintenance ☐ Service RFS Number _____

Technician _____ Technician ID Number _____ Territory _____

LOCATION OF SYSTEM Model Number _____ Serial Number _____

Company Name _____ Phone Number _____

Address _____

Bypass Type: OBBM ☐ MBB Date of service _____ Time of service _____

1. Authorization to perform maintenance and test UPS (Contact Signature) _____
2. Comments or problems regarding the LIPS. _____
3. Is the UPS environment clean and free from dust and dirt? ___Yes ___No*

Before removing cover and continuing with steps **4, 5,** and 6:
- Shut down the load equipment or bypass the UPS.
- Shut off the UPS. Turn off AC line and DC input power and discharge the capacitors.

4. Perform a visual inspection of the UPS.
   Check battery terminal connections; are connections tight, free of corrosion and in good condition? ___Yes ___No*
5. Are there open fuses, blown MOVs, or damaged components on any of the boards? ___Yes* ___No
   Note any repairs in step 13.
6. List the five most recent alarm and system log events below. List Parameter 92 Sys Hrs _____

Alarm Log	System Log
AL 1 _____	SL 1 _____
AL2 _____	SL 2 _____
AL3 _____	SL 3 _____
AL4 _____	SL 4 _____
AL5 _____	SL 5 _____

7. Is there anything in the logs that implies the UPS will not sustain the load equipment during an outage?
   Notify the site that you are going to perform a battery load test and that, in the unlikely event of a problem, all equipment should be prepared for a power outage.
8. Is customer using the DB9 communication pat for a communications link? Take the necessary precautions so that this contact closure will not cause a premature shutdown.

The UPS must be in an operative mode with at least 50% of the nonessential load applied for the following tests.

9. Perform a battery test. Record the value of parameter 77 _____. Set parameter 77 to "I" and escape parameter mode. Then press the [TEST] keys and hold them down for 2 seconds. Watch the LED status indicators and display to make sure they work. (The Bypass LED will not light.) The unit will perform a brief battery test. Reset parameter 77 to original value.

= Call BEST immediately

N9246 Highway 67 South, PO Box 280, Necedah, WI 54646 U.S.A., Web site: www.bestpower.com
1-608-565-7200, 1-800-356-5794 (U.S.A. and Canada), Fax: 1-608-565-2221
service: 1-800-356-5737, Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

10. Battery load test. Remove AC line from the UPS. With 50% load applied, run on battery power for 10 minutes per battery string or until average battery voltage is 11.5 volts. Record the voltages below. If any battery is more than 0.5 volt different from the others, that battery has failed. Circle the date code for any failed batteries. If you replace one or more batteries, note this in step 14. While the unit is running on battery, fill out the "On Battery" column in step 11.

Battery Number	1	2	3	4	S	6	7	8
On Battery with Load								
Date Code								

Length of battery load test _____ Battery type BAT- _____

Put the unit back on line in auto mode to do the "On Line" readings listed below in step 11

11. Is there anything in these parameters that indicates that the UPS will not sustain the load equipment? _____

Parameter Number	On Line	On Battery	Parameter Number	On Line	On Battery
1 Serial Number Low	XXX		32 Batt Temp		
2 Serial Number High	XXX		34 Percent Load		
5 Nominal V Out			35 Power Factor		
6 Full Load Setpoint	XXX		36 Watts		
13 Frequency			37 VA Out		
21 Volt.9 In			62 Hot Swap V In		
28 Volts Out			89* Hours/Min	xxx	
29 I Out			90* Month/Day	XXX	
30 V Batt			91* Year	xxx	
31 Amb Temp					

*For Software v. 1.05 and below, Parameter 90 = Time and Parameter 91 = Month/Day.

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

_____

_____

_____

_____

_____

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

_____

_____

_____

_____

14. **BEST IFSCs:** Operational Unit? ☐ Yes ☐ No Return trip required? ☐ Yes ☐ No

Travel Time _____ Time cm Site _____

BEST must contact customer in reference to today's service: ___Yes N o Phone l-800-356-5737

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

Quoted price _____ (Quoted price does not include shipping or tax, if applicable.)

_____ _____

Site Representative Signature Service Representative Signature

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UN 601
January 1995

Verifying the Basic Operation of the Single-Phase UNITY/I™ UPS

This document explains how to verify the basic operation of a single-phase **UNITY/I** UPS. This procedure can be used after performing maintenance or as a stand-alone procedure. If a complete recalibration is required or if a complete scheduled maintenance procedure is required, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. and Canada) or your local BEST office.

If the DB9 port on the back of the UPS is being monitored by automatic shutdown software, take the necessary precautions so that this procedure does not trigger a shutdown of the load equipment.

Tools required (use insulated tools):

True RMS *voltmeter*	Clamp-on ammeter	Pen or pencil
Phillips screwdriver	*UNITY/I User Manual*	
DC voltmeter	Personal safety equipment as required by local code	

WARNING

1. These procedures must be performed by a **qualified service technician only.**

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

TEST BEFORE TOUCHING!

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage and injury. A short circuit can cause a battery to explode.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified technicians servicing the UPS:

a. Remove rings, watches and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Removing the Covers

CAUTION

If you use an external bypass switch to bypass the UPS, the loads are powered by direct AC line and are not protected by the UPS.

☐ 100-l. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the UPS key switch to "Off

WARNING

There is still live voltage inside the UPS.

☐ 100-3. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 100-4. Lift each side cover **straight** up, then off.

Section 200: Verifying Basic Unit Operation

NOTE: During start-up and during transfers from battery power to line power, the tap changers will make clicking sounds. This is normal.

NOTE: If the UPS will not accept a new parameter setting during the procedure, re-enter the password as instructed in steps 201-3 to 201-7.

If you encounter a problem while performing this procedure:

1. Completely shut down the unit as instructed in the UNITY/I *User Manual.*
2. Verify all connections/troubleshoot the UPS.
3. Check to see if something external to the UPS may be causing the problem.
4. Start this procedure over.
5. If you encounter the same problem a second time, shut the unit down and phone BEST's Technical Support Center or your local BEST office for assistance. Do not continue the procedure until the problem is remedied.

If you need assistance, phone BEST's Technical Support Center at 1-800-356-5737 (U.S.A. and Canada); elsewhere, phone your local BEST office. Have the UPS serial number and UPS model number available when you call.

201: Accessing Parameter Mode and Entering a Password

NOTE: When the unit is in parameter mode, each of the front panel keys has a specific function. The label inside the front door of the unit explains the parameter mode key functions. The label also shows a "Programming Template" with alternate key names which correspond to the parameter mode key functions.

WARNING

As a safety precaution, stand clear of the UPS whenever reapplying AC input line voltage to the **unit** or restarting the unit.

Wear personal safety equipment whenever the UPS covers are removed.

❑ 201-l. Before restarting the UPS, verify the following:

- ❑ The load equipment is **not** applied to the UPS
- ❑ AC input line voltage is applied to the UPS.

❑ 201-2. Turn the key switch inside the front door of the UPS to "Auto." The BATTERY LED should light briefly, then the LINE LED should tight. After five seconds, check the front display.

- ❑ The four-digit display should be on.
- ❑ The LINE LED should be on.
- ❑ The BATTERY, BYPASS, and ALARM LEDs should all be off.
- ❑ The **RUNTIME** LED should be on.

❑ 201-3. Simultaneously hold down the **[CANCEL]** and **[RUNTIME]** keys for two seconds. Release them when the display reads P - 0 0.

❑ 201-4. Press **[CANCEL]**. The display should read 0.

❑ 201-5. Use the **[%LOAD]** key to change the display reading to 2 6 3 9 (service password). If you inadvertently increase the display value to more than 2639, use the **[VOUT]** to decrease the value.

NOTE: If you hold down either the **[%LOAD]** key or the **[VOUT]** key, the display will begin to scroll more quickly after a few seconds.

❑ 201-6. Press **[RUNTIME]** to enter the password. The display should read 2. If it does not, repeat 201-5 and 201-6.

❑ 201-7. Press **[CANCEL]**. The display should read P- 0 0.

202: Calibrating the AC Input Voltage

❑ **202-I** Parameter 21 is used to adjust the metering for units with optional 380 - 415 VAC input. Parameter 21 must be set to "0" while calibrating the input voltage. Set Parameter 21 as follows:

- ❑ a. The display should read P-XX (where XX is a parameter number). Use the **[%LOAD]** key or the **[VOUT]** key to change the display reading to P- 2 1.
- ❑ b. Press **[CANCEL]**. If the display reads 0, skip to step "d". If the display reads 1, use the **[VOUT]** key to set it to 0.
- ❑ **c.** Press **[RUNTIME]**. The display should read 0.
- ❑ d Press **[CANCEL]**. The display should read P- 2 1.

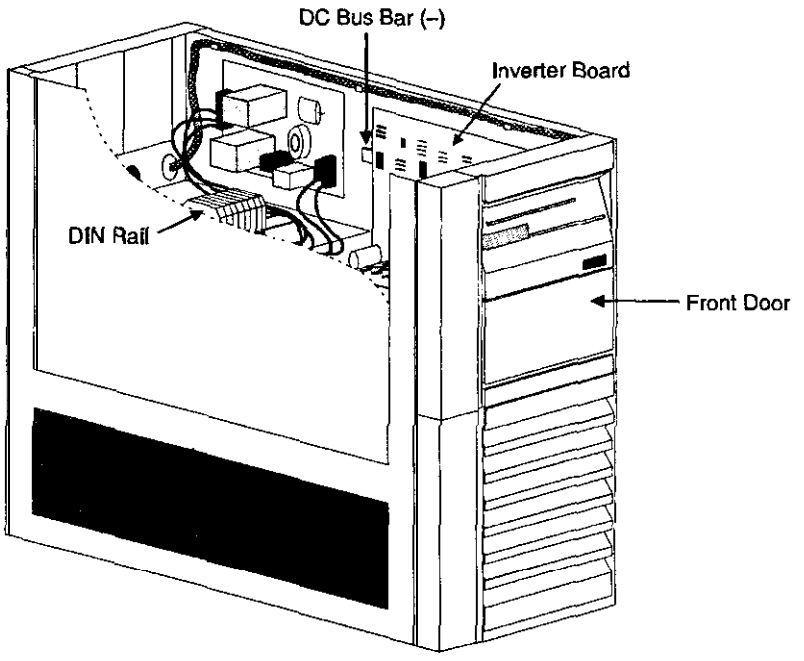

Figure I

☐ 202-2. Go to Parameter 27 (Input Voltage) as follows:

☐ a. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to P - 27.

☐ b. Press [CANCEL]. The display should show the UPS input voltage. Displayed input voltage = _____ VAC.

☐ 202-3. Calibrate Parameter 27 (Input Voltage) as follows:

☐ a. Use a true RMS voltmeter to measure the AC input voltage from Ll to L2 on the UPS DIN rail (see Figure 1). Measured input voltage = _____ VAC.

NOTE: If the displayed voltage is within ±2.0 volts of the measured voltage, you may skip to step 202-4.

☐ b. Use the [%LOAD] key or the [VOUT] key to change the display reading to the measured voltage.

• i c. Press [RUNTIME] to enter the new value. The displayed voltage should now be within ±2.0 volts of the measured voltage. If it is not, repeat all of 202-3.

☐ 202-4. Press [CANCEL]. The display should read P- 27.

cl 202-5. On the label inside the unit's front door, find the "Input Volts" rating.

- If the "Input Volts" rating is 200 - 240 VAC, skip to Section 203.
- If the "Input Volts" rating is 380 - 415 VAC, set Parameter 21 to "1" as follows:

☐ a. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] or [VOUT] key to change the display reading to P-21.

☐ b. Press [CANCEL]. Use the [%LOAD] key to change the display reading to 1.

☐ c. Press [RUNTIME]. The display should read 1.

☐ d. Press [CANCEL]. The display should read P-21.

203: Calibrating the AC Output Voltage

The AC output voltage to the loads is dependent upon three main factors:

- The Parameter 05 setting, which determines what voltages will be present at the output terminals on the UPS DIN rail.
- The connection of the output wires to the correct UPS DIN rail terminals.
- The calibration of Parameter 28 (Output Voltage).

❑ 203-l. Check the Output Voltage Reference setting **(Parameter 05).**

☐ a. Use Table 1 to determine the correct Parameter 05 setting for your application. Write the correct Parameter 05 setting here _____

Table 1: Parameter 05 Setting

Voltage required by loads (UPS Output)	Correct Parameter 05 setting
100 and/or 200	200
110 and/or 220	220
115 and/or 230	230
120 and/or 240	240
208	208
127	254
1271220	220

☐ b. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to P-05.

☐ c. Press [CANCEL]. The display will show the Parameter 05 setting _____

☐ d. Does the displayed setting (step "c") match the correct setting (step "a")?

☐ YES Continue with step 203-2.

☐ NO For the UPS to provide the desired output voltage to the loads, Parameter 05 **must** be set properly. Do not continue until you are certain of the correct Parameter 05 setting fcr your application. You may wish to refer to the *UNITY/I Installation Manual*. If you need assistance, call BEST's Technical Support Center or your local BEST office.

⚠ CAUTION

Before continuing, make sure that no load equipment is applied to the UPS. The next step may change the unit's output voltage.

Parameter 28 (Output Voltage) will not calibrate properly unless Parameter 05 is set to "240" as instructed in this section.

☐ 203-2. Temporarily set Parameter 05 (Output Voltage Reference) to "240" as follows:

☐ a. The display should still show the Parameter 05 setting.
NOTE: If the setting is already "240", you may skip to step 203-3.

☐ b. Read the CAUTION above. Make sure that **no loads** are applied.

☐ c. Use the [%LOAD] key or [VOUT] key to change the display reading to 240.

☐ d. Press [RUNTIME]. You may hear clicking. The display should read 240.

☐ 203-3. Press [CANCEL]. The display should read P-05.

☐ 203-4. Go to Parameter 28 (Output Voltage) as follows:

☐ a. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to P-28.

☐ b. Press [CANCEL]. The display should show the UPS output voltage,
Displayed output voltage = _____ VAC.

NOTE: The unit uses the highest nominal voltage developed on the transformer secondary to monitor both the high and low voltage outputs. Parameter 28 displays the **high** output voltage only.

☐ 203-5. Calibrate Parameter 28 (Output Voltage) as follows:

Cl a. Use a true RMS voltmeter to measure the AC output voltage from Xl to X5 on the UPS DIN rail (see Figure 1). Measured output = ___VAC.

NOTE: If the displayed voltage is within ±2.0 volts of the measured voltage, you may skip to step 203-6.

❑ b. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the measured voltage.

• I c. Press [RUNTIME] to enter the new value. The displayed voltage should now be within ±2.0 volts of the measured voltage. If it is not, repeat all of 203-5.

☐ 203-6. Press [CANCEL]. The display should read P- 28

❑ 203-7. Reset Parameter 05 (Output Voltage Reference) to the correct setting as follows:

☐ a. Look back at step 203-la on page 6 and write the correct Parameter 05 setting for your application here _____

NOTE: If the correct Parameter 05 setting for your application is 240, you may skip to Section 204. **Otherwise, follow the steps below.**

☐ b. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 0 5.

• I c. Press [CANCEL]. The display should read 240

☐ d. Use the [%LOAD] key or the [VOUT] key to change the display reading to the value recorded in step 203-7a.

☐ e. Press [RUNTIME] to enter the value. You may hear clicking.

☐ f. Press [CANCEL]. The display should show P- 05.

204: Calibrating the Battery Voltage

❑ 204-I. Go to Parameter 30 (Battery Voltage) as follows:

☐ a. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 30.

☐ b. Press [CANCEL]. The display should show the battery voltage.

☐ 204-Z Remove AC input line voltage. The unit should transfer to battery power.

☐ The four-digit display should be **on.**
☐ The **BATTERY** LED should be **on.**
☐ The LINE, BYPASS, and ALARM **LEDs** should all be **off.**
☐ The fan should be on. You should be able to hear the fan and feel air flowing out of the top of the unit.

☐ 204-3. Watch the displayed battery voltage. When the battery voltage stabilizes (about 60 seconds), recalibrate Parameter 30 as follows:

NOTE: See Figure 1 for the locations of the DC bus bar (-) and inverter board.

☐ a. Place the DC voltmeter so that you can see the voltmeter display and the UPS display at the same time.

☐ b. Use the DC voltmeter to measure the battery voltage between the DC bus bar **(-)** and one of the **outside heatsinks** on the inverter board **(+),** as shown in Figure 2.

Look at the measured DC voltage and the UPS display **at the same time.** Is the UPS display within rt0.2 volts of the measured voltage?

☐ YES Skip to step **204-4.**
☐ NO Recalibrate as instructed in steps "c" and "d" below.

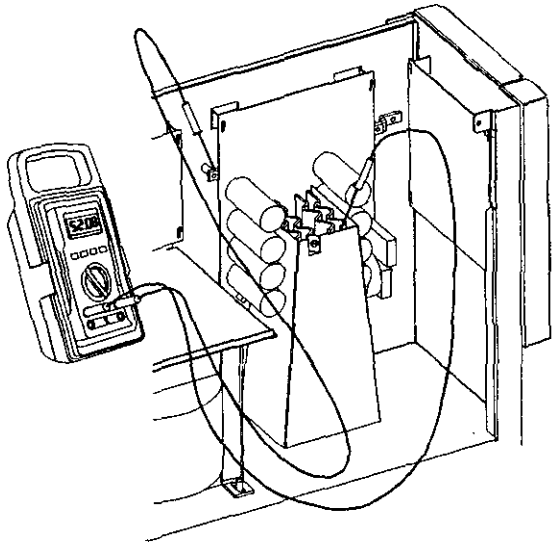

Figure 2

☐ c. Use the **[%LOAD]** or **[VOLJT]** key to change the UPS display reading to the measured DC voltage.

☐ d. Press **[RUNTIME].** The displayed voltage should now be within ±0.2 volts of the measured voltage. **If it** is not, repeat all of step 204-3.

❑ 204-4. Press [CANCEL]. The display should read P- 3 0.

❑ 204-5. Reapply AC input line voltage. The unit should transfer to line power. After five seconds, check the front display.

- ☐ The four-digit display should be on.
- ❑ The LINE LED should be on.
- ☐ The BATTERY, BYPASS, and ALARM LEDs should all be off.

205: Calibrating the Output Current

❑ 205-1 Reapply the load equipment.

☐ 205-2. Check the Parameter 06 (Full Load Set Point) setting as follows:

❑ a. Open the front door of the unit. Find the model number UTXK, where X is the KW/KVA rating of the unit. Unit rating = _____ KW/KVA.

☐ b. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to step to P- 0 6.

❑ c. Press [CANCEL]. The display should show the Parameter 06 setting. Displayed Parameter 06 setting = _____

☐ d. Does the displayed Parameter 06 setting in step "c" match the unit KW/KVA rating written in step "a"?

☐ YES Continue with step "e" below.

☐ NO Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the correct KW/KVA rating. Then, press [RUNTIME] to enter the new value.

> **☞IMPORTANT!**
>
> If the Parameter 06 setting was incorrect, a full recalibration may be required. After completing this procedure contact, BEST's Technical Support Center at 1-800-356-5737 (U.S.A. and Canada) or your local BEST office for assistance.

☐ e. Press [CANCEL]. The display should read P- 0 6.

☐ 205-3. Check Parameter 34 (Percent Load) as follows:

☐ a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-34.

☐ b. Press [CANCEL]. The display should show the percent of the unit's rated capacity presently being used. Percent load = _____ %.

☐ c. If the percent load is over 100%, remove load until the percent load is less than 100%.

☐ d. Press [CANCEL]. The display should read P-34.

☐ 205-4. Go to Parameter 29 (Output Current) as follows:

☐ a. The display should read P-XX (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to P-29.

☐ b. Press [CANCEL]. The display should show the output current in amperes. Displayed output current = _____ amps.

☐ 205-5. Calibrate Parameter 29 (Output Current) as follows:

☐ a. Use a clamp-on ammeter to measure the current of the output wire connected to Xl on the UPS DIN rail. Xl = _____ amps.

☐ b. Use a clamp-on ammeter to measure the current of either the output wire at X4 or the output wire at X5, whichever is used. X4 or X5 = _____ amps.

☐ c. In the spaces provided below, add the value recorded in step "a" to the value recorded in step "b" and divide by 2.

(_____ amps + _____ amps) + 2 = _____ amps
I Out at X1 — I Out at X4 or X5 — Calibrated I Out (Parameter 29)

NOTE: If the calculated current is within i0.2 amps of the displayed output current, you may skip to step 205-6.

☐ d. Use the [%LOAD] key or the [VOUT] key to change the UPS display reading to the correct output current value as calculated in step "c."

• i e. Press [RUNTIME]. The displayed output current should now be within ±0.2 amps of the calculated current. If it is not, repeat all of 205-5.

☐ 205-6. Press [VLINE] twice to escape parameter mode.

206: Checking Unit Transfers (with Loads) and Battery Charger Operation

In Section 204, you transferred the unit from line power to battery power and from battery **power** to **line** power **without the** loads applied. In this section, you will check these transfers **with** the loads applied. You will also check for battery charger operatiop.

> ☞ **IMPORTANT!**
>
> Unit runtime may be low if the batteries are not fully charged.

☐ 206-l. Remove **AC** input line voltage. The unit should transfer to battery power.

- ☐ The four-digit display should be on.
- ☐ The BATTERY LED should be **on.**
- ☐ The LINE, BYPASS, and **ALARM** LEDs should all be off.
- ☐ The fan should be on. You should be able to hear the fan and feel air flowing out of the top of the unit.

☐ 206-2. Reapply AC input line voltage. The unit should transfer to line power. After five seconds, check the front display.

- ☐ The four-digit display should be on.
- ☐ The LINE LED should be **on.**
- ☐ The **BATTERY, BYPASS,** and **ALARM** LEDs should all be off.

☐ 206-3. To verify charger operation, simultaneously press the two [WATT] keys to display the battery voltage. The charger should be recharging the batteries, so the displayed battery voltage should be **increasing.**

Section 300: Replacing the Covers

☐ 300-l. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 300-2. Open the front door of the UPS. Turn the UPS key switch to "Off'.

☐ 300-3. Replace the side covers and secure them with the seven screws. Replace the right cover first, then the **left. Slide** each **cover straight down** to secure it on the notches that hold it in place.

☐ 300-4. Turn the UPS key switch to "Auto".

☐ 300-5. Reapply the load equipment.

Best Power
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OWER SYSTEMS

UN608
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August 29, 1997

Generator Setup for UNITY/I UT3K, UT4K, UT5K, and UT8K

This UNITY/I technical supplement (UTY) describes how to program UNITY/I models to accept generator power. A qualified technician who is familiar with the UNITY/I must program the unit. If you encounter problems during this procedure, call Best Power Worldwide Service at 1-800-356-5737 (U.S. and Canada only). 1-608-565-2100. or call your ocal Best Power office.

JNITY/I units automatically adjust to the input power available. This means that you should not need to reprogram a UNITY/I using input power from a generator. However. in some cases the UNITY/I does not accept generator power because the generator power is relatively unstable. To help the UNITY/I work with the input from the generator. you must follow steps 101 through 108 below to reprogram some parameters.

You can perform this procedure using the front control panel on your unit. (See Figure 1.) You can also perform this procedure through a dumb terminal or a computer running terminal emulation software connected to the DB9 communication port on the back of the unit. You must know how to display and program parameters. If you need more information, see the *User* Manual if you are using the control panel or UTY 50 1 if you are using a terminal or computer.

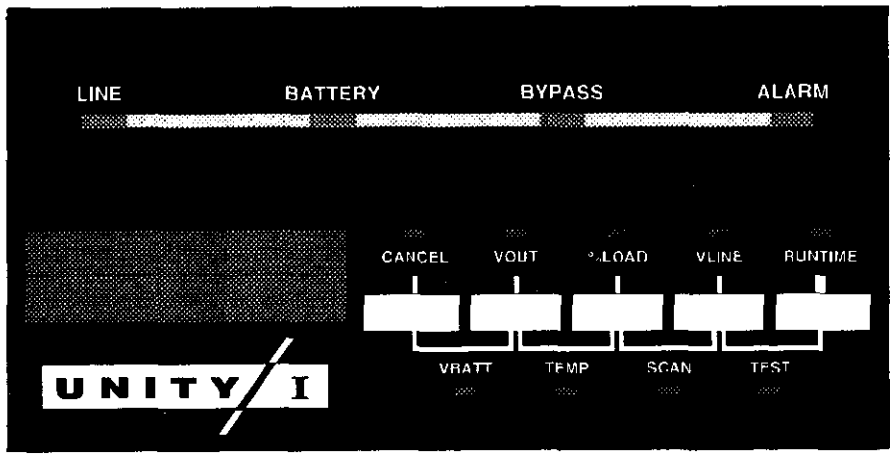
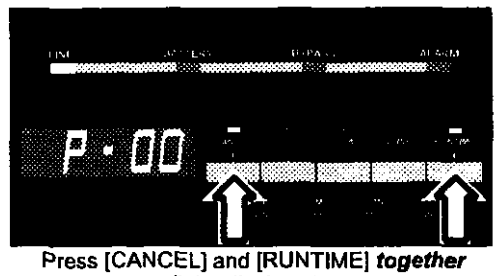


Figure 1

101. Enter the Service password.

From the front ***control panel:***

a. Press **the [CANCEL] and the [RUNTIME] keys together** until the display shows **P-00. (See Figure 2.)**



Press [CANCEL] and [RUNTIME] ***together*** *until the display shows* *P-00*

Figure 2

UT /8A

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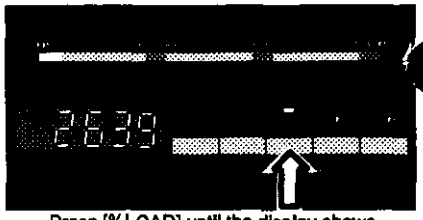
1-608-565-7200 / 1-800-356-5794 (U.S.A. and Canada) / Fax: 1-608-565-2221
Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

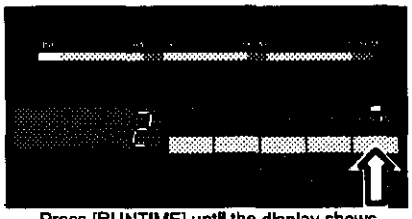
b. Then, press [%LOAD] until the unit displays 2639. (See Figure 3.)

c. Then, press [RUNTIME]. The display should read 2 (for password level 2). (See Figure 4.)



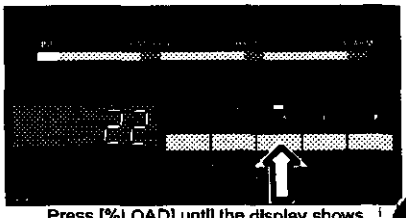
Press [%LOAD] until the display shows 2639

Figure 3



Press [RUNTIME] until the display shows 2

Figure 4



Press [%LOAD] until the display shows 22

Figure 3

From a computer or terminal:

a. Set the UNITY/I to the proper baud rate. If the baud rate needs to be changed:

I. press the [CANCEL] and the [RUNTIME] keys together until the display shows P-00. (See Figure 2 on page 1.)

ii. Then, press [%LOAD] until the unit displays 22. (See Figure 5.)

ttt. Once you reach P-22, press [CANCEL]. Use the [%LOAD] key or the [VOUT] key to change the display to the correct setting. (See Table 1 below to determine the correct setting.)

iv. To enter the new setting, press [RUNTIME]. To escape parameter mode, press [VLINE] twice.

NOTE: To escape *without* saving, press the [VLINE] or the [CANCEL] key.

Table 1 Baud Rate Settings

Parameter 22 Setting*	Communication Mode
O-F.	Contact mode. Sets the delay (ii seconds) on pin 2.
10	RS232 mode 1200 baud
20	RS232 mode, 2400 baud.
30	RS232 mode, 4800 baud.
40	RS232 mode, 9600 baud.

* Parameter 22 settings are in hexadecimal.

b. Type P 00 2639 and press <ENTER>. The display should read OK=>.

102. Change parameter #8 (Glitch Limit) to a value of "25."

From the front control panel:

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display reads P-08. Then. press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 25. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 8.

From a computer or terminal:

Type P 08 = 25, then press <ENTER>. The display should read OK=>.

103. Change parameter #86 (Generator) to a value of "1." This sets the inverter lockout.

From the front control panel:

Press [CANCEL] to return to the parameter display. then press [%LOAD] or [VOUT] until the display reads P-86. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 1. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 86.

From a computer or terminal:

Type P 88 = 1, then press <ENTER>. The display should read OK=>.

104. Change parameter #87 (Inverter Lock Out) to a value of "5." This sets the number of cycles after a transfer to line that line-interactive operation is prohibited.

From the front control panel:

Press [CANCEL] to return to the parameter display. then press [%LOAD] or [VOUT] until the display reads P-67. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 5. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 87.

From a computer or terminal:

Type P 87 = 5, then press <ENTER>. The display should read OK=>.

105. Change parameter #78 (Line Delta Mode) to a value of "2." This sets the Line Delta to poor line.

From the front controlpanel:

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display reads P-78. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 2. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 78.

From a computer or terminal:

Type P 78 = 2, then press <ENTER>. The display should read OK=>.

106. Change parameter #9 (Frequency Slew Rate) to a value in the range of "400" to "700."

From the front control panel:

Press [CANCEL] to return to the parameter display, then press [%LOAD] or [VOUT] until the display reads P-09. Then, press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads a value between 400 and 700. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 9.

From a computer or terminal:

Type P OS =, enter a value between 400 and 700, then press <ENTER>. The display should read OK=>.

Adjust this parameter until you find the optimum setting.

107. Change parameter #85 (Tap Delay Count) to a value of "4." This programs the "N" cycle delay for the relay operate and debounce times.

From the front control panel:

Press [CANCEL] to return to the parameter display. then press [%LOAD] or [VOUT] until the display reads P-85. Then. press [CANCEL] to display the parameter value. Press [%LOAD] or [VOUT] until the display reads 4. Press [RUNTIME] to save the value. The UPS should beep to indicate that you have saved the new value for parameter 85.

From a computer or terminal:

Type P 85 = 4, then press <ENTER>. The display should read OK=>.

Table 2 Parameter Changes for Generator Setup

Parameter		New Value	Explanation
8	(Glitch Limit)	25	Increases number of glitches before unit goes to inverter.
86	(Generator)	1	Enables the inverter lockout to be set.
87	(Inverter Lock Out)	5	Sets the number of cycles after transfer to line that line-interactive operation is prohibited.
78	(Line Delta Mode)	2	Sets the Line Delta to poor line.
9	(Frequency Slew Rate)	400-700	Maximum frequency of slew rate of change.
85	(Tap Delay Count)	4	Programs the "N" cycle for relay and debounce times.

108. Exit from the parameter mode.

From the front control panel, press [VLINE] ***twice*** to exit from the parameter mode.

From a computer or terminal, type P 00 = *

Your UNITY/I UPS should now be set for the generator used in your application. If you still have trouble with the UPS locking to line, call Best Power Worldwide Service at I-800-356-5737 (U.S. and Canada only), l-608-565-2100, or call your local Best Power office.

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UTY 620
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December 5, 1997

Replacing the External Batteries for UNITY / I UT3K, UT4K, UT5K, and UT8K

This publication describes how to change the external batteries in UNITY/I™ models UT3K, UT4K, UT5K, and UT8K. Since many UNITY/I models with external batteries also have internal batteries, this UTY includes instructions for replacing them as well. If your UNITY/I has no external batteries, refer to UTY 619, instead.

Replace batteries with the same series and type of battery. **A qualified service person must perform this procedure.** Should questions or problems arise while performing this procedure, call Best Power Worldwide Service at l-800-356-5737 (U.S.A. and Canada only), l-608-565-2100, or your local Best Power office.

Tools Required -- Use Insulated Tools:

Safety Equipment Required by Local Codes	*UNITY/I User Manual*	7/16-inch and 1/4-inch Nut Drivers
½-inch Heat Shrink Tubing or Electrical Tape	7/16-inch Box Wrench	DC Voltmeter
Phillips Screwdriver	Diagonal Cutters	

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

&CAUTION!

This procedure must be performed by a qualified service person only. UNITY/I UPS units are designed to provic le power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or D C voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

Turn off the UNITY/I UPS according to the procedure describing "Shutting Down the UNITY/I" in the *UNITY/I Us r* Manual. Make sure that the UNITY/I batteries and AC input are off or disconnected before you replace the batterie s.

This unit contains electrostatic sensitive devices (ESD). If you do not follow proper ESD procedures, you ma y cause severe damage to electronic circuitry.

UNITY/I UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cau se severe arcing, equipment damage and injury. A short circuit can cause a battery to explode. Always wear protectiv e clothing and eye protection and use insulated tools when working near batteries.

Best Power reeommends the following for qualified service people servicing the UNITY/I UPS:

A) Remove rings, watches, and other jewelry before servicing the UNITY/I UPS.

B) Always wear protective clothing and eye protection, and use insulated tools when working near batteries.

C) Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follo w all local safety codes.

CAUTION!

Full voltage and current are always present at the battery terminals.

The batteries used in this system can produce dangerous voltages, extremely high currents, and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). You must be extremely careful to avoid electric shock and bums caused by contacting battery terminals or shorting terminals during battery installation. Do not touch uninsulated battery terminals.

A qualified service person who is familiar with battery systems and required precautions must service the batteries. Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. Batteries must be replaced with Best Power battery number BAT-*XXXX* or equivalent, The installation must conform to national and local codes.

Keep unauthorized personnel away from batteries.

The technician or electrician must take these precautions:

1. Wear protective clothing and eye wear. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Remove rings and metal wristwatches or other metal objects and jewelry. Do not carry metal objects in your pockets where the objects can fall into the battery cabinet.

2. Tools must have insulated handles and must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet at any time. Do not lay tools or metal parts on top of the batteries, and do not lay them where they could fall onto the batteries or into the cabinet.

3. When connecting cables, never allow a cable to short across a battery's terminals, the string of batteries, or to the cabinet.

4. Align the cables on the battery terminals so that the cable lug does not contact any part of the cabinet even if the battery is moved. Keep the cable away from any sharp metal edges.

5. Install the battery cables so they cannot be pinched by the battery cabinet door or UPS covers.

6. Make sure the fuse is positioned so that it will not contact any cabinet parts or other battery posts if the batteries move. Make sure there is enough clearance when the battery cabinet door closes.

7. If you are replacing batteries or repairing battery connections, follow the procedure in the *UNITY/I* User ***Manual*** to shut off the UPS and ***remove*** both AC and DC input power, unless you must use "Battery Maintenance Mode."

8. If your local or national code requires you to ground either battery terminal, remove the connection from the terminal to ground (earth) before you service the batteries. If any battery terminal is inadvertently grounded, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. An electric shock will be less likely if you disconnect the grounding connection before you work on the batteries.

9. Assume that old batteries are fully charged. Use the same precautions you would use when handling a new battery. Do not short battery terminals or the battery string with a cable or tool when you disconnect the batteries.

10. Do not dispose of batteries in a fire because the batteries could explode. Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

11. Batteries contain lead. Many state and local governments have regulations about disposing of used batteries. Please dispose of batteries properly.

Section 100: Before Replacing the Batteries . . .

IMPORTANT: Before beginning, measure the voltage of each replacement battery. Each battery should measure at least 12 VDC.

Hardwired or Softwired..... Whenever possible, you should shut down your UPS and remove all AC and DC power to replace the batteries. However you may use "Battery Maintenance Mode" if necessary. To help you select the best way to change batteries in your UNITY/I System, look at your system's wiring configuration. Most UNITY/I units are "soft-wired." This means they have a line cord and plug that connects to utility power at a wall electrical outlet. The "Protected Loads" are plugged into outlets on the back of the UNITY/I. If your unit is softwired, go to Table 1, below.

If your UNITY/I was installed so it is wired directly, without an input AC plug or receptacles for the loads, it is "hardwired." Go to the next page for information regarding hard wired UNITY/I units.

Table 1 - Softwired

❑ **Do this if your "Protected Loads" can be shutdown:**

1. Turn off protected loads.
2. Unplug them and then plug them into wall receptacles. Switch them on while you replace the batteries. Battery replacement takes up to about eight hours.
3. Turn off the UNITY/I UPS by opening the front door and turning the key switch to "OFF."

⚠ **CAUTION!** Turning the key switch to "OFF" is **not sufficient.** Shut off UPS circuit breaker or remove UPS AC input plug from the wall receptacle.

4. Go to Section 200, "Removing the Internal Batteries" on page 13. Complete steps **5** through **8,** below, **after** you complete the battery installation.

When battery installation is finished, complete steps 5 through 8 to restart the UPS.

5. Reapply AC line to the UPS.
6. Turn the UPS key switch to "AUTO."
7. Turn off the protected loads and plug them into the UNITY/I UPS receptacles. Switch on the loads.
8. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The LINE LED should be on, and the BATTERY, BYPASS, and ALARM LEDs should be off

❑ **If your "Protected Loads" cannot be shut down, go to Section 103, "Using Battery Maintenance Mode."**

Use Table 2 - Hardwired (below), to help determine how to proceed.

1. Decide if your protected loads can be shut down for a few minutes, for up to eight hours while you replace the batteries, or whether they must not be shut down at all. Find a statement that applies under "Protected Load Status," and note the row in Table 2.

2. Under "Bypass Switch Status" find the column that tits your installation.

3. Where the row and column selected meet, place a check mark. Go to the Section and page indicated.

Table 2 - Hardwired

Protected Load Status	Bypass Switch Status		
	Break-Before-Make Bypass Installed	**Make-Before-Break Bypass Installed**	**No Bypass Switch Installed**
Load can be shut down for only a few minutes	❑ Go to Section 101 on page 6	❑ Go to Section 102 on page 7	❑ **Go** to Section 103 on page 9
Load can be shut down while batteries are replaced (up to 8 hours)	❑ Go to Section 101 on page 6	❑ Go to Section 102 on page 7	❑ Go to Section 101 on page 6
Load must not be shut down	❑ Go to Section 103 on page 9	❑ Go to Section 102 on page 7	❑ Go to Section 103 on page 9

Section 101: Powering Down the Loads

101-l. Shut down the load equipment,

101-2. If you have an external Break-Before-Make Bypass Switch, and your protected loads can be shut down for only a few minutes while you replace the batteries, set the BBM Switch to "LINE." You can now switch on the loads and operate on utility line power.

101-3. Open the front door of the UPS. Turn the key switch to "OFF."

101-4. Disconnect AC input power to the UPS.

⚠ **CAUTION!** Turning the key switch to "OFF" is **not sufficient**.

101-S. Go to Section 200, "Removing the Internal Batteries" on page 13. You will complete steps 101-6 through 101-10 after you complete internal and external battery installation.

When battery installation is finished, complete steps 101-6 through 101-10 to restart the UPS.

101-6. Reapply AC line to the UPS.

101-7. Turn the UPS key switch to **"AUTO."**

101-8. If you have a BBM Switch, shut down the loads, set BBM Switch to "UPS",

101-9. Switch on the loads.

101-10. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The **LINE** LED should be on, and the BATTERY, BYPASS, and ALARM LEDs should be off.

Table 3-Alarm Status Table (table duplicated on page 10)

UNITY/I Model	Serial Number	ALARM LED State-Battery Maintenance Mode
3 K	25098 and below	ON
	25099 and above	OFF
4 K	25097 and below	ON
	25098 and above	OFF
5K	20778 and below	ON
	20779 and above	OFF
8K	25097 and below	ON
	25098 and above	OFF

Section 102: **Using the Make-Before-Break Bypass Switch**

102-1 If you do not need to operate the protected load while you replace the batteries, you may want to shut it down. To connect the protected loads to utility power while you replace the batteries, follow the procedure in steps 102-2 through 102-6.

To switch the MBB bypass switch from "UPS" to "LINE" (or vice versa) with a UNITY/I single-phase unit, **the unit must be operating in BYPASS mode** (the BYPASS light must be ON).

To operate the bypass switch, enter the BYPASS mode by following the instructions below:

102-2. Enter the user password (377):

a. Hold down the [CANCEL] and [RUNTIME] keys; release the keys when the display shows "P-00."
b. Press [CANCEL]. The display should show "0."
c. Press and hold the [%LOAD] key until the display shows "377." (If you go past "377," press [VOUT] to scroll backwards.)
d. Press [RUNTIME]. The display should show "I."

102-3. Program parameter 62 (nominal input voltage):

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-00."
b. Press [%LOAD] to scroll up to "P-62." (If you go past "P-62," press [VOUT] to **scroll** backwards.)
c. Press [CANCEL] to toggle to the parameter value.
d. Set the value to the nominal input voltage (200, 208, 220, 230, or 240). Press [%LOAD] to increase the setting or [VOUT] to decrease the setting.

NOTE: If the UPS has optional 380-415 VAC input, set the nominal AC input voltage value to "240."

e. Press [RUNTIME] to enter the value. The new value should remain on the display.

102-4. Program parameter 63 to "I":

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-62."
b. Press [%LOAD] to go to parameter 63 (P-63).
c. Press [CANCEL]. The display should show "0."
d. Press [%LOAD] to change the parameter value to "I."
e. Press [RUNTIME] to enter the new value. The display should still show "I," and the BYPASS light should be on. Refer to the Alarm Status Table on the preceding page and see if ALARM light should be on or off. If either light is incorrect, repeat steps 102-4, d and e.

102-5. **If the BYPASS light will not** come **on:** When input line is bad, the UPS will not transfer to bypass mode, and the BYPASS light will not come on. Follow these steps:

a. Turn off the load equipment.
b. Turn the UPS keyswitch to "OFF."
c. Turn the AC Disconnect switch to "OFF."
d. Turn the MBB bypass switch to "LINE."
e. Turn on the load equipment.

102-6. If the BYPASS light came on, you can safely operate the MBB bypass switch. Quickly turn the bypass switch from "UPS" to "LINE."

Now you can shutdown the UPS to replace the batteries.

102-7. Open the front door of the UPS. Turn the key switch to "OFF."

102-S. Disconnect AC input power to the UPS.

⚠ **CAUTION!** Turning the key switch to "OFF" is **not sufficient.**

102-9. Go to Section 200, '*Removing the Internal Batteries" on page 13. Do not do Section 103. You will come back and complete steps 102-10 through 102-14 after completing the battery installation.

When battery installation is finished, complete steps 102-10 through 102-14 to restart the UPS.

102-10. Before continuing:

a. Reapply AC line.
b. Turn the UPS key switch to "AUTO."
c. Look at the UPS front panel lights:
   - **The ALARM** light status is shown in Table 3-Alarm Status. (See page 6 or 10.)
   - **The BYPASS** light should be ON.
   - The LINE light should be OFF.

IMPORTANT! If the **ALARM** light status is wrong or the BYPASS light is OFF, repeat steps 102-2, 102-3 and 102-4 before continuing.

102-I 1. Quickly turn the MBB bypass switch back to "UPS."

102-12. Enter the user password (377). See step 102-2.

102-13. Program parameter 63 back to "0":

a. Press [CANCEL] to toggle to the parameter number. The display should show "P-00."
b. Press [%LOAD] to scroll to "P-63." (Use [VOUT] to scroll backwards if you go past "P-63.")
c. Press [CANCEL]. The display should show "l."
d. Press **[VOUT]** to change the value to "0."
e. Press [RUNTIME]. The display should show "0," and the BYPASS and **ALARM** lights should now be OFF. The LINE light should be ON.

If the BYPASS **light will not turn off:** When input line is bad, the UPS will not transfer out of bypass mode, and the BYPASS light will stay ON. If this occurs, you must wait until input AC line is good. If the BYPASS light stays ON for an extended period of time, have an electrician check your AC line or call Best Power Worldwide Service at I-800-356-5737 or l-608-565-2100.

102-14. Press [VLINE] twice to exit the parameter mode. The load is once more protected by the UPS.

Section 103: Using Battery Maintenance Mode

Battery maintenance mode allows a qualified service person to service the batteries without powering down the loads connected to the UNITY/I unit. Battery maintenance mode should be used only when the unit does not have an external bypass switch and is powering critical loads that cannot be shut down while servicing the batteries.

IMPORTANT! In battery maintenance mode, the unit **does not** regulate voltage or provide back-up power in case of a power outage.

> **⚠ CAUTION!**
>
> When the unit is in battery maintenance mode (Parameter 63 set to "I"), there is still live voltage inside the UPS.
>
> Battery maintenance mode (Parameter 63 set to "I") should be used during **battery maintenance only.** Do **not** use battery maintenance mode for any other type of UPS service or maintenance.

103-l. Verify the stability of the AC line. If there are irregularities with the input AC line, Best Power recommends that you do not use battery maintenance mode at this time.

- Press the **[VLINE]** key on the front of the unit. Watch to see if the input voltage is stable,
- You can also check the UPS system log to see if the unit has frequently switched to battery power (inverter) recently. See the *UNITY/I* User ***Manual*** for instructions on viewing the system log. Look for the system event code "in" (inverter).

103-2. Access parameter mode and enter the user password (377) as follows:

NOTE: When the unit is in parameter mode, each of the front panel keys has a specific function. The label inside the front door of the unit explains the parameter mode key functions. The label also shows a "Programming Template" with alternate key names that correspond to the parameter mode key functions.

a. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two (2) seconds. Release them when the display reads "P-00."

b. Press [CANCEL]. The display should read "0."

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to "377."

NOTE: Use the [%LOAD] key to **increase** the value. Use the [VOUT] key to **decrease** the value. If you hold down either key, the display begins to scroll more quickly.

d. Press [RUNTIME]. The display should read "l." If it does not, repeat steps "c" and "d."

e. Press [CANCEL] The display should read "P-00."

103-3. Enter the nominal AC input line voltage in Parameter 62 (Nominal Input Voltage) as follows:

a. The display should show P-*XX* (where *XX* is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to "P-62."

b. Press [CANCEL].

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to the nominal AC input line voltage (200,208, 220, 230 or 240).

NOTE: If the UPS has optional 380-415 VAC input, set the nominal AC input voltage value to "240."

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read "P-62."

103-4. Put the unit into battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "I" as follows:

a. The display should read P-*XX*, where *XX* is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to "P-63."

b. Press [CANCEL]. The display should read "0."

c. Press the [%LOAD] key to change the display reading to "I."

d. Press [RUNTIME]. The display should read "I."

103-5. Look at the LEDs on the UPS front panel. The LINE and BYPASS LEDs should be on, and the BATTERY LED should be **off,** as shown in Figure 1. The ALARM LED state is shown below.

Table 3-Alarm Status Table (Table duplicated on page 6.)

UNITY/I Model	Serial Number	ALARM LED State-Battery Maintenance Mode
3K	25098 and below	ON
	25099 and above	OFF
4K	25097 and below	ON
	25098 and above	OFF
5k	20778 and below	ON
	20779 and above	OFF
8K	25097 and below	ON
	25098 and above	OFF

See table on page 10 for Alarm status

Figure 1: Battery Maintenance Mode LEDs

⚠ CAUTION!

If the front panel LEDs do not light as shown in Figure 1, the unit is **not** in battery maintenance mode and it is not **safe** to service the batteries. Repeat Section 103-l to 103-5 or power down the UPS as instructed in Section 101.

NOTE: If, after repeated attempts, the unit does not transfer to battery maintenance mode, the AC input voltage may be out of tolerance. Call Best Power Worldwide Service for technical assistance.

103-6. Once the UPS is in battery maintenance mode, go to Section 200, "Removing the Internal Batteries," on page 13. You will complete steps 103-7 through 103-10 after the battery installation is done.

When battery installation is finished, complete steps 103-7 through 103-10 to restart the UPS

103-7. Access parameter mode and enter the user password (377) as follows:

a. Simultaneously hold down the [CANCEL] and [RUNTIME] keys. Release them when the display reads "P-00."

b. Press [CANCEL]. The display should read "0."

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to "377."

d. Press [RUNTIME]. The display should read "l."

e. Press [CANCEL]. The display should read "P-00."

103-8. Take the unit out of battery maintenance mode by setting Parameter 63 (Battery Maintenance Mode) to "0" as follows:

a. The display should read P-00. Use the [%LOAD] key or the [VOUT] key to change the display reading to "P-63."

b. Press [CANCEL]. The display should read "I:'

c. Press the [VOUT] key. The display should read "0."

d. Press [RUNTIME]. The display should read "0."

IMPORTANT:

The BYPASS LED should be **off** and the LINE LED should be ON.

If the BYPASS LED is ON, the unit is still in battery maintenance mode. Repeat steps "a" through "d" above. If the BYPASS LED remains lit, call Best Power Worldwide Service for technical assistance.

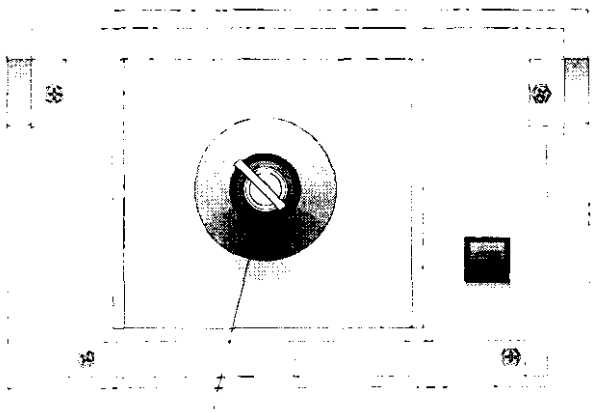
103-9. Press [VLINE] twice to escape parameter mode. If you have an "A-l 7 " alarm, press CANCEL for five (5) seconds to clear alarm.

103-10. You have completed the battery replacement procedure. The UPS should be running on line power with all of the load equipment applied. The LINE LED should be ON, and the BATTERY, BYPASS, and ALARM LEDs should be off.

Section 200: Removing the Internal Batteries

IMPORTANT: The steps in Sections 200 and 300 must be performed **in order.**

201. **At each external battery cabinet,** shut the DC power OFF by pushing the DC switch in and removing the key. This locks the DC switch to the "Off' position. (See Figure 2.)



KEY SWITCH

Figure 2

201-l. Disconnect the battery pack(s) from the **UNITY/I** UPS by removing the DC connector from the UNITY/I. If you have multiple battery packs, remove the connectors from each battery pack. (See Figure 3.)

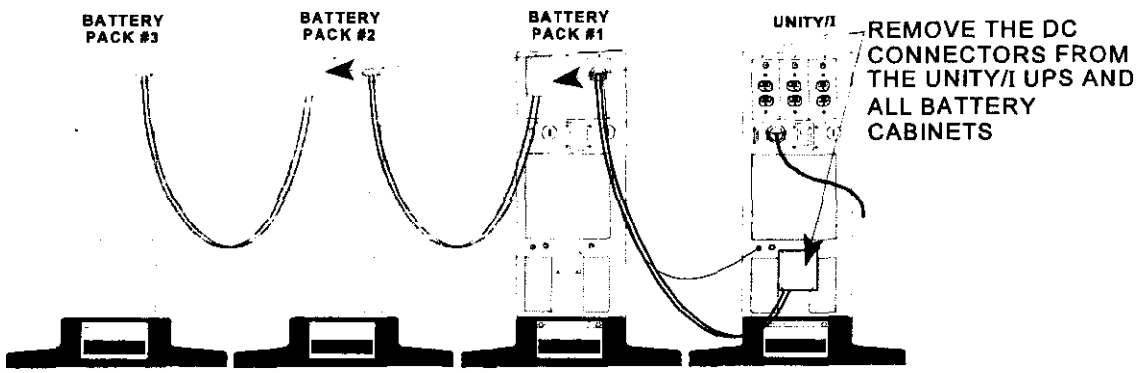


Figure 3

201-2. Most **UNITY/I** units with extended runtime options have external batteries and internal batteries. If there are internal batteries in the bottom of the **UNITY/I** cabinet you must replace them as well as the external batteries. Figure 4 on the next page shows internal battery location.

201-3. To see if there are internal UPS batteries, remove the screws at the comers of the front ventilation panel and remove the panel from the unit. There are only two screws in the 3K, 4K and 5K models; Figure 4 shows the 8K model.

If there are batteries in the UPS, go on to step 201-4.

If there are no internal UNITY/I UPS batteries, replace the panel and screws. Then go to Section 400, "Removing the External Batteries," on page 17.

201-4. To replace the internal batteries, remove the narrow front panel(s).On the 8K, remove the front kick plate (below the front ventilation panel); slide it upward, then pull it away from the unit.

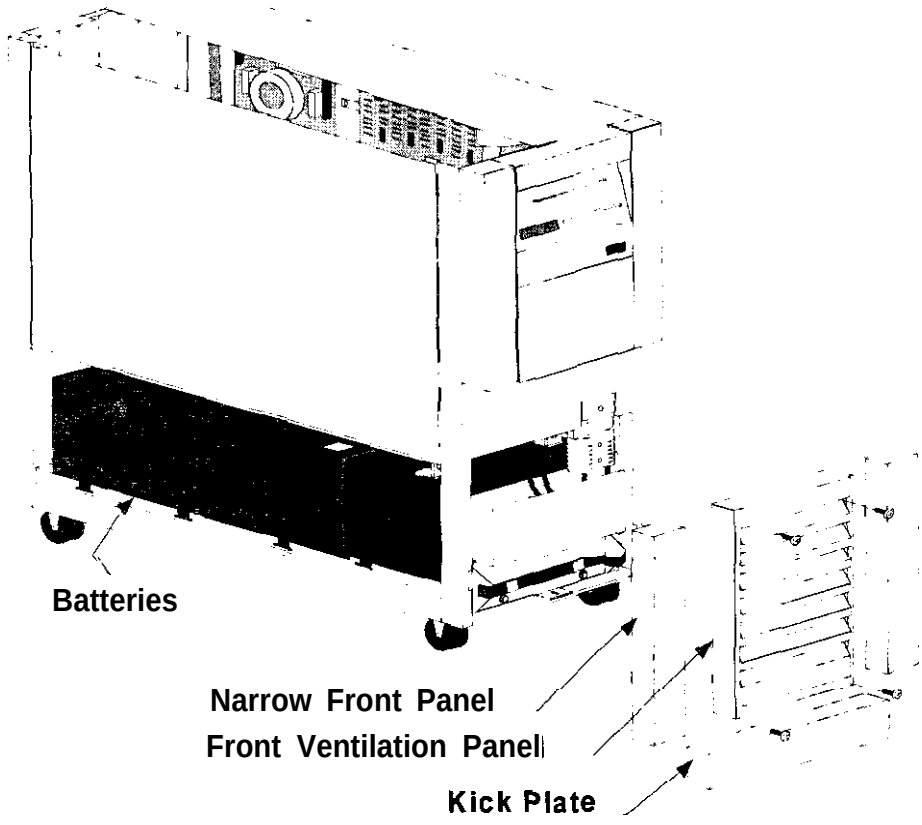


Figure 4

201-S. At the front of the unit, remove the bolt that secures the battery tray to the chassis floor. (See Figure 5).

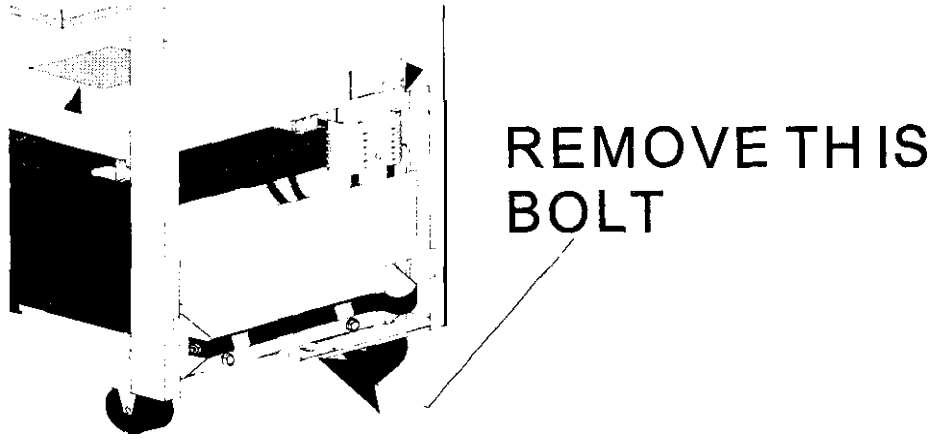


Figure 5

201-6. Disconnect the DC connector by pulling it down. (See Figure 6.)

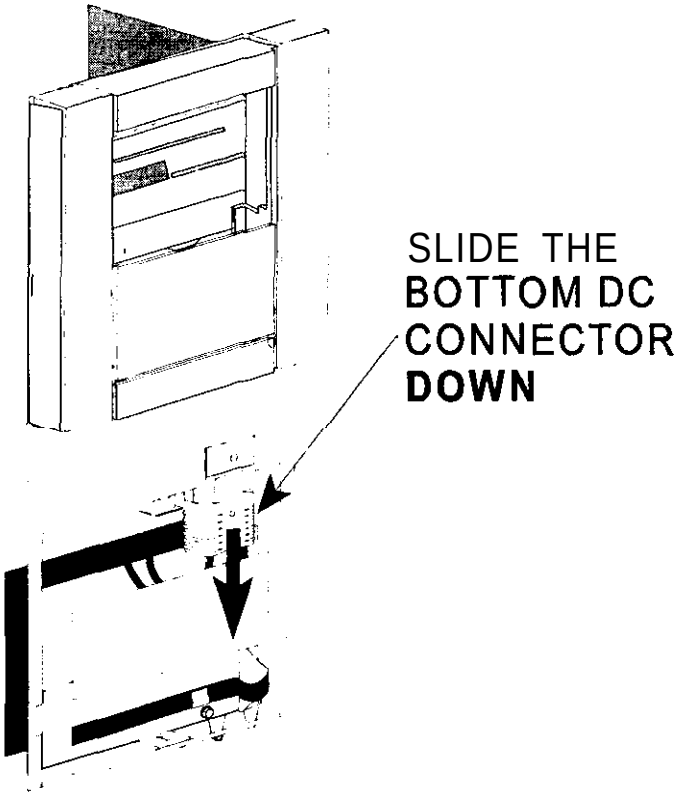


Figure 6

201-7. Disconnect the HRS-370 "quick connect" connector on the front of the battery tray. (See Figure 7.)

201-6. **Note!** The end of the battery tray with the strap will drop to the floor as you slide out the tray. Do not drop this very heavy tray on your toes or hands! Take the strap and *carefully* pull the battery tray out of the unit just far enough to expose all of the battery terminals.

Note the battery cable wiring order and the position of the battery tie down buckles so that you can install new batteries in the same fashion.

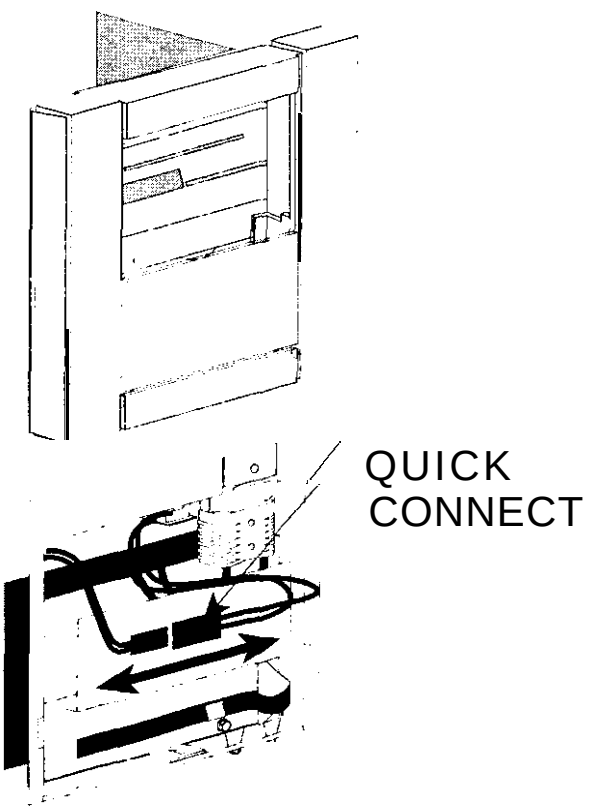


Figure 7

Section 300: Replacing the Internal Batteries

301. Installing batteries and putting the UPS together.

301-1. Replace the old batteries with new ones of the same **series and type** and rewire in the same order. See Figure 8.

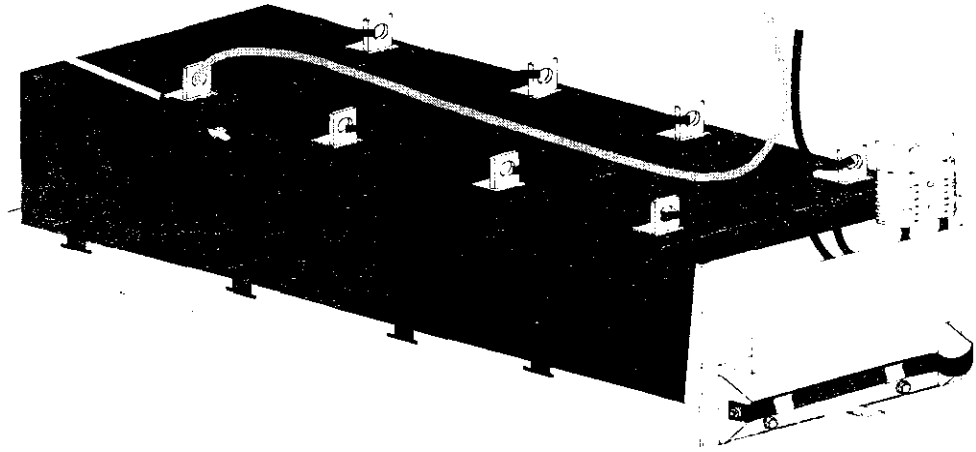


Figure 8

&CAUTION!

When pushing the battery tray into the unit, be careful not to pinch your fingers between the battery tray and the chassis.

301-2. Make sure that the HRS-370 "quick connect" connector is not in the battery cavity. Use the palms of your hands to push the battery drawer all the way into the unit.

301-3. Reconnect the "quick connect" connector on the front of the battery tray. (See Figure 7 on page 15.)

301-4. Replace the bolt that secures the front of the battery tray to the floor of the chassis. (See Figure 5 on page 14.)

301-5. Reconnect the DC connector at the bottom of the unit. (See Figure 6 on page 15.)

301-6. Replace the bottom narrow front panel(s). If you have a UT8K, also replace the front kick plate (See Figure 4 on page 14.)

301-7. Replace the front ventilation panel and secure it with the screws. (See Figure 4 on page 14.)

301-8. Now go to Section 400 "Removing the External batteries."

Section 400: Removing the External Batteries

400. On the external battery cabinet(s), the DC disconnect switch should be "OFF." The DC connector on the back of the UNITY/I UPS should be disconnected, as well as DC connectors between battery cabinets.

401-l. Remove the screws from the battery cabinet left side panel. Remove the panel from the battery pack. (See Figure 9.)

Figure 9

401-2. Remove the front ventilation panel at the bottom of the battery pack. On UT8K units, remove the kick plate found below the front ventilation panel. Slide the kick plate up, then pull it away from the battery pack. (See Figure 10.)

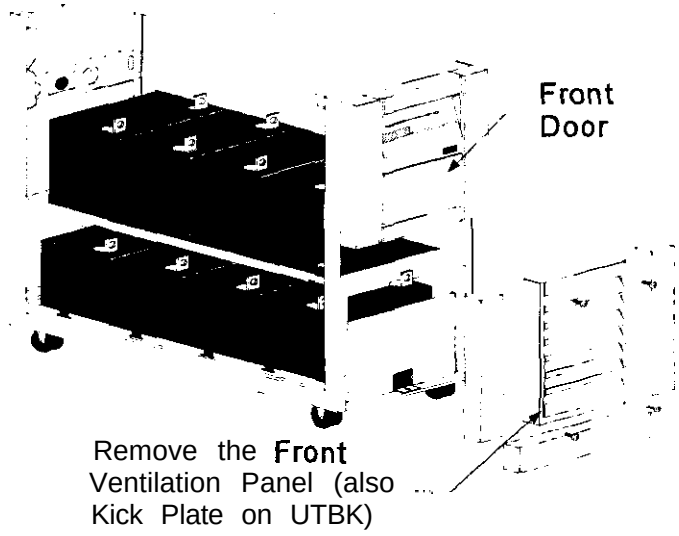


Figure 9

401-3. At the front of the battery pack, remove the bolt that secures the battery tray to the floor of the chassis. (See Figure 11.)

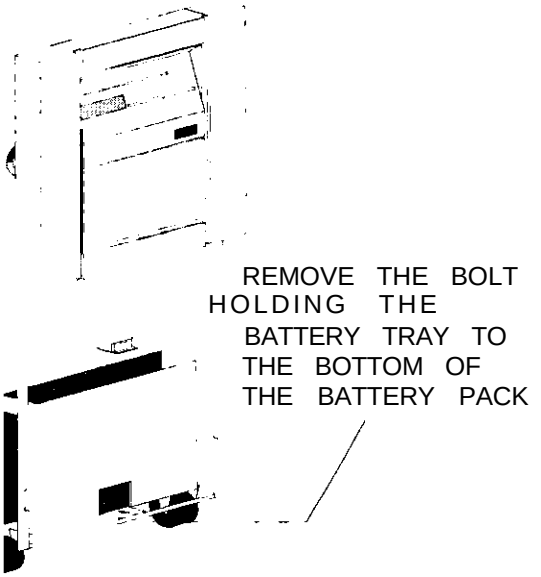


Figure 11

401-4. Remove the cable from the DC fuse(s) at the top of the battery pack. **Insulate the battery cable lead with heatshrink wrap or electrical tape to prevent shorting. (See** Figure 12.)

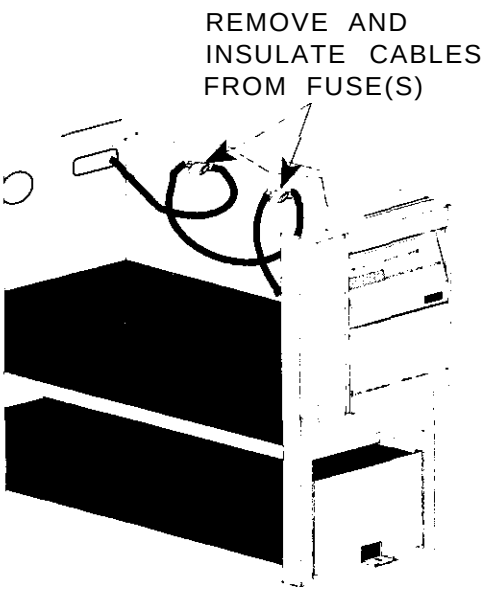


Figure 12

401-S. Pull the battery tray out just far enough to expose the first battery.

401-6. Disconnect the negative (-) battery cable **from** the first battery. **Insulate the cable lead with electrical tape or heat shrink tubing.**

> **⚠ CAUTION!**
>
> **The battery tray may drop to the floor if it is completely removed from the unit. Make sure that your feet and/or hands are not under the battery tray while pulling the tray out of the unit.**

401-7. Read the CAUTION! above. Then, carefully pull the battery tray out of the unit just far enough to expose all of the battery terminals.

Section 500: Replacing the External Batteries

501. Installing the batteries and putting the battery cabinets together.

501-l Replace the old batteries with new ones of the **same series and type** and rewire in the same order. (See Figure 13.)

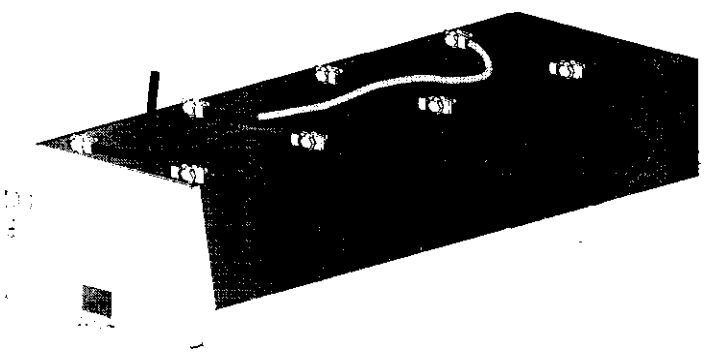


Figure 13

501-2. Slide the battery tray into the unit until only the front battery is exposed,

501-3. Attach the negative (–) battery cable to the first battery.

> **&CAUTION!**
>
> **When pushing the battery tray into the unit, be careful not to pinch your fingers between the battery tray and the chassis.**

501-4. Use the palms of your hands to push the battery drawer all the way into the battery pack. Replace the bolt that secures the front of the battery tray to the floor of the battery pack chassis.

501-5. Next, replace the batteries on the top shelf with the same series and **type** and rewire in the same order.

501-6. Reconnect the battery cables to the DC fuse(s).

501-7. Replace the bottom narrow front panel(s). If you have a UT8K, also replace the front kick plate. Replace the front ventilation panel and secure it with the screws. (See Figure 10 on page 17.)

501-8. Replace the side panel on the battery pack. (See Figure 9 on page 17.) Repeat steps 400 through 501-8 for each additional external battery cabinet.

501-9. Reconnect the DC connector to the UNITY/I UPS. If you have multiple UNITY/I battery cabinets, reconnect each battery cabinet. (See Figure 14.)

RECONNECT THE BATTERY PACK(S) TO THE UNITY/I UPS (AND EACH OTHER)

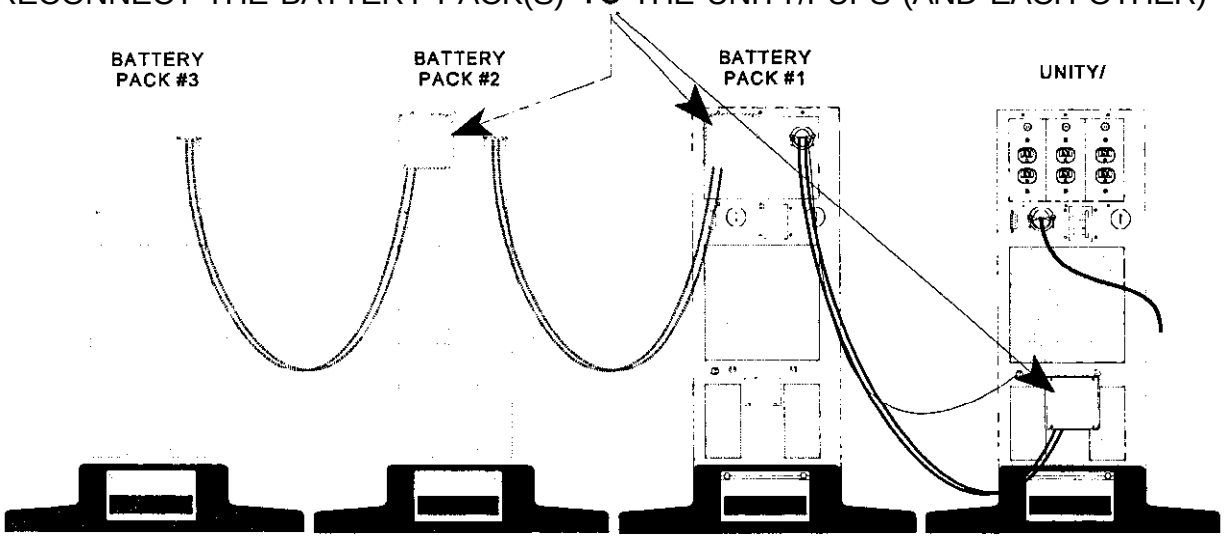


Figure 14

501-10. You have completed replacing the batteries in the battery packs. Press the **Precharge** switch, on the front of each battery cabinet, for five (5) seconds. (See Figure 15.)

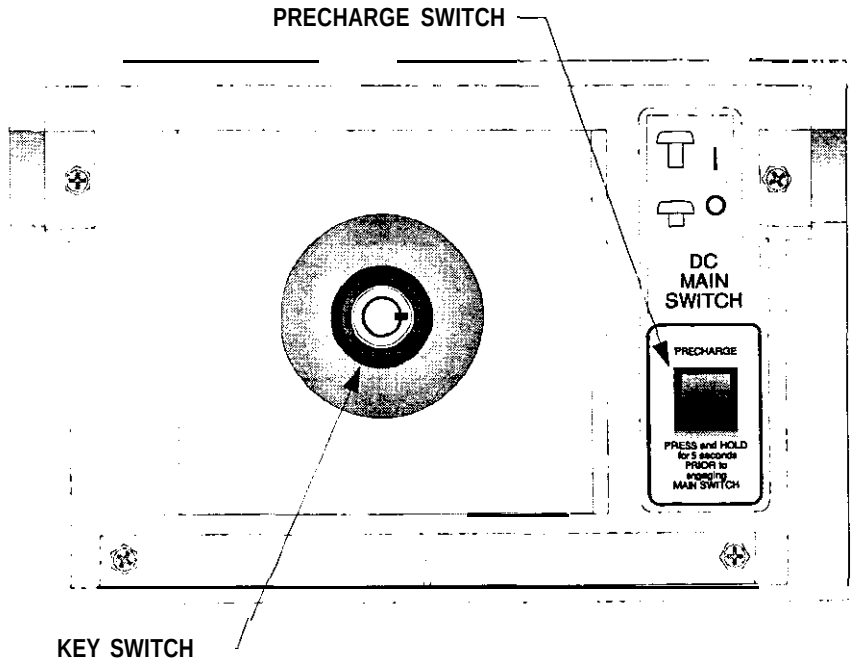


Figure 15

501-l 1. (a.) Insert the key into the main DC switch on the front of each battery pack. (b.) Turn the key clockwise, then pull the switch out. (c.) The ON-LINE LED should light up. (See Figure 16.)

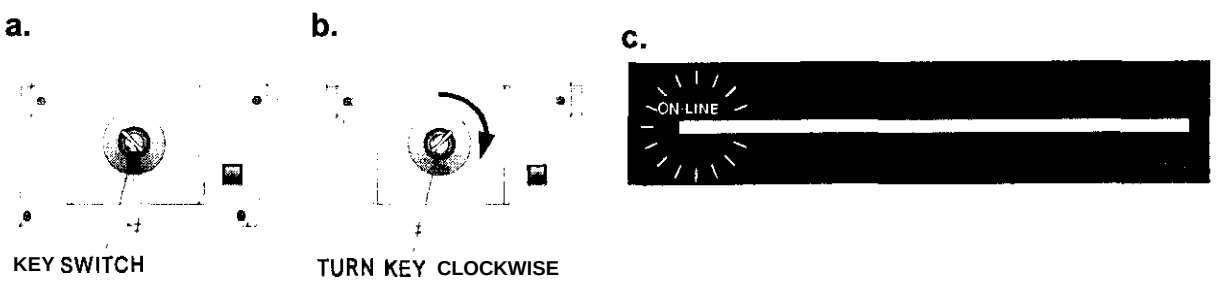


Figure 16

501-12. **If your UNITY/I is softwired,** and you shut down your loads, return to Table 1 on page 4, and complete the remaining steps. If you did not shut down your loads and used the "Battery Maintenance Mode," complete steps 103-7 through 103-10 beginning on page 11.

If your UNITY/I is hard-wired, go to the Section you selected from Table 2 on page 5, and complete the remaining steps to return the **UNITY/I UPS** to normal operation.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UTY 627
July 1995

Replacing the User Interface Board in UNITY/I™ Models UT3K, UT4K, UT5K, and UTSK

This document explains how to replace the user interface board in UNITY/I models UT3K, UT4K, UT5K, and UTSK. This procedure must be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at 1-800-356-5737 (U.S.A. and Canada) or your local BEST office.

Tools required (use insulated tools):

Phillips screwdriver	Personal safety equipment required by local codes
DC voltmeter	7/16" nut driver

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified service technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection, and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

RESTRICTED

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

Contents

Section 100: Disconnecting AC and DC Power

☐ 100-l. **If there** is an external bypass switch, you may use it to bypass the UPS Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off."

☐ **100-3**. Remove AC input to the UPS. (Turning the key switch to **"Off"** is **not sufficient.)**

☐ **100-4**. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-S. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1). Remove narrow front panel(s).

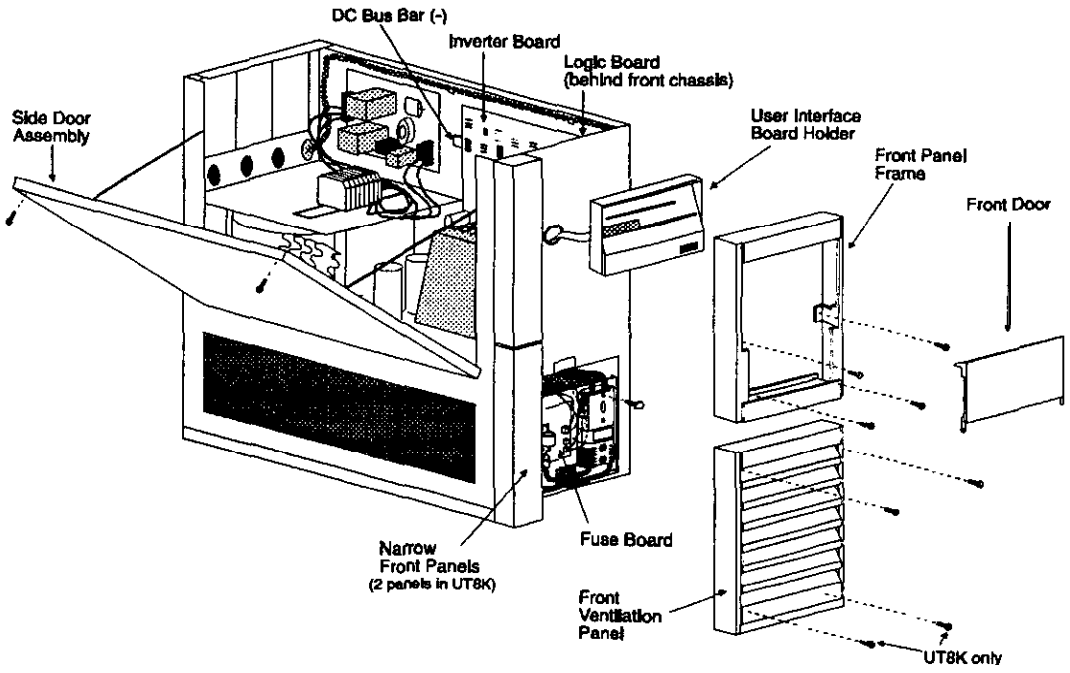


*Figure 1: Single-Phase **UNITY/I**, Covers Removed*
UT3K, UT4K, and UT5K pictured. **UT8K varies slightly in appearance with two inverter boards, two narrow front panels, two fans, and a larger chassis.**

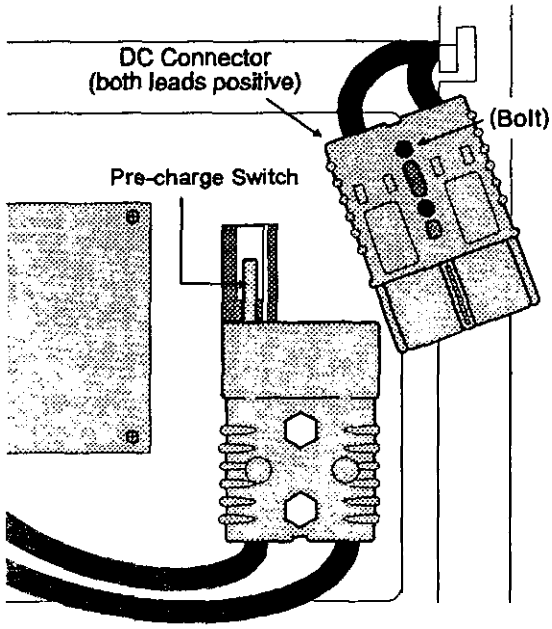


Figure 2: DC Connector

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2)

☐ 100-i. Disconnect the top DC connector (see Figure 2). Make sure that the DC connector does no? contact the pre-charge switch after it is disconnected.

WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 203-I. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 200-2. Lii each side cover straight up, then off.

☐ 200-3. Remove the two screws in the upper comers of the side door assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

☐ 300-1 *With AC and DC power disconnected (see* Section 100), turn the UPS key switch to "Auto" for at least five seconds. The key switch is found inside the front door.

☐ 300-2. Turn the UPS key switch back to "Off."

☐ 300-3. To verify that the capacitors are discharged, use a CC voltmeter to measure the DC voltage between the DC bus bar (-) and one of the outside heatsinks on the inverter board (+), as shown in Figure 3. For model UT8K check the voltage on both inverter boards to make sure the capacitors on each board are discharged.

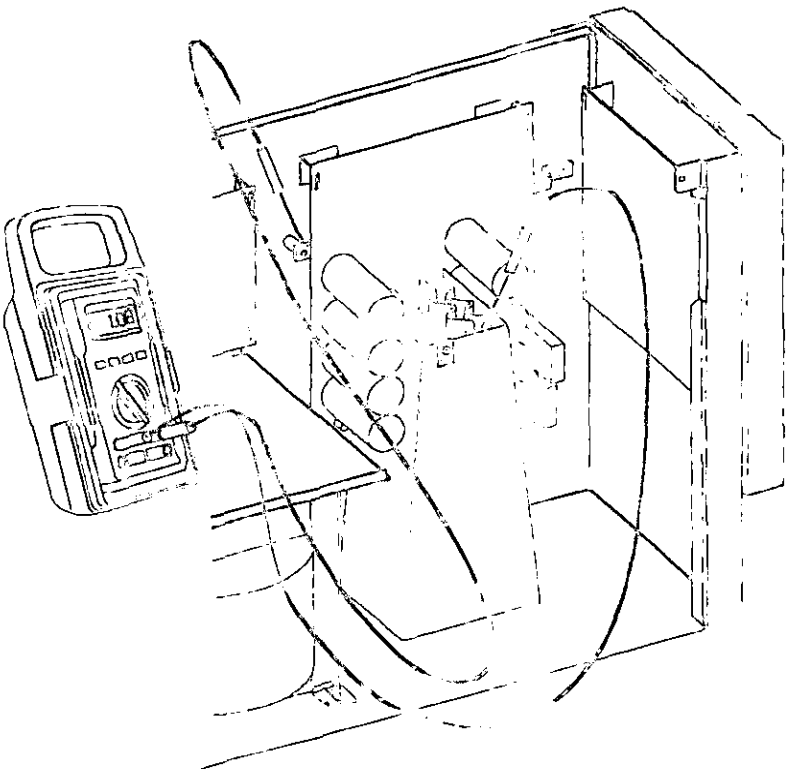


Figure 3: Verifying Capacitor Discharge

☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait 5 minutes to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

☐ 300-5. Remove the fast-on connector from E5 in the upper right corner of the fuse board. See Figure 1 for the location of the fuse board.

Section 400: Removing the Front Panels

Refer to Figure 1 for panel locations.

☐ 400-1. Remove the front door from the unit.

☐ 400-2. Remove the four Phillips screws located inside the front door.

☐ 400-3. Slide the front panel frame up about ½ inch to release it, then remove it from the chassis by pulling it away from the unit

Section 500: Removing the User Interface Board

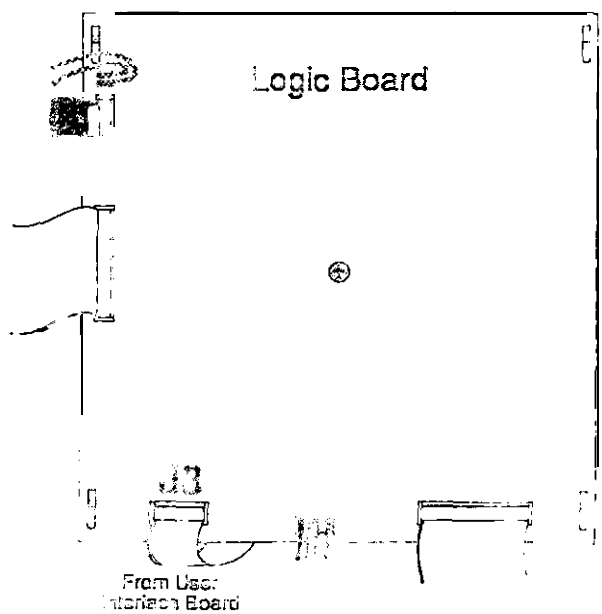


Figure 4: Logic Board Connections

☐ 500-1. Disconnect the ribbon cable from J3 on the logic board (see Figure 4).

☐ 500-2. Remove the screw and tooth lock washer from the logic board (see Figure 4).

☐ 500-3. Slide the logic board up and unseat it from the mounting notches.

☐ 500-4. Slide the user interface board holder upward and pull out the bottom to release the bottom tabs. Pull the holder down and away from the chassis, being careful not to damage the ribbon cable.

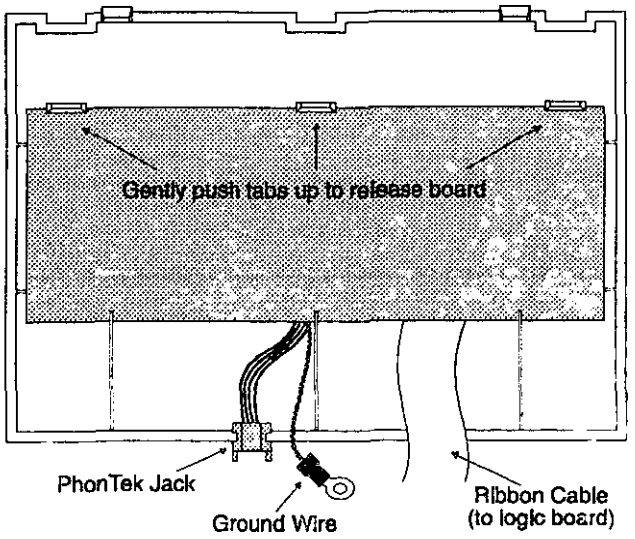


Figure 5: User Interface board connections

☐ 500-5. Disconnect the ground wire from the chassis (see Figure 5).

☐ 500-6. Carefully pull the ribbon cable through the hole on the front of the chassis.

☐ 500-7. Slide the PhonTek jack out of the user interface boa-d holder (see Figure 5)

☐ 500-8. Gently push up on each of the three tabs to release the user interface board (see Figure 5).

Section 600: Replacing the User Interface Board

☐ 600-l. Put the new user interface board into the interface board holder. Gently push up the three tabs while putting the board into place.

☐ 600-2. Feed the ribbon cable through the hole on the front of the chassis. Route it behind the logic board.

☐ *600-3.* Attach the ground wire to the chassis in this order: ground wire, tooth lock washer, screw.

☐ 600-4. Slide the PhonTek jack into the user interface board holder (see Figure 5)

☐ 600-5. Attach the user interface board holder to the chassis.

☐ 600-6. Connect the ribbon cable to J3 on the logic board. Make sure that the red stripe on the ribbon cable is aligned with pin 1 on J3 (see Figure 4).

☐ 600-7. Remount the logic board on the mounting notches, and secure it with the tooth lock washer and the screw.

Section 700: Restarting the UPS

☐ 700-I. Replace the fiont panel frame (with four screws), and then the front door (see Figure 1).

☐ 700-2. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the door and the chassis.

☐ 700-3. At the front of the unit, reconnect the fast-on connector to ES on the fuse board.

☐ 700-4. At the front of the unit, reconnect the top DC connector and secure it with the bolt.

Cl 700-S. Replace the narrow front panel(s).

☐ 700-6. Replace the front ventilation panel and secure it with the screws

☐ 700-7. Replace the side covers

NOTE: Replace the right cover first, then the left. Slide each cover straight down to secure it on the notches that hold it in place.

☐ 700-8. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

Cl 700-9. Reapply AC line.

☐ 700-10. Turn the key switch inside the unit's front door to "Auto."

☐ 700-I 1. Perform a system self-test. Simultaneously press the VLINE and RUNTIME keys for two seconds to verify that the new board is functioning properly. The unit will test the front panel lights (except BYPASS) and four-digit display. (See the *User Manual* for specific parameter options.)

NOTE: If you have switched to external bypass, you may now switch to "UPS."

Cl 700-12. Reapply the loads

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UTY 628
September 1995

Using the PhonTek™ Interface in the Single-Phase UNITY/I™

The UNITY/I has the ability to transmit its alarm and system logs, UPS status data, and real time data, to BEST's Technical Support Center. This information helps BEST's field service technicians troubleshoot the UPS. Data is transmitted via a jack located behind the front door of the UPS. If transmission of PhonTek data is necessary, BEST's field service technician will give you instructions. The basic procedure is explained below.

1. Obtain a phone with a handset cord that can reach the front panel of the UPS. The phone must have a detachable handset. Call BEST's Technical Support Center. You will be able to speak with the field service technician before transmitting the PhonTek data.

2. Open the front door of the UPS and locate the PhonTek jack (see Figure 1).

3. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two seconds. Release them when the display reads P-00.

4. Press the [CANCEL] key. The display should read 0.

5. Enter the password "377." To do this, use the [%LOAD] key to increase the value on the display and the [VOUT] key to decrease the value on the display.

6. Once the display reads 3 7 7, press [RUNTIME] to enter the password. The display should read 1.

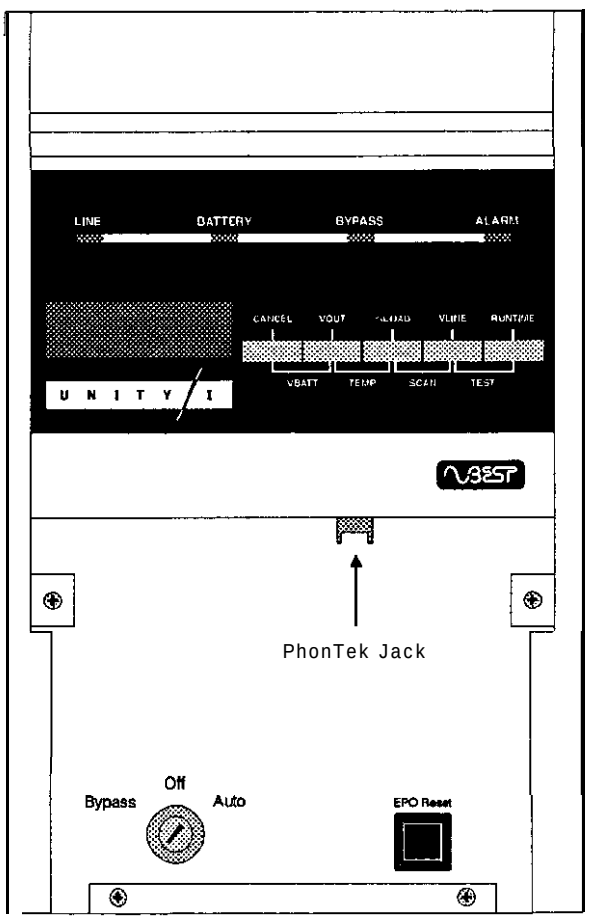

Figure 1

UTY-0628C

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7. Press the [CANCEL] key. The display should read P- 0 0.

8. Press the [%LOAD] key until the display reads P- 2 6. If you inadvertently step past P - 2 6, press the [VOUT] key to step back.

9. Press the [CANCEL] key. Then, press the [%LOAD] key until the display shows the number of copies of PhonTek data that the field service technician requests.

10. When the field service technician requests, unplug the handset cord from the handset of the telephone and plug it into the PhonTek jack (see Figure 1 for location of jack).

11. Press the [RUNTIME] key. The unit will beep and the display will count down to 0.

NOTE: If "99" was entered for the number of copies, the unit will continuously transmit data and the display reading will remain at 9 9. To end the data transmission, hold down the D/OUT] key until the display reads 0, then press [RUNTIME]. (If more than five minutes have passed since the value "99" was entered, you may need to re-enter the password before you can reprogram the PhonTek parameter to 0. If this is the case, press [VLINE] twice, then repeat steps 3 - 10, but in step 10 use the [VOUT] key to change the value from 9 9 to 0. Then, press [RUNTIME]).

12. When the beeper is silent and the four-digit display reads 0, unplug the cord from the PhonTek jack and plug it back into the handset. You can now speak with the field service technician again.

13. Press [VLINE] to escape parameter mode.

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UTY 639
July 1995

Replacing the Fuse Board in UNITY/I™ Models UT3K, UT4K, UT5K, and UT8K

This document describes how to replace the fuse board in **UNITY/I** models UT3K, UT4K, UT5K, and UT8K. This procedure must be performed by a qualified service technician only. If you have any questions or problems while performing this procedure, call BEST's Technical Support Center at 1-800-356-5737 (U.S.A. or Canada) or your local BEST office.

Tools required (use insulated tools):

- Phillips screwdriver
- 7/16" nut driver
- 1/4" nut driver (optional)
- 1/2" heat shrink tubing or electrical tape
- Personal safety equipment required by local code

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. Remove **all AC** and **DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified service technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection, and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-l. If there is an external bypass switch, you may use it to bypass the UPS Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off."

☐ 100-3. Remove AC input to the UPS. (Turning the key switch to "Off" is not **sufficient.)**

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the external battery cabinets.

☐ 100-5. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1). Remove the bottom narrow front panel(s).

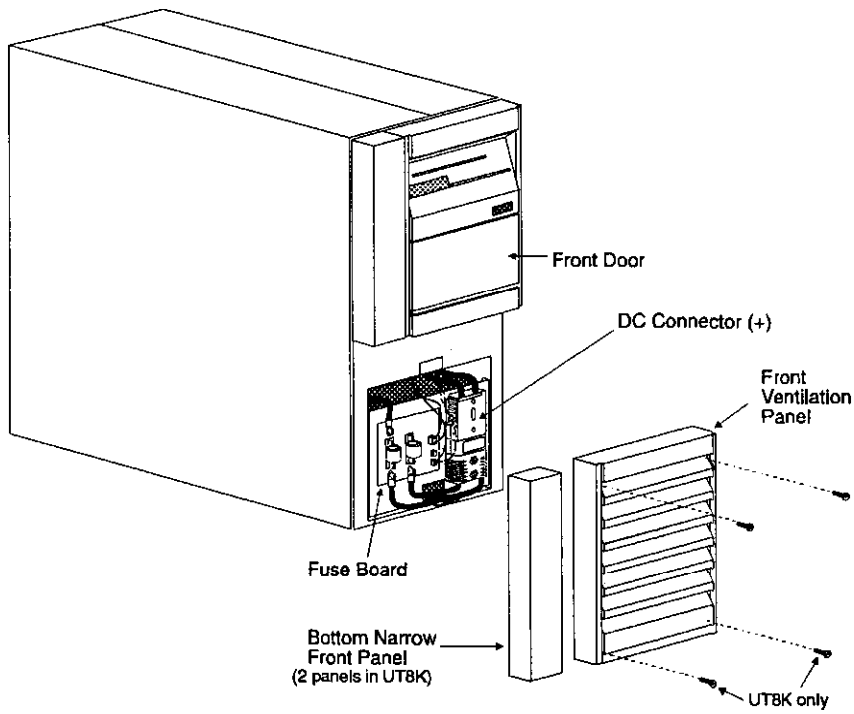

Figure 1: Single-Phase ***UNITY/I***

☐ 100-6. At the front of the unit, remove the bolt from the top DC connector. See Figure 1 for the location of the DC connector.

☐ 100-7. Disconnect the top DC connector (see Figure 2).

Section 200: Removing the Fuse Board

> ☞ **IMPORTANT**
>
> Read the WARNINGS on page 1.

Refer to Figure 2 for board connections.

☐ 200-l. Remove the positive battery cable from the post labeled "+BATT" at the top of the board. **Insulate the battery cable with a piece of heat shrink tubing or electrical tape.**

For units with external batteries, there may be two positive battery cables, one connected to each of the "+BATT" posts. Remove and insulate **both** cables.

❑ 200-2. Remove the two cables labeled "+" from the bottom of the board.

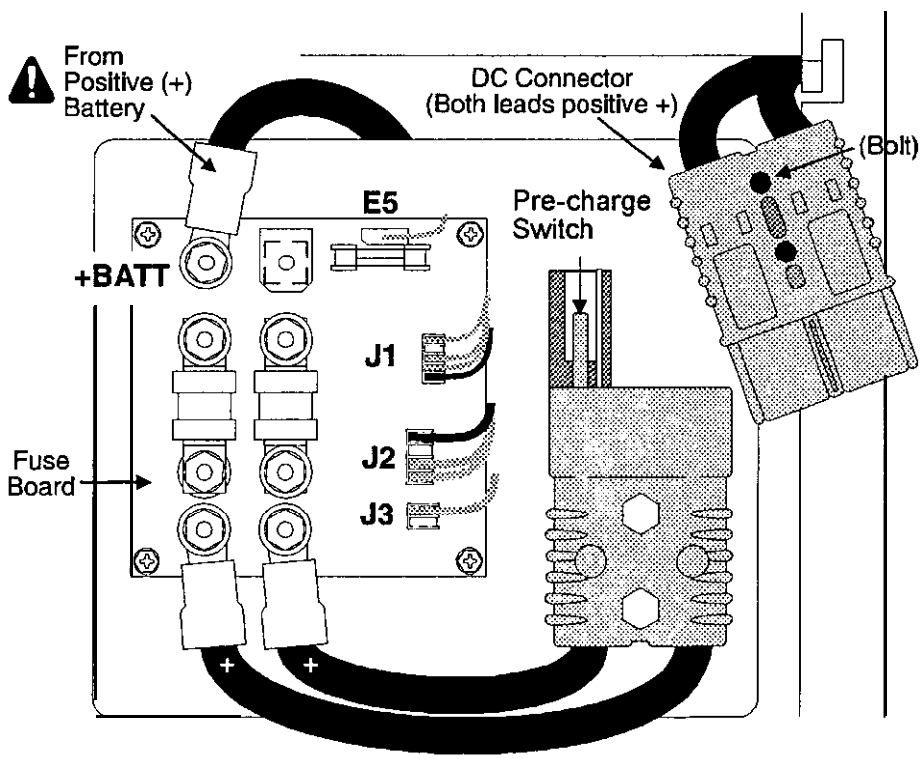

Figure 2: Fuse Board Connections

☐ 200-3. Disconnect the following:

- L-shaped connector from ES
- Plug from J3.
- Plug from 12.
- Plug from J1.

☐ 200-4. Remove the four screws securing the board to the chassis and remove the board from the unit.

Section 300: Replacing the Fuse Board

> **IMPORTANT**
>
> Read the WARNINGS on page 1.

Refer to Figure 2 for board connections.

☐ 300-l. Mount the new fuse board so that J1, J2, and J3 are on the right-hand side. Tighten all four screws.

☐ 300-2. Reconnect the following:

- Plug to J1.
- Plug to J2.
- Plug to J3.
- L-shaped connector to ES

☐ 300-3. Reconnect the two cables labeled "+" to the two posts at the bottom of the board Reassemble in this order:

- Cable lead
- Flat washer
- Split lock washer
- Nut

OR

- Cable lead
- Flat washer
- Nut with attached star washer

☐ 300-4. Reconnect the positive battery cable to the "+BATT" post in the upper left corner of the board. Reassemble in the same order as listed in step 300-3.

For units with external batteries, there may be two positive battery cables Connect one to each of the "+BATT" posts.

Section 400: Restarting the UPS

☐ 400-l. At the front of the unit, reconnect the top DC connector and replace the bolt.

☐ 400-2. Replace the bottom narrow front panel(s) and the front ventilation panel

☐ 400-3. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

☐ 400-4. Reapply AC line.

☐ 400-5. Turn the UPS key switch inside the unit's front door to "Auto."

NOTE: If you have switched to external bypass, you may now switch back to "UPS."

☐ 400-6. Reapply the loads

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UTY 640
July 1995

Replacing the EM1 Board in UNITY/I™ Models UT3K, UT4K, UT5K, and UTSK

This document explains how to replace the EMI board in UNITY/I models UT3K, UT4K, UT5K, and UT8K. This procedure must be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. or Canada) or your local BEST office.

☞ **IMPORTANT!** BEST publication **UTY 601 is required** as part of this procedure

Tools required (use insulated tools):

Phillips screwdriver	BEST publication UTY 60 1
7/16" nut driver	Personal safety equipment required by local codes
DC voltmeter	

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). f you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified service technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection, and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-l. If there is an external bypass switch, you may use it to bypass the UPS Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off."

☐ 100-3. Remove AC input to the UPS. (Turning the key switch to "Off' is **not sufficient**.)

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-5. Remove the screws at the corners of the Front ventilation panel and remove the panel from the unit (see Figure 1). Remove the bottom narrow front panels on model UT8K only.

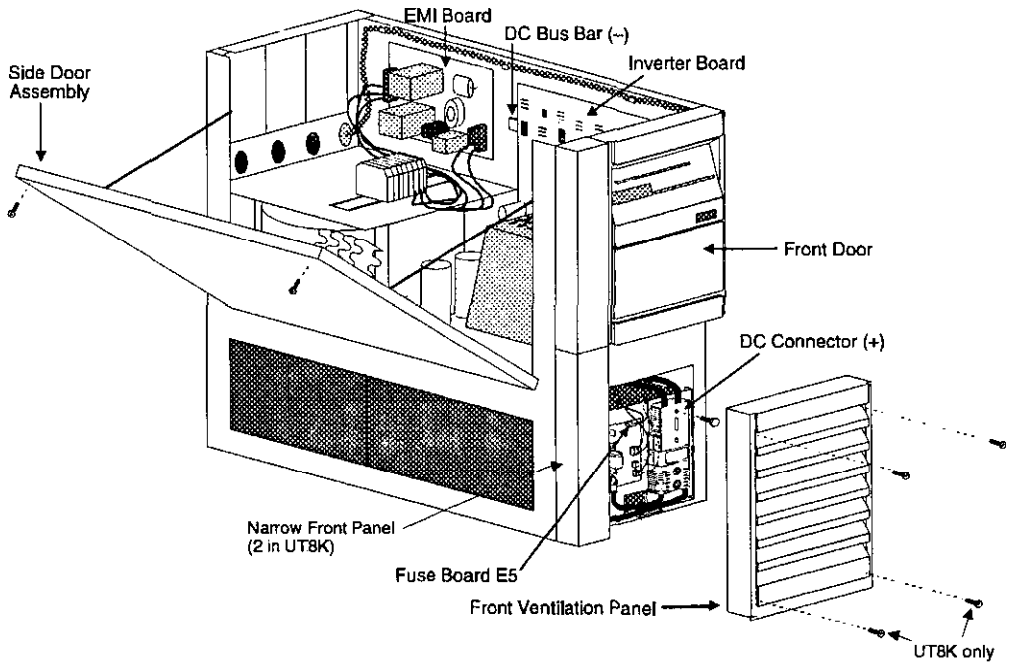

Figure 1: UNITY/I, Covers Removed

UT3K, UT4K, and UT5K pictured. UT8K varies slightly in appearance with two inverter boards, two fans, two narrow front panels, and a larger chassis.

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2)

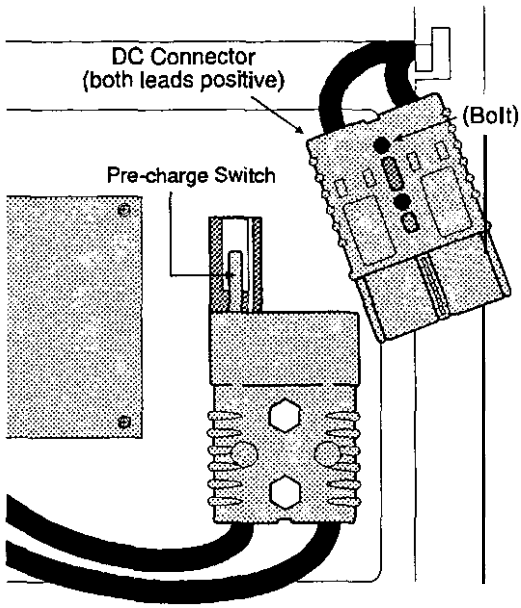

Figure 2: DC Connector

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that **the connector** does not contact the pre-charge switch after it is disconnected.

⚠ WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 200-l. Remove the seven screws from the side covers. Three screws are found on top of the unit, and two on each side panel.

☐ 200-2. Lift each side cover **straight up,** then off.

☐ 200-3. Remove the two screws in the upper comers of the side **door** assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

☐ 300-1. *With* AC *and DC power disconnected* (see Section 100), turn the UPS key switch to "Auto" for at least five seconds.

☐ 300-2. Turn the UPS key switch back to "Off."

☐ 300-3. To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar **(-)** and one of the **outside** heatsinks on the inverter board (+), as shown in Figure 3. For model UTSK, check the voltage on **both** inverter boards to make sure the capacitors on each board are discharged.

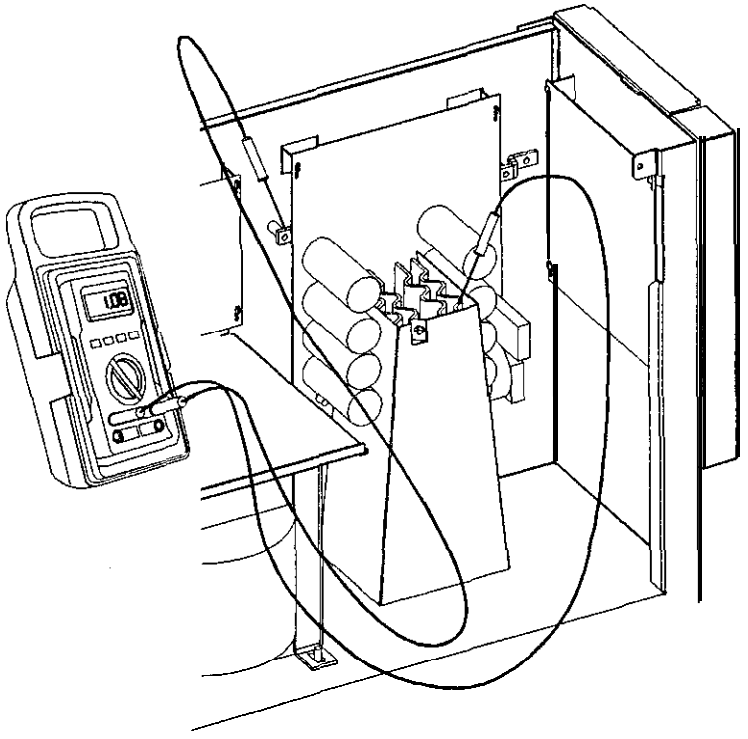

Figure 3: Verifying Capacitor Discharge

☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait 5 minutes to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

☐ 300-5. Remove the fast-on connector from E5 in the upper right corner of the fuse board. See Figure 1 for the location of the fuse board.

Section 400: Removing the EM1 Board

⚠ WARNING

Make sure that AC line is completely removed from the UPS input.

If AC is present at the UPS input, the EMI board will be fully energized and dangerous voltages will be present, even if the UPS key switch is turned "Off."

TEST BEFORE TOUCHING!

Refer to Figure 4 for board connections

☐ 400-l. Disconnect the following from the EMI board:

NOTE: To release the locking connectors, squeeze the sides of the connector while pulling away from the board.

- Locking connector from J3.
- P6 from J2.
- Locking connector from J1.

☐ 400-2. Remove the Phillips screw from the upper left comer of the board.

☐ 400-3. Slide the board upward to unseat it from the mounting notches. Remove the board from the unit.

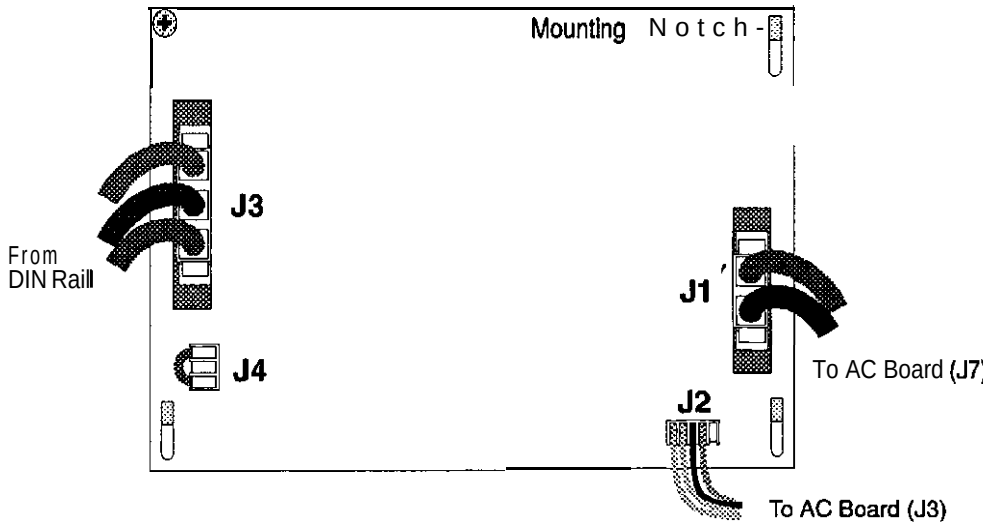

*Figure 4: EMI board connections**

*J1 has four wires and J3 has six wires on model UT8K.

Section 500: Replacing the EM1 Board

Refer to Figure 4 for board connections.

☐ 500-l. Verify that there is a jumper connected to J4 on the new EMI board. If there is no jumper, remove the jumper from the old board and place it on the new board.

☐ 500-2. Seat the new board on the mounting notches and replace the Phillips screw in the upper left corner of the board.

☐ 500-3. Reconnect the following to the EMI board:

- Locking connector to J1
- P6 to J2.
- Locking connector to J3.

Section 600: Restarting the UPS

☐ 600-l. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the side door and the chassis.

☐ 600-2. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board.

☐ 600-3. At the front of the unit, reconnect the top DC connector. Secure it with the bolt.

☐ 600-4. Replace the bottom narrow front panels (on UT8K)

☐ 600-5. Replace the front ventilation panel and secure it with the screws.

☐ 600-6. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

☐ 600-7. Reapply AC line

NOTE: If you have switched to external bypass, you may now switch to "UPS."

☐ 600-8. Perform the entire procedure in BEST publication UTY 601, "Verifying the Basic Operation of the Single-Phase UNITY/I UPS."

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UTY 641
March 1995

Replacing the Logic Board in UNITY/I™ Models UT3K, UT4K, UT5K and UT8K

This document describes how to change the logic board in UNITY/I models UT3K, UT4K, UT5K and UT8K. This procedure must be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. and Canada) or your local BEST office.

Tools Required:

Phillips screwdriver	True RMS voltmeter	*UNITY/I User Manual*
7/16" nut driver	Clamp-on ammeter	Pen/pencil
DC voltmeter	Personal safety equipment as required by local codes	

⚠ WARNING!

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources.**

TESTBEFORETOUCHING!

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

100-l. If there is an external bypass switch, you may use it to bypass the UPS. Othetwise, shut down the load equipment.

100-2. Open the front door of the UPS. Turn the key switch to "Off'.

100-3. Remove AC input to the UPS. (Turning the key switch **"Of?'** is **not sufficient.)**

100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

100-s. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1).

100-6. At the front of the unit, remove the bolt from the top DC connector (see Figure 1).

100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the precharge switch after it is disconnected.

⚠ WARNING

There is still power inside of the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

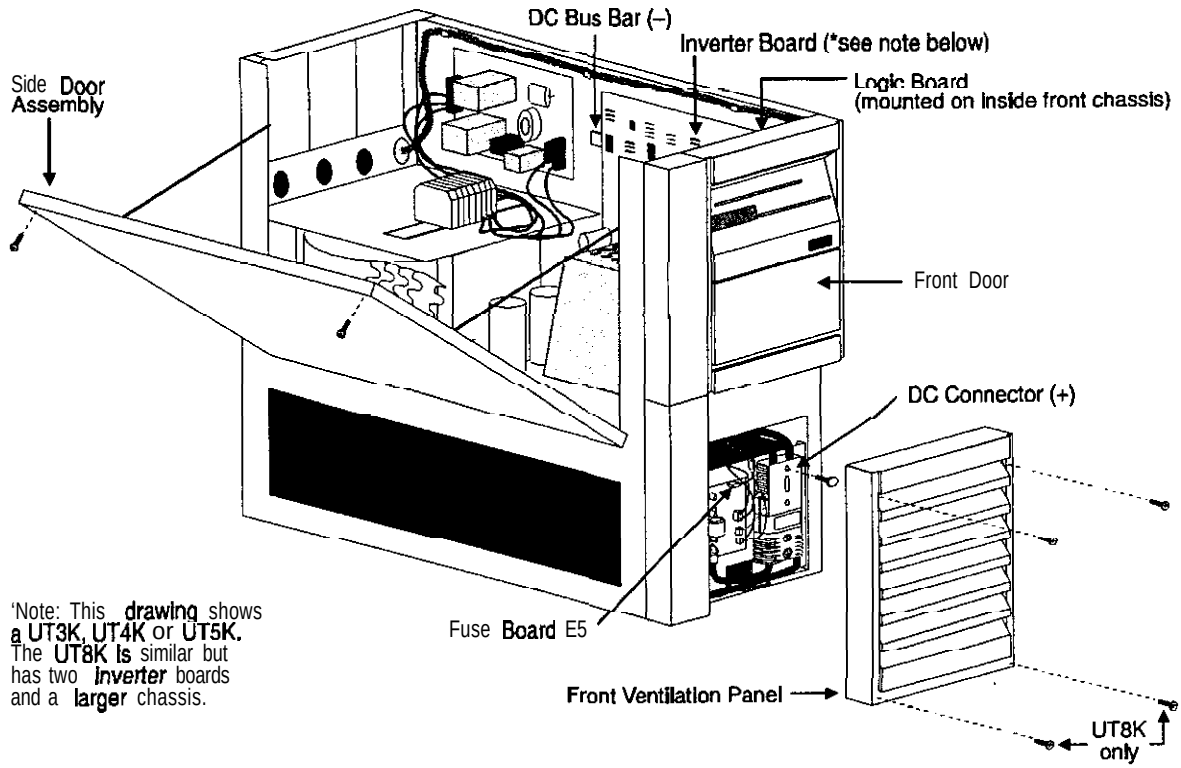

Figure 1: Single-Phase UNITY/I UPS

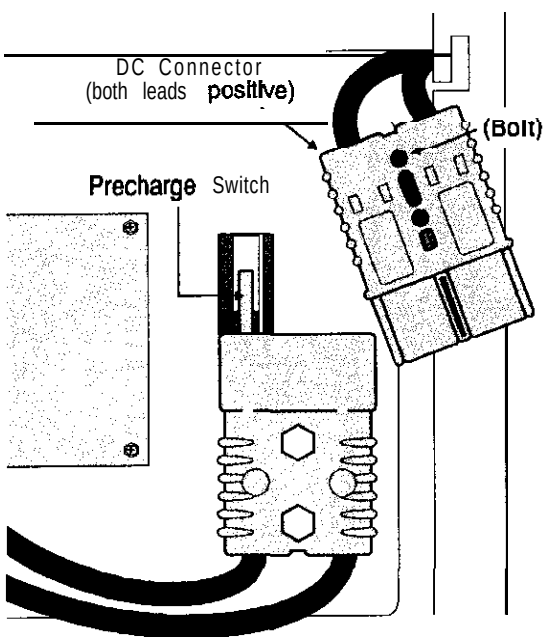

Figure 2: DC Connector

Section 200: Removing the Side Covers

200-1. Remove the seven screws from the side covers. Three of the screws are located on top of the unit, and two on each side panel.

200-2. Lii each side cover straight up, then off.

200-3. Remove the two screws in the upper comers of the side door assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

300-1. *With AC and DC power disconnected* (see Section 100), turn the UPS key switch to "Auto" for at least five seconds. The key switch is located inside the front door.

300-2. Turn the UPS key switch back to "Off".

300-3. To verify that the capacitors are discharged, use a DC voltmeter to measure the DC voltage between the DC bus bar (-) and one of the outside heatsinks on the inverter board (+), as shown in Figure 3.

NOTE: On a UT8K, check each inverter board to make sure that the capacitors on each board are discharged.

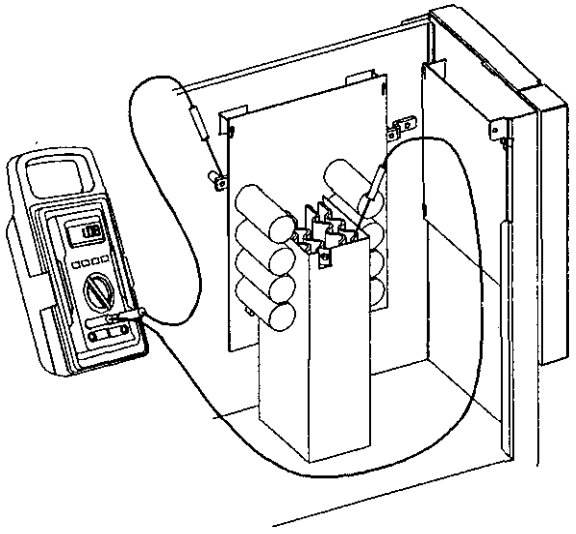

Figure 3: Verifying Capacitor Discharge

300-4. If the reading in step 300-3 is greater than S volts, wait five minutes to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

300-5. Remove the fast-on connector from E5 in the upper right comer of the fuse board (see Figure 1).

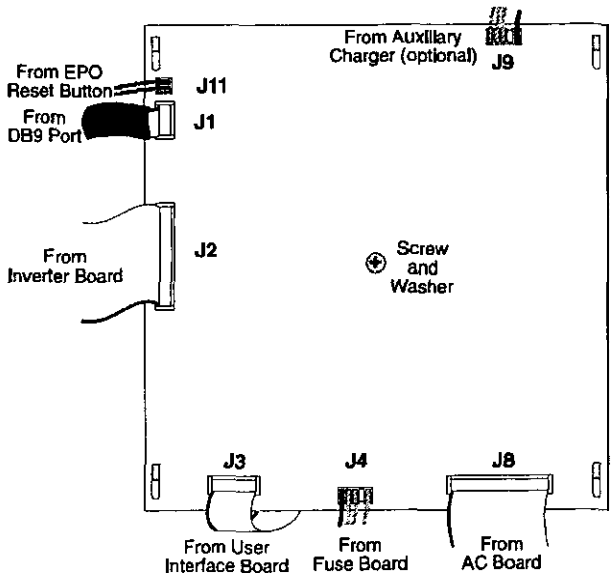

Figure 4: Logic Board

Section 400: Removing the Logic Board

Refer to Figure 4 for board connections.

400-1. Disconnect the following from the logic board:

- Ribbon cable from J8.
- Connector from J4.
- Ribbon cable from J3.
- Ribbon cable from J2.
- Ribbon cable from J1
- Connector from J11.
- Connector from J9 (if applicable).

400-2. Remove the screw and tooth lock washer from the center of the board.

400-3 Unseat the board from the mounting notches and remove it from the UPS

Section 500: Replacing the Logic Board

Refer to Figure 4 for board connections.

500-1. Reseat the logic board on the mounting notches with J3, J4, and J8 at the bottom

500-2. Replace the screw and tooth lock washer.

500-3. Reconnect the following:

NOTE: Make sure that the red stripe on each ribbon cable lines up with pin 1 on the board.

- Connector to J1 1.
- Ribbon cable to J1
- Ribbon cable to J2.
- Ribbon cable to J3.
- Connector to J4.
- Ribbon cable to J8.
- Connector to J9 (if applicable)

Section 600: Restarting the UPS

600-1. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

600-2. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board (see Figure 1).

600-3. At the front of the unit, reconnect the top DC connector and secure it with the bolt

> **WARNING**
>
> Stand clear of the UPS when reappiying AC input line voltage to the unit or restarting the unit. Wear personal safety equipment whenever the UPS covers are removed.

600-4. Reapply AC line. Do **not reapply the loads yet.**

600-5. Turn the key switch inside the front door of the UPS to "Auto." The BATTERY LED should light briefly, **then** the LINE LED should light. After five seconds, check the front display.

- ☐ The LINE LED should be on.
- ☐ The BATTERY, BYPASS, and ALARM LEDs should all be off.

Section 700: Calibrating the UPS and Verifying Basic Unit Operation

NOTE: During start-up and during transfers from battery power to line power, the tap changers will make clicking sounds. This is normal.

NOTE: If the UPS will not accept a new parameter setting during the procedure, re-enter the password as instructed in Section 701.

701: Accessing Parameter Mode and Entering a Password

NOTE: When the unit is in parameter mode, each of the front panel keys has a specific function. The label inside the front door of the unit explains the parameter mode key functions. The label also shows a "Programming Template" with alternate key names which correspond to the parameter mode key functions.

701-I. Simultaneously hold down the **[CANCEL]** and **[RUNTIME]** keys for two seconds. Release them when the display reads P - 0 0.

701-2. Press [CANCEL]. The display should read 0.

701-3. Use the [%LOAD] key to change the display reading to 2 6 3 9 (service password). If you inadvertently go past 2639, use the [VOUT] key to decrease the value.

NOTE: If you **hold down** the [%LOAD] key or the [VOUT] key, the display will begin to scroll more quickly after a few seconds.

701-4. Press [RUNTIME] to enter the password. The display should read 2. If it does not, repeat 701-3 and 701-4.

701-5. Press [CANCEL]. The display should read P-00.

702: Calibrating the AC Input Voltage

702-l. In units with the 380 - 415 VAC input option, Parameter 21 tells the UPS to scale the metered input voltage. While calibrating the input voltage, Parameter 21 must be set to "0".

set Parameter 21 **as follows:**

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 2 l.

b. Press [CANCEL].

c. If the display reads 0, skip to step "e." If the display reads l, use the [VOUT] key to change the display reading to 0.

d. Press [RUNTIME]. The display should read 0.

e. Press [CANCEL]. The display should read P-2 l.

702-2. Go to Parameter 27 (Input Voltage) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P - 2 7.

b. Press [CANCEL]. The display should show the UPS input voltage.
Displayed input voltage = _____ VAC.

702-3. Calibrate Parameter 27 (Input Voltage) as follows:

a. Use a true RMS voltmeter to measure the AC input voltage from L1 to L2 on the UPS DIN rail. Measured input voltage = _____ VAC.

NOTE: If the displayed voltage is within ±2.0 volts of the measured voltage, you may skip to step 702-4.

b. Use the [%LOAD] key or the [VOUT] key to change the display reading to the measured voltage.

c. Press [RUNTIME] to enter the new value. The displayed voltage should now be within ±2.0 volts of the measured voltage. If it is not, repeat all of step 702-3.

702-4. Press [CANCEL]. The display should read P- 2 7.

702-5. On the label inside the unit's front door, find the "Input Volts" rating.

- If the "Input Volts" rating is 200 - 240 VAC, skip to Section 703
- If the "Input Volts" rating is 380 - 415 VAC, set Parameter 21 to "1" as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 2 1.

b. Press [CANCEL]. The display should read 0.

c. Use the [%LOAD] key to change the display reading to 1.

d. Press [RUNTIME]. The display should read 1

e. Press [CANCEL]. The display should read P- 2 1.

703: Calibrating the AC Output Voltage

To properly calibrate the AC output voltage, you must **follow all of the steps** in Section 703.

703-1 Check the Output Voltage Reference setting (Parameter 05)

a. Use Table 1 to find the correct Parameter 05 setting for your application. Write the correct setting here _____

Table 1: Parameter 05 Setting

Voltage required by loads (UPS Output)	Correct Parameter 05 setting
100 and/or 200	200
110 and/or 220	220
115 and/or 230	230
120 and/or 240	240
208	208
127	254
1271220	220

b. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P-05.

c. Press [CANCEL]. The display will show the Parameter 05 setting _____

d. Does the displayed setting (step "c") match the correct setting (step "a")?

☐ YES Continue with step 703-2.

☐ NO For the UPS to provide the desired output voltage to the loads, Parameter 05 **must be** set properly. Do not continue until you are certain of the correct Parameter 05 setting for your application. You may wish to refer to the *UNITY/I* ***Installation Manual.*** If you need assistance, call BEST's Technical Support Center or your local BEST office.

CAUTION

Before continuing, make sure that no load equipment is applied to the UPS The next step may change the unit's output voltage.

Parameter 28 (Output Voltage) will not calibrate properly unless Parameter 05 is set to "240" as instructed in this section.

703-2. Temporarily reset Parameter 05 (Output Voltage Reference) to "240" as follows:

a. The display should still show the Parameter 05 setting. If the setting is already "240", you may skip to step 703-3.

b. Read the CAUTION above. Make sure that no loads are applied to the UPS,

c. Use the [%LOAD] key or the [VOUT] key to change the display reading to 240.

d. Press [RUNTIME]. You may hear clicking. The display should read 2 40.

703-3. Press [CANCEL]. The display should read **P-U 5.**

703-4. Go to Parameter 28 (Output Voltage) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P-28

b. Press [CANCEL]. The display should show the UPS output voltage.
Displayed output voltage = _____ VAC.

NOTE: The unit uses the highest nominal voltage developed on the transformer secondary to monitor both the high and low voltage outputs. Parameter 28 displays the high output voltage only.

703-5. Calibrate Parameter 28 (Output Voltage) as follows:

a. Use a true RMS voltmeter to measure the AC output voltage from Xl to X5 on the UPS DIN rail. Measured output voltage = _____ VAC.

NOTE: If the displayed voltage is within ±2.0 volts of the measured voltage, you may skip to step 703-6.

b. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the measured voltage.

c. Press [RUNTIME] to enter the new value. The displayed voltage should now b e within ±2.0 volts of the measured voltage. If it is not, repeat all of 703-5.

703-6. Press [CANCEL]. The display should read P- 2 8

703-7. Reset Parameter 05 (Output Voltage Reference) to the correct setting as follows:

a. Look back at step 703-la on page 9 and write the correct Parameter 05 setting for your application here _____

NOTE: If the correct Parameter 05 setting for your application is 240, you may skip to Section **704. Otherwise, follow the steps below.**

b. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 0 5.

c. Press [CANCEL]. The display should read I? 4 0.

d. Use the [%LOAD] key or the [VOUT] key to change the display reading to the value recorded in step "a."

e. Press [RUNTIME] to enter the value. You may hear clicking.

f. Press [CANCEL]. The display should show P- 05

704: Calibrating tbe Battery Voltage

704-I. Go to Parameter 30 (Battery Voltage) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display reading to P- 3 0.

b. Press [CANCEL]. The display should show the battery voltage.

704-2. Remove AC input line voltage. The unit should transfer to battery power.

- ☐ The BATTERY LED should be on.
- ☐ The LINE, BYPASS, and ALARM LEDs should all be off.
- ☐ The fan should come on. You should be able to hear the fan and feel air flowing out of the top of the unit.

704-3. The display should still show the battery voltage. When the battery voltage stabilizes (about 60 seconds), recalibrate Parameter 30 as follows:

a. Place the DC voltmeter so that you can see the voltmeter display and the UPS display at the same time.

b. Use the DC voltmeter to measure the battery voltage between the DC bus bar **(-)** and one of the **outside** heatsinks on the inverter board (+), as shown in Figure 5. (On a UT8K, you may use either inverter board).

Look at the measured DC voltage and the UPS display **at the same time.** Is the UPS display within ±0.2 volts of the measured voltage?

☐ **YES** Skip to step 704-4.
☐ NO Recalibrate as instructed in steps "c" and "d" below.

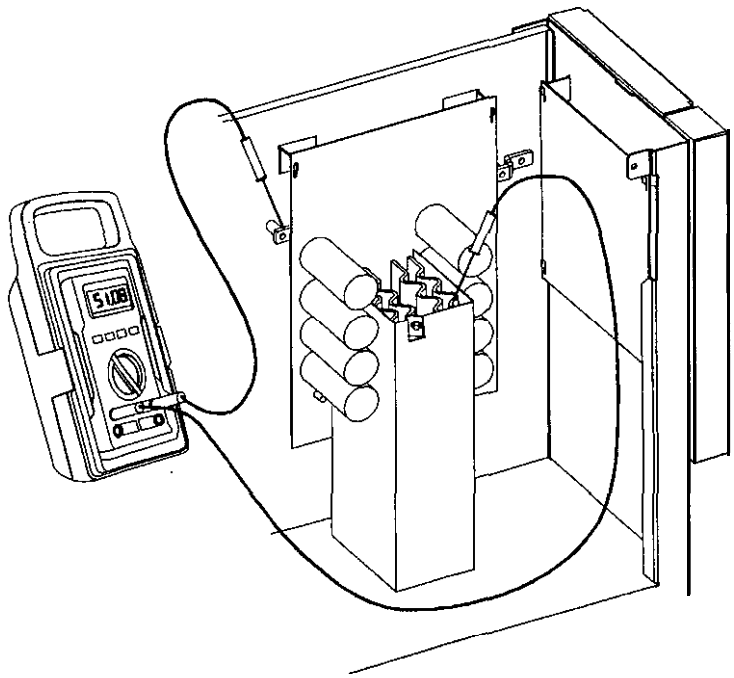

Figure 5: Measuring Battery Voltage

c. Use the [%LOAD] key or the [VOUT] key to change the UPS display reading to the measured DC voltage.

d. Press [RUNTIME] to enter the new value. The displayed voltage should now be within ±0.2 volts of the measured voltage. If it is not, repeat steps "c" and "d".

704-4. Press [CANCEL], The display should read P- 30.

704-5. Reapply AC input line voltage. The unit should transfer to line power. After five seconds, check the front display.

- ☐ The LINE LED should be on.
- ☐ The BATTERY, BYPASS, and ALARM LEDs should all be off.

705: Setting the Unit Identification Parameters

705-I. Open the front door of the unit and find the unit serial number (SN) label.

Unit serial number = UT (Model) K (Five-digit serial number)

705-2. Enter the **first** digit of the five-digit serial number into Parameter 01 (Serial Number Low) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-01.

b. Press [CANCEL].

c. Use the [%LOAD] key to change the displayed reading to the **first** digit of the five-digit serial number (see step 705-l).

d. Press [RUNTIME] to enter the new value

e. Press [CANCEL]. The display should read P-01.

705-3. Enter the last four digits of the serial number into Parameter 02 (Serial Number High) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-02.

b. Press [CANCEL]

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the last four digits of the five-digit serial number (see step 705-l).

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P-02.

705-4. Enter the unit model number into Parameter 04 (Model Number) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P- 04.

b. Press [CANCEL].

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the unit model number (see step 705-l).

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P- 04.

706: Setting the Battery-Related Parameters

706-l. Does the UPS have any external battery strings?

☐ NO Go to step 706-2.

☐ YES Go to the Appendix on page 20 and calculate the correct values for Parameters 55, 57, and 58. After you calculate the correct values, record them here:

Parameter 55 _____ Parameter 57 _____ Parameter 58 _____

After you calculate the correct values and record them above, continue with step 706-2.

706-2. Enter the proper battery capacity in Parameter 55 (Battery Capacity) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P- 55.

b. Press [CANCEL]

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the correct amp-hour rating. The list below shows the correct Parameter 55 value for units with **one string of *internal*** batteries only (no external batteries). For units with external batteries, see step 706-l.

- 17.0 for a UT3K with one string of *standard* (17 AH) internal batteries only.
- 33.0 for a UT3K with one string of *extended runtime* (33 AH) internal batteries only.
- 33.0 for a UT4K with one string of standard (33 AH) internal batteries only.
- 33.0 for a UT5K with one string of standard (33 AH) internal batteries only.
- 90.0 for a UTSK with one string of standard (90 AH) internal batteries only.

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P- 55

706-3. Set Parameter 56 (Full Charge Open Circuit Voltage) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P- 56.

b. Press [CANCEL].

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the following value:

- 52.50 for a UT3K, UT4K or UT5K
- 51.50 for a UT8K.

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P - 5 6

706-4. Set Parameter 57 (Runtime K1) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-57.

b. Press [CANCEL].

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the correct value. The list below shows the correct Parameter 57 value for units with **one string of *internal batteries only*** (no external batteries). For units with external batteries, see step 706-l.

- 0.65 for a UT3K with one string of *standard* internal batteries only.
- 0.50 for a UT3K with one string of extended *runtime* (33 AH) internal batteries only.
- 0.50 for a UT4K with one string of standard internal batteries only.
- 0.20 for a UT5K with one string of standard internal batteries only.
- 0.00 for any UT8K.

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P-57.

706-5. Set Parameter 58 (Runtime K2) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-58.

b. Press [CANCEL].

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the correct value. The list below shows the correct value for units with one **string of internal batteries** only. For units with external batteries, see step 706-l.

- 99C hex for a UT3K with one string of *standard* internal batteries only.
- 6B8 hex for a UT3K with one string of extended *runtime* (33 AH) internal batteries only.
- 6B8 hex for a UT4K with one string of standard internal batteries only.
- 7D0 hex for a UT5K with one string of standard internal batteries only.
- 14B4 hex for a UT8K with ***one*** string of standard internal batteries only.

d. Press [RUNTIME] to enter the new value,

e. Press [CANCEL]. The display should read P-58.

706-6. Enter the battery charger rating in Parameter 60 (Charger Rating) as follows:

a. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to P-60.

b. Press [CANCEL]

c. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the value below.

NOTE: For units with an optional 15-amp auxiliary battery charger, add 15.0 to the value below.

- 5.0 for a UT3K, UT4K or UT5K with standard internal charger only.
- 10.0 for a UTSK with standard internal charger only.

d. Press [RUNTIME] to enter the new value.

e. Press [CANCEL]. The display should read P-60.

707: Reapplying the Loads and Calibrating the Output Current

707-1. Reapply all of the load equipment

707-2. Set Parameter 06 (Full Load Set Point) as follows:

a. Open the front door of the unit. Find the model number UTXK, where X is the KW/KVA rating of the unit. Unit rating = _____ KW/KVA.

b. The display should read P-XX, where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the display to P-06.

c. Press [CANCEL]

d. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to the correct KW/KVA rating (see step 707-2a).

e. Press [RUNTIME] to enter the new value

707-3. Press [CANCEL]. The display should read P-06.

707-4. Check Parameter 34 (Percent Load) as follows:

a. The display should read **P-xX,** where XX is a parameter number. Use the [%LOAD] key or the [VOUT] key to change the displayed reading to **P- 3 4.**

b. Press [CANCEL]. The display should show the percent of the unit's rated capacity presently being used. Percent load = _____ %.

c. If the percent load is more than 100%, too much load is applied to the unit Remove load until the percent load is less than 100%.

d. Press [CANCEL]. The display should read **P- 3 4.**

707-5. Go to Parameter 29 (Output Current) as follows:

a. The display should read **P-xx** (where XX is a parameter number). Use the [%LOAD] key or the [VOUT] key to change the display reading to **P- 2 9.**

b. Press [CANCEL]. The display should show the output current in amperes. Displayed output current = _____ amps.

707-6. Calibrate Parameter 29 (Output Current) as follows:

a. Use a clamp-on ammeter to measure the current of the output wire connected to Xl on the UPS DIN rail. Measured output current (Xl) = _____ amps.

b. Use a clamp-on ammeter to measure the current of the output wire at X4 or the output wire at X5, whichever is used.
Measured output Current (X4 or X5) = _____ amps.

c. In the spaces below, add the value recorded in step "a" to the value recorded in step "b" and divide by 2.

(_____ amps + _____ amps) ÷ 2 = _____ amps
I Out at X1 — I Out at X4 or X5 — Calibrated I Out (Param. 7.9)

NOTE: If the calculated value is within ±0.2 amps of the displayed output current, you may skip to step 707-7.

d. Use the [%LOAD] key or the [VOUT] key to change the UPS display reading to the correct output current value as calculated in step "c."

e. Press [RUNTIME]. The displayed output current should now be within ±0.2 amps of the value calculated in step "c." If it is not, repeat all of step 707-6.

707-7. Press [VLINE] twice to escape parameter mode.

708: Checking Unit Transfers and Battery Charger Operation

In Section 704, you transferred the unit from line power to battery power and from battery power to line power **without** the loads applied. In this section, you will check the unit transfers **with** the loads applied. You will also check for battery charger operation.

☞ **IMPORTANT!** Unit nmtime may be low if the batteries are not fully charged.

708-1. Remove AC input line voltage. The unit should transfer to battery power,

- ☐ The BATTERY LED should be **on.**
- ☐ The LINE, BYPASS, and ALARM LEDs should all be off.
- ☐ The fan should be on.

708-2. Reapply AC input line voltage. The unit should transfer to line power. After five seconds, check the front display.

- ☐ The LINE LED should be on.
- ☐ The BATTERY, BYPASS, and ALARM LEDs should all be off,

708-3. To verify battery charger operation, simultaneously press the two [VBATT] keys to display the battery voltage. The charger should be recharging the batteries, so the displayed battery voltage should be **increasing.**

Section 800: Replacing the Covers

800-I. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

800-2. Open the front door of the UPS. Turn the UPS key switch to "Off'

800-3. Replace the front ventilation panel and **secure it** with the screws

800-4. Close the side door assembly and secure it with the two screws. When closing the door assembly, make sure that no wires are pinched between the door and the chassis.

800-5. Replace the side covers and secure them with the seven screws. Replace the right cover first, then the left. Slide each **cover straight down** to secure it on the notches that hold it in place.

800-6 Turn the UPS key switch to "Auto"

800-7. Reapply the load equipment

Appendix: Calculating Parameters 55, 57 and 58 for Units with External Batteries

For a unit with external batteries only or a unit with a combination of internal and external batteries, this appendix tells how to calculate the correct values for Parameter 55 (Battery Capacity), Parameter 57 (Runtime K1), and Parameter 58 (Runtime K2). After calculating the correct values, go back to step 706-Z and continue the calibration procedure.

You will find two examples on page 21

- **Calculating Parameter 55 (Battery Capacity)**

  Add the amp-hour capacity of **all** of the battery strings.

  Your Parameter 55 value = _____

- **Calculating Parameter 57 (Runtime K1)**

  Take *your* Parameter 55 value (calculated above) and divide it by the standard Parameter 55 value for your UPS (see Table 2). Then, multiply by the *standard* Parameter 57 value for your UPS (see Table 2). Round to two decimal places.

  Your Parameter 57 value = _____

- **Calculating Parameter 58 (Runtime K2)**

  Take your Parameter 55 value (calculated above) and divide it by the *standard* Parameter 55 value for your UPS (see Table 2). Then, multiply by the value listed below:

  - 2460 for a UT3K with *standard* (17 AH) internal batteries **or** no internal batteries.
  - 1720 for a UT3K with extended runtime (33 AH) internal batteries.
  - 1720 for a UT4K.
  - 2000 for a UT5K.
  - 5300 for a UT8K.

  Convert the answer to hexadecimal,

  Your Parameter 58 value = _____ hexadecimal.

- **Programming the Values**

  Record your Parameter 55, 57 and 58 values in step 706-l on page 14. Then, go step 706-2 on page 15 and continue the calibration procedure.

  NOTE: When you resume the calibration procedure, if the UPS does not allow you to program new values, re-enter the service password (see Section 701).

Table 2: Standard Values for Parameters 55 and 57

Your UPS model	Standard Value for Parameter 55	Standard Value for Parameter 57
UT3K [1]	17.0	0.65
UT3K (internal ext. runtime batts) [2]	33.0	0.50
UT4K	33.0	0.50
UT5K	33.0	0.20
UT8K	90.0	0

[1] Use these values for a UT3K which has 17 AH internal batteries or no internal batteries.
[2] Use these values for a UT3K which has 33 AH internal batteries.

Examples

Example I: UT4K, no internal batteries, two external strings of 100 AH batteries

- To calculate **Parameter** 55, add the amp-hour capacities of all of the battery strings. 100 + 100 = **200**.

- To calculate **Parameter** 57, take your Parameter 55 value (200) and divide it by the *standard* Parameter 55 value in Table 2 (33.0 for a UT4K). Then, multiply by the *standard* Parameter 57 value in Table 2 (0.50 for a UT4K).
(200 ÷ 33.0) x 0.50 = 3.0303 ≈ 3.03.

- To calculate **Parameter** 58, take your Parameter 55 value (200) and divide it by the *standard* Parameter 55 value in Table 2 (33.0 for a UT4K). Then, multiply by the correct value listed on page 20 (1720 for a UT4K) and convert the answer to hex.
(200 ÷ 33.0) x 1720 = 10424.24242 = **28B8** hex.

Example 2: UT3K, internal extended runtime (33 AH) batteries, one string of 100 AH batts.

- To calculate **Parameter** 55, add the amp-hour capacities of all of the battery strings.
33 + 100 = 133.

- To calculate **Parameter** 57, take *your* Parameter 55 value (133) and divide it by the *standard* Parameter 55 value in Table 2 (33.0 for a UT3K with internal extended runtime batteries). Then, multiply by the *standard* Parameter 57 value in Table 2 (0.50 for a UT3K with internal extended runtime batteries). (133 ÷ 33) x 0.50 = 2.0151 ≈ 2.02.

- To calculate **Parameter** 58, take *your* Parameter 55 value (133) and divide it by the *standard* Parameter 55 value in Table 2 (33.0 for a UT3K with internal extended runtime batteries). Then multiply by the correct value listed on page 20 (1720 for a UT3K with internal extended runtime batteries) and covert the answer to hex.
(133 ÷ 33) x 1720 = 6932.121212 = **1B14** hex.

Best Power
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OWER SYSTEMS

UN 642
January 1995

Replacing the AC Board in UNITY/I™ Models UT3K, UT4K and UT5K

This document explains how to remove and replace the AC board in UNITY/I models UT3K, UT4K and UT5K. This procedure must be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. and Canada) or your local BEST office.

☞ **IMPORTANT!** BEST publication **UTY 601 is required** as part of this procedure.

Tools required (use insulated tools):

Phillips screwdriver	DC voltmeter	Pliers (optional)
7/16" nut driver	BEST publication UTY 601	1/4" nut driver (optional)

Personal safety equipment as required by local code

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.
2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**
3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-1. If there is an external bypass switch, use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off

☐ 100-3. Remove AC input to the UPS. (Turning the key switch "Off" is not **sufficient**.)

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-5. Remove the screws at the comers of the front ventilation panel and remove panel from the unit (see Figure 1).

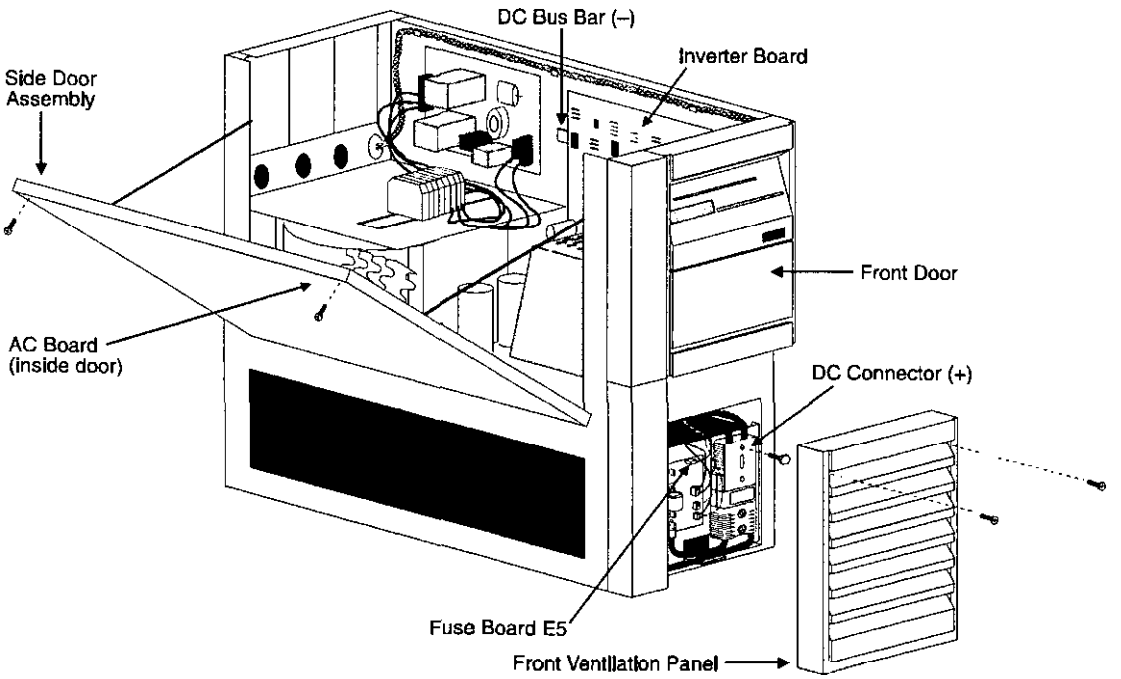

Figure 1

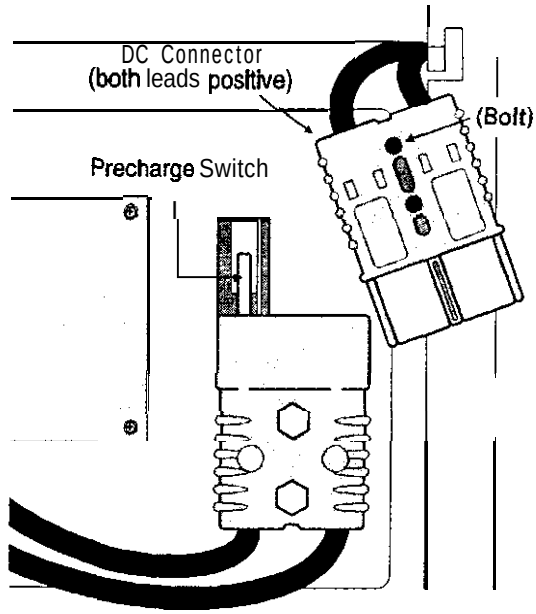

Figure 2

❑ 100-6. Remove the bolt from the top DC connector (see Figure 2).

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the precharge switch after it is disconnected.

⚠ WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 200-1. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 200-2. Lift each side **cover straight** up, then off.

Section 300: Discharging the Capacitors

• 1 300-l. With AC and DC power disconnected (see Section 100), turn the UPS key switch to "Auto" for at least five seconds.

☐ 300-2. Turn the UPS key switch back to "Off."

☐ 300-3. To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar (-) and one of the outside heatsinks on the inverter board (+), as shown in Figure 3.

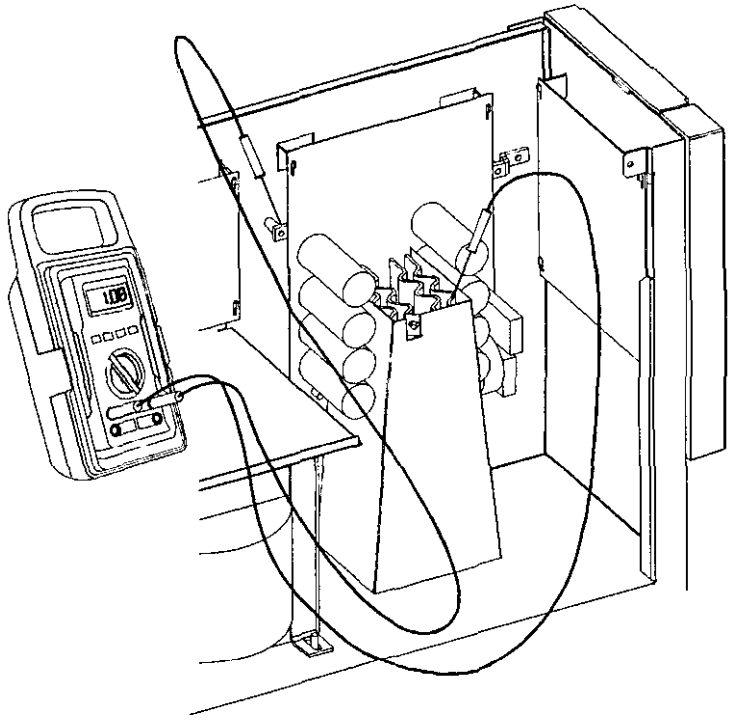

Figure 3

☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait five minutes to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

☐ 300-5. Remove the fast-on connector from E5 in the upper right comer of the fuse board. See Figure 1 for the location of the fuse board.

Section 400: Removing the AC Board

⚠ WARNING

Make sure that AC is **completely removed** from the UPS input. If AC is present at the UPS input, sections of the AC board will be energized, even if the UPS key switch is turned "Off."

TEST BEFORE TOUCHING!

☐ 400-1 On the side door assembly (see Figure 1), remove the two hex head screws that secure the AC board's nylon standoffs to the door (see Figure 4).

❑ 400-2. Remove the screws from the upper corners of the side door assembly (see Figure 4). Open the side door assembly.

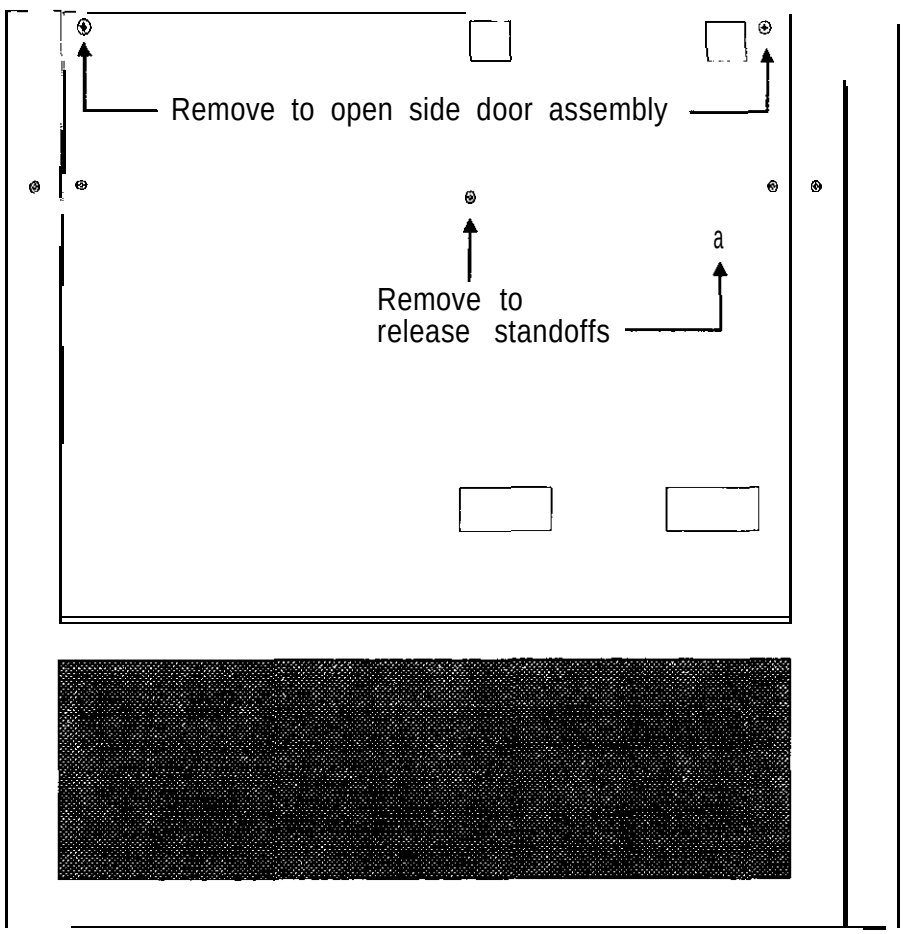

Figure 4

☐ 400-3. Remove the following connectors from the AC board (see Figure 5). To release a locking connector, squeeze the sides of the connector while pulling up.

- P1 from J1.
- P2 from J2.
- P3 from J3.
- Ribbon cable from J4.
- Locking connector from J5.
- Locking connector from J6.
- Locking connector from J7.

☐ 400-4. Remove the screw and tooth lock washer located near the large heatsink.

☐ 400-5. Carefully slide the board toward the top of the door and unseat it from the mounting notches. Remove the board from the unit.

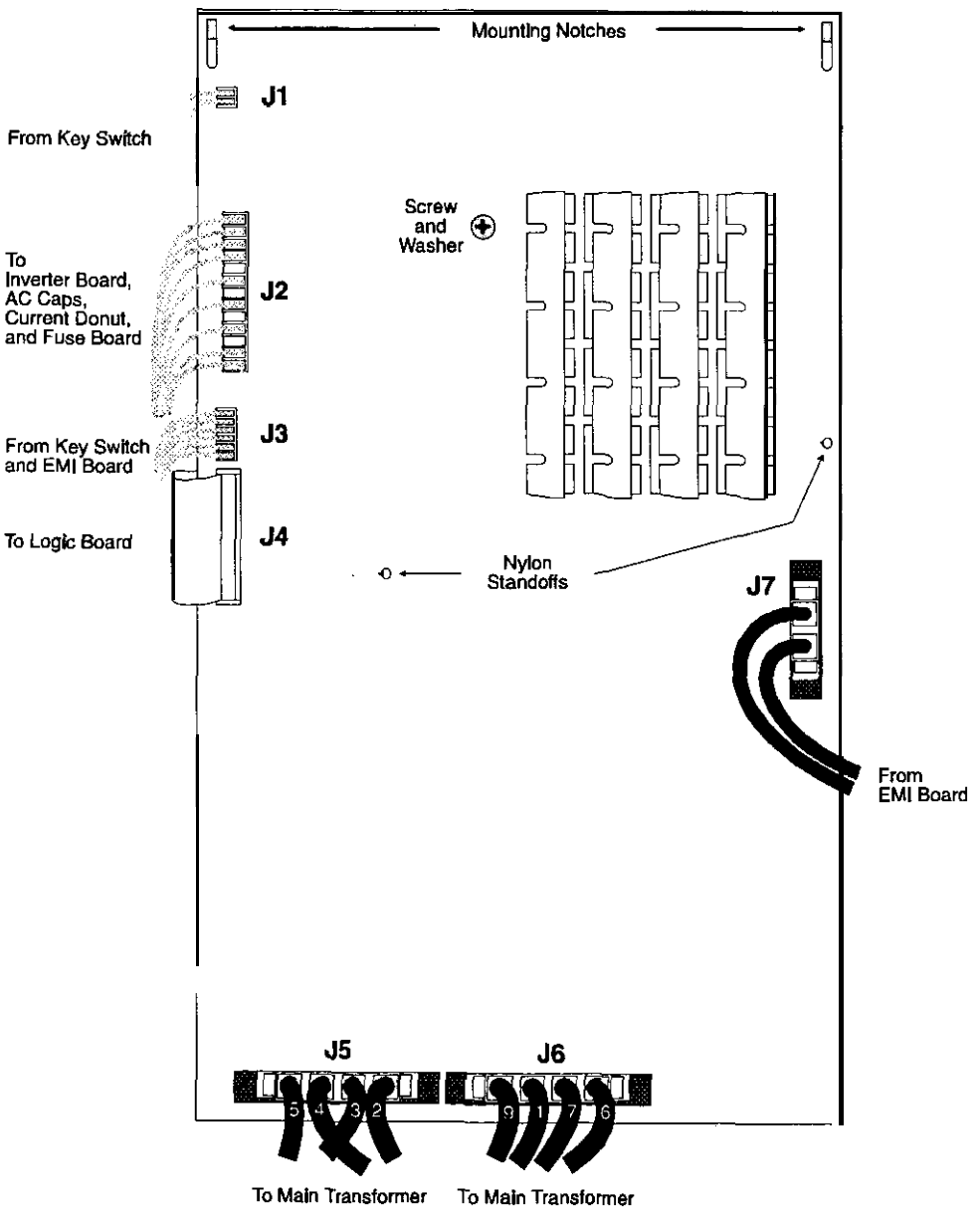

Figure 5

Section 500: Replacing the AC Board

Refer to Figure 6 for board connections.

- ❑ 500-l. Remove the nylon standoffs from the old board.
- ☐ 500-Z. Put the nylon standoffs on the new board
- ☐ 500-3. Mount the new board onto the side door. Be careful not to trap any of the connectors underneath the board.
- ☐ 500-4. Replace the tooth lock washer and screw
- ❑ 500-5. Reconnect the following:
  - Locking connector to J7.
  - Locking connector with wires labeled 2, 3, 4, 5 to J5.
  - Locking connector with wires labeled 9, 1, 6, 7 to J6.
  - Ribbon cable to J4. Align the red stripe on the ribbon cable with pin 1 on J4.
  - P3 to J3.
  - P2 to J2.
  - P1 to J1.
- ☐ 500-6. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the door and the chassis.
- ☐ 500-7. Replace the two hex head screws to secure the nylon standoffs to the side door.

Section 600: Restarting the UPS

- ☐ 600-l. Switch on the DC disconnect switches on the external battery cabinets (if applicable).
- ☐ 600-2. At the front of the unit, reconnect the fast-on connector ,to E5 on the fuse board.
- ☐ 600-3. At the front of the unit, reconnect the top DC connector and secure it with the bolt.
- ☐ 600-4. Replace the front ventilation panel and secure it with the screws.
- ☐ 600-5. Reapply AC line
- ❑ 600-6. Perform the procedure in BEST publication **UTY** 601, "Verifying the Basic Operation of the Single-Phase UNITY/I UPS."

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UTY 644
July 1995

Replacing the Fan in UNITY/I™ Models UT3K, UT4K, UT5K, and UT8K

This document explains how to replace the fan in UNITY/I models UT3K, UT4K, UT5K, and UT8K. This procedure must be performed by a qualified service technician only. If you have any questions or problems while performing this procedure, call BEST's Technical Support Center at 1-800-356-5737 (U.S.A. and Canada) or your local BEST office.

Tools required (use insulated tools):

Phillips screwdriver	Small standard screwdriver
7/16" nut driver	DC voltmeter
3/8" nut driver	Personal safety equipment required by local codes

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources.**

TEST BEFORE TOUCHING!

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified service technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-I. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment,

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off."

☐ 100-3. Remove AC input to the UPS. (Turning the key switch to "Off" is **not sufficient.)**

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-S. Remove the screws at the comers of the front ventilation panel and detach the panel from the unit (see Figure 1). Remove the bottom narrow front panel on model UT8K only.

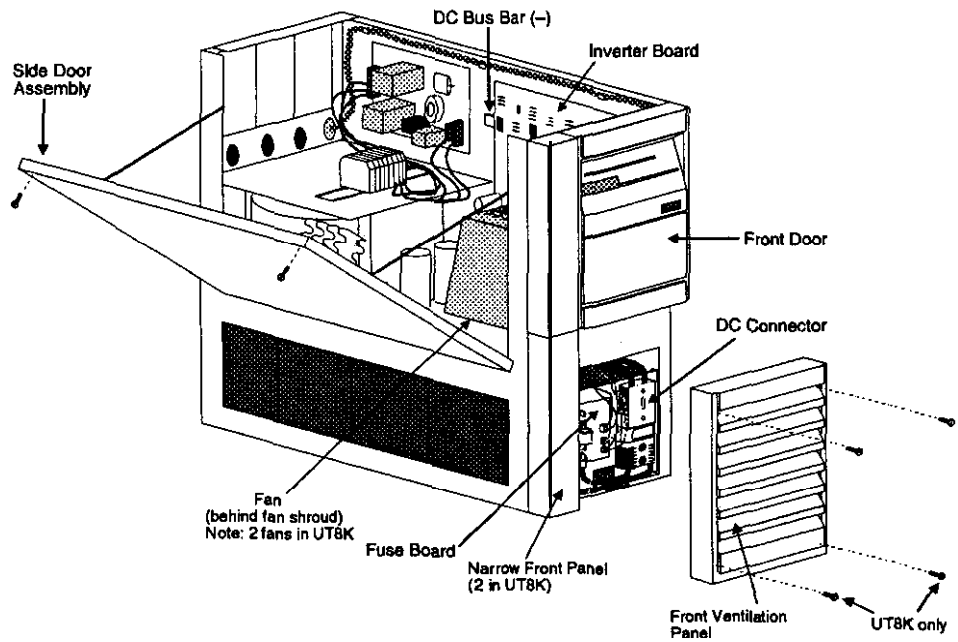

Figure I: Single-Phase UNITY/1

UT3K, UT4K, and UT5K pictured. UT8K varies slightly in appearance with two inverter boards, two fans, two narrow front panels, and a larger chassis.

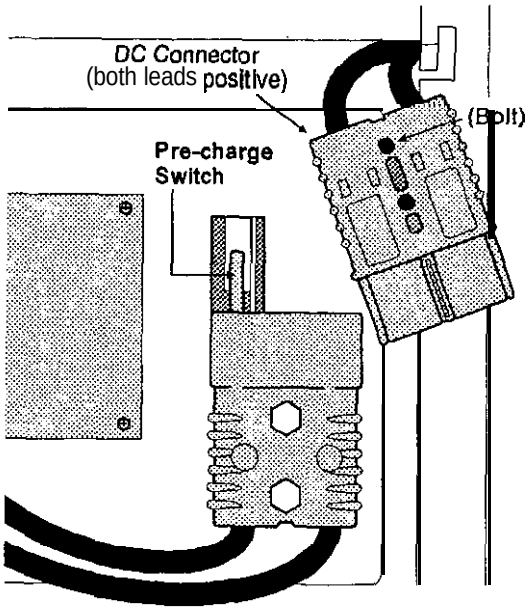

Figure 2: DC Connector

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2).

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the pre-charge switch after it is disconnected.

WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 200-l. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 200-2. Lift each side cover **straight up,** then off

Cl 200-3. Remove the two screws in the upper comers of the side door assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

❑ 300-l. ***With AC and DC power disconnected (see*** Section 100), turn the UPS key switch to "Auto" for at least five seconds.

☐ 300-2. Turn the UPS key switch back to "Off"

☐ 300-3. To verify that the capacitors are discharged, use a DC voltmeter to measure the DC voltage between the DC bus bar (-) and one of the **outside** heatsinks on the inverter board (+), as shown in Figure 3. For model UT8K, check the voltage on **both** inverter boards to make sure the capacitors on each board are discharged.

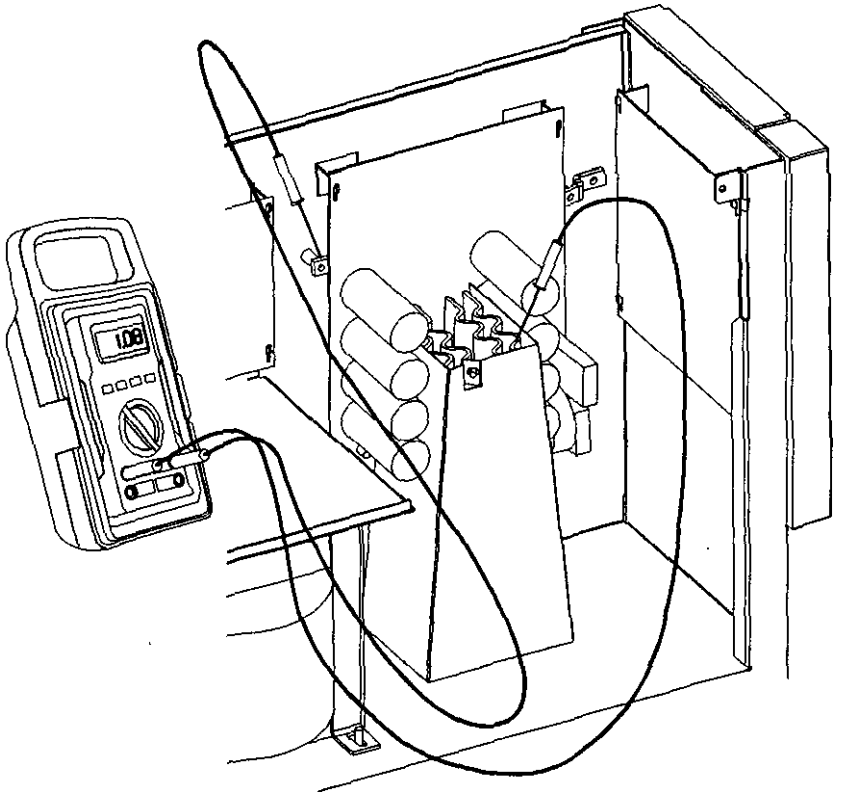

Figure 3: Verifying Capacitor Discharge

☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait 5 minutes to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

☐ 300-5. Remove the fast-on connector E5 in the upper right comer of the fuse board. See Figure 1 for the location of the fuse board.

Section 400: Removing the Fan

☐ 400-l. Remove the nut and flat washer securing the fan shroud to the inverter board heatsink. Remove the fan shroud from the unit.

☐ 400-2. Remove the four plastic snap rivets securing the fan to the chassis. Gently pry with a small screwdriver if necessary.

NOTE: The two rivets closest to the inverter board may be difficult to remove from the top. You can push these rivets out from the bottom. (See Figure 4 for location of rivets.)

☐ 400-3. Unplug the fan lead from J3 on the inverter board

☐ 400-4. Remove the fan from the unit.

Section 500: Replacing the Fan

☐ 500-l. Place the fan into the unit with the label and the four fan motor bars facing **up** The three fan wires should exit toward the front of the unit (see Figure 4).

☐ 500-2. Use the four plastic snap rivets to mount the new fan to the chassis

NOTES: The two rivets *farthest* from the inverter board should be installed from above, as shown in Figure 4.

The two rivets closest to the inverter board should be installed from below, as shown in Figure 4.

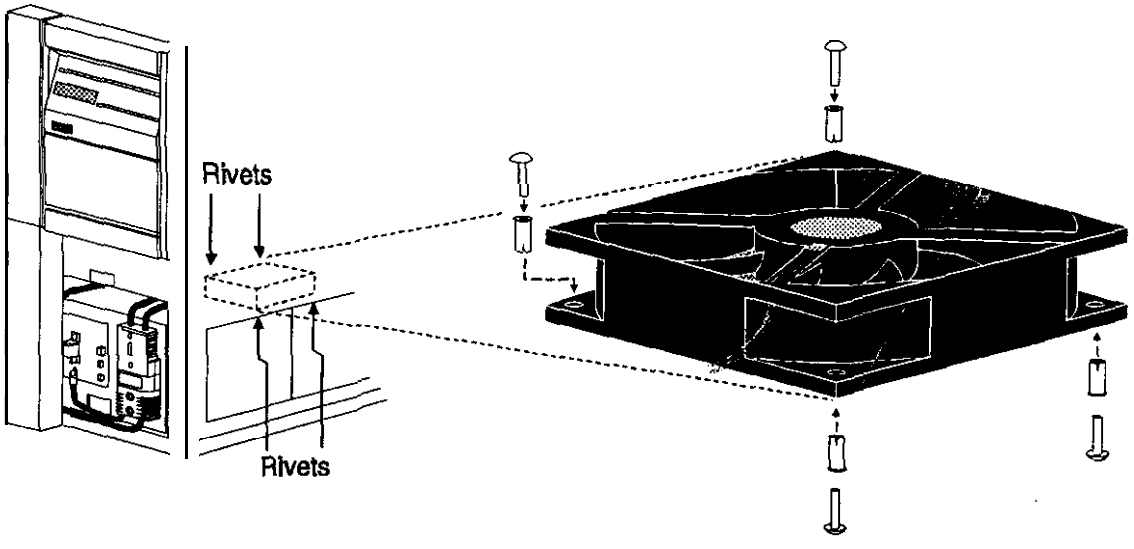

Figure 4: Fan Placement

☐ 500-3. Connect the fan wire lead to J3 on the inverter board.

☐ 500-4. Place the fan shroud tabs into the slots in the UPS chassis. Refasten the fan shroud to the inverter board heatsink using the flat washer and nut.

Section 600: Replacing the Side Covers

☐ 600-l. Close the door assembly and secure it with the two Phillips' screws. Make sure that no wires are pinched between the door and the chassis.

☐ 600-2. Replace the right side cover, then the left, and secure with the seven screws.

NOTE: Slide each cover **straight down** to secure it on the notches that hold it in place.

Section 700: Restarting the UPS

☐ 700-l. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board.

☐ 700-Z. At the front of the unit, reconnect the top DC connector and secure it with the bolt.

☐ 700-3. Replace the bottom narrow front panel (on UT8K only),

☐ 700-4. Replace the front ventilation panel and secure it with the Phillips screws.

☐ 700-5. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

☐ 700-6. Reapply AC line.

☐ 700-7. Turn the key switch inside the unit's front door to "Auto."

NOTE: If you have switched to external bypass, you may now switch to "UPS."

☐ 700-8. Reapply the loads.

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UTY 643
January1995

Replacing the Inverter Board in UNITY/P Models UT3K, UT4K and UT5K

This UTY describes how to remove and replace the inverter board in UNITY/I models UT3K, UT4K and UT5K. This procedure must be performed by a qualified service technician only. If you have any questions or problems while performing this procedure, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. and Canada) or your local BEST office.

☞ **IMPORTANT!** BEST publication **UTY 601 is required** as part of this procedure,

Tools required (use insulated tools):

Phillips screwdriver	DC voltmeter
7/16" nut driver	Personal safety equipment as required by local code
3/8" nut driver	3M 2209 disposable wrist strap (or equivalent)
5/16" nut driver	BEST Publication UTY 601

⚠ WARNING

1. These procedures must be performed by a qualified service technician only!

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage and injury A short circuit can cause a battery to explode.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for the qualified technician servicing the UPS:

a. Remove rings, watches and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

UTY-0643A

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-l. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off'

☐ 100-3. Completely remove the AC input to the UPS. (Note: Turning the key switch to "Off' is **not** sufficient.)

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-5. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1).

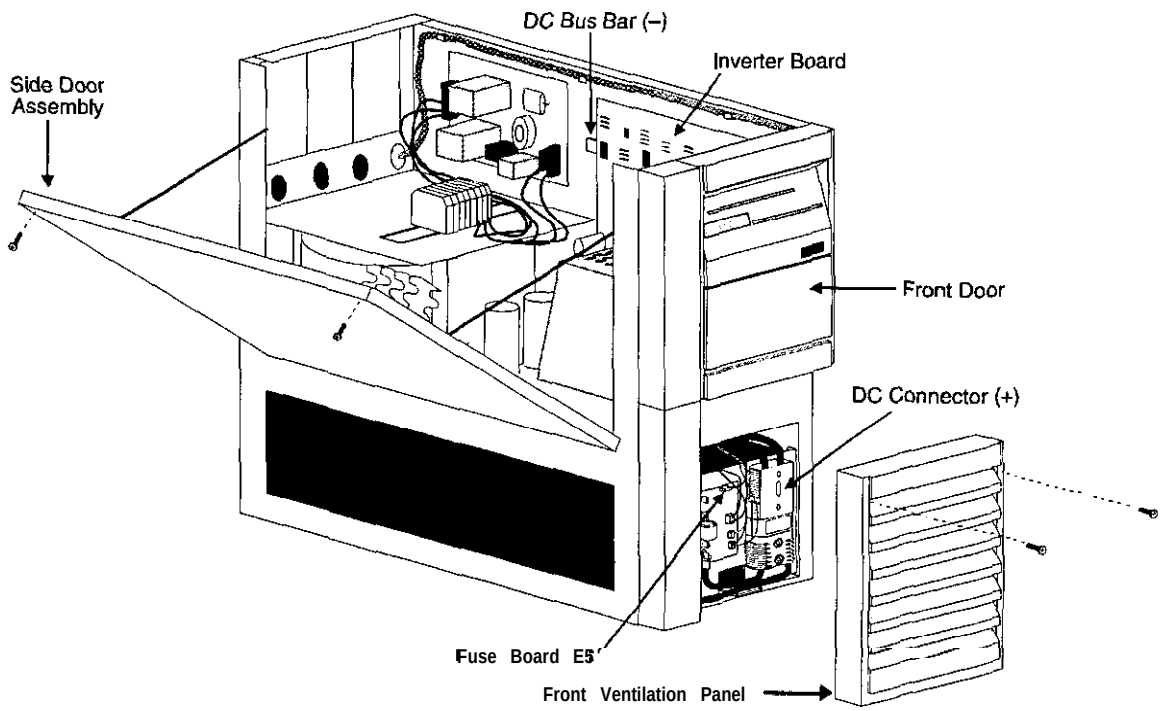

Figure 1

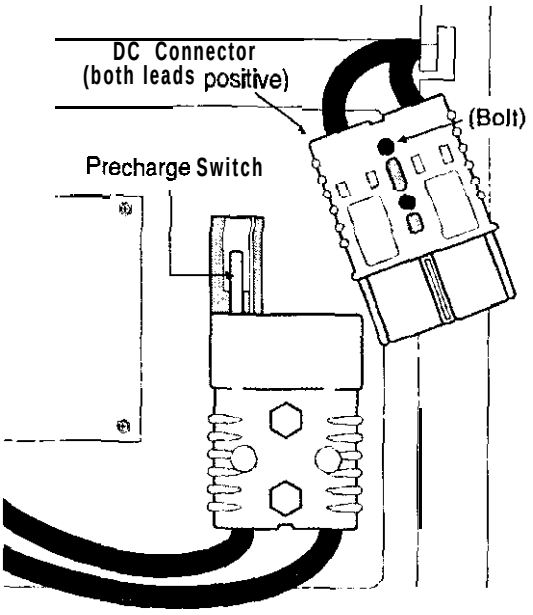

Figure 2

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2).

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the precharge switch after it is disconnected.

WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section ZOO: Removing the Side Covers

☐ 200-l. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 200-2. Lift each side cover **straight up,** then off.

☐ 200-3. Remove the screws in the upper comers of the side door assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

- ❑ 300-l. **With AC and DC power disconnected** (see Section 100), turn the UPS key switch to "Auto" for at least five seconds.

- ☐ 300-2. Turn the UPS key switch back to "Off."

- ☐ 300-3. To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar **(-)** and one of the **outside** heatsinks on the inverter board (+), as shown in Figure 3.

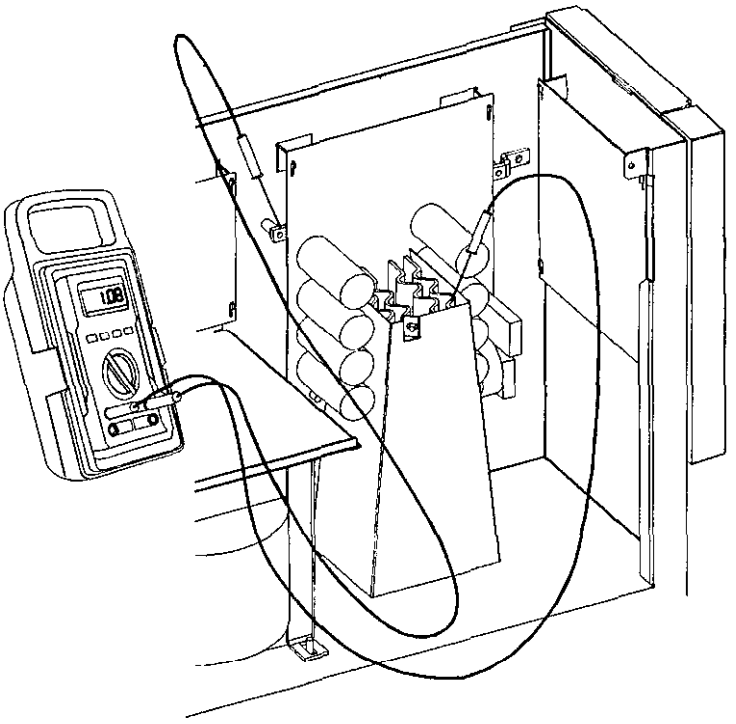

Figure 3

- ☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait five minutes to allow the capacitors to discharge. Then, repeat step 300-3 before continuing.

- ☐ 300-5. Remove the fast-on connector from E5 in the upper right comer of the fuse board See Figure 1 for fuse board location.

Section 400: Removing the Inverter Board

Refer to Figure 4 for inverter board connection locations,

☐ 400-l. Remove the nut and flat washer securing the fan shroud to the inverter board heatsink. Remove the fan shroud from the unit.

☐ 400-2. Disconnect the following from the inverter board:

- Ribbon cable from J1
- Plug P5 from J2
- Plug from J3
- Fast-on connector from E5

☐ 400-3. Remove the nut and flat washer securing transformer lead #16 to W3 (VOSENS-). Remove the transformer lead from the post.

☐ 400-4. Remove the nut and flat washer securing transformer lead #15 to W2 (VOSENS+). Remove the transformer lead from the post.

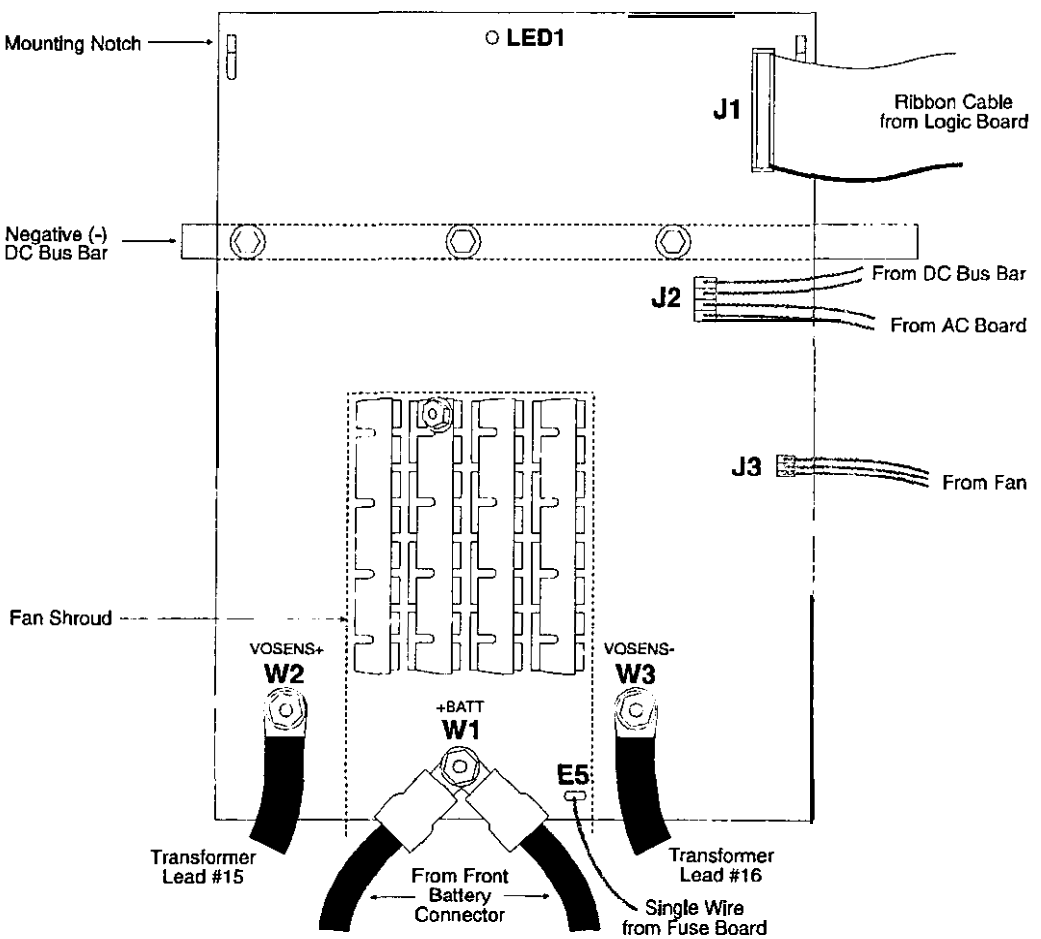

Figure 4

☐ 400-5. Remove the nut and flat washer securing the two positive (+) battery cables to W1 (+BATT). Remove the cables from the post.

☐ 400-6. Remove the three bolts and flat washers securing the board to the DC bus bar.

WARNING

Before continuing, make sure that you have discharged the capacitors as instructed in Section 300. Failure to do so could result in personal injury or component damage.

☐ 400-7. You must wear an ESD wrist strap for the rest of this procedure. Do not continue unless you are wearing an ESD wrist strap.

☐ 400-8. Unseat the board from the mounting notches and grooves. Remove the board from the unit,

Section 500: Replacing the Inverter Board

Refer to Figure 4 for connection locations.

☐ 500-l. On the new board, there is a jumper (RSA-0021) connecting ES and E6 (see Figure **5). Remove the jumper from the hoard.** Then, install the jumper on the **old** board and place the old board in the ESD-protective bag.

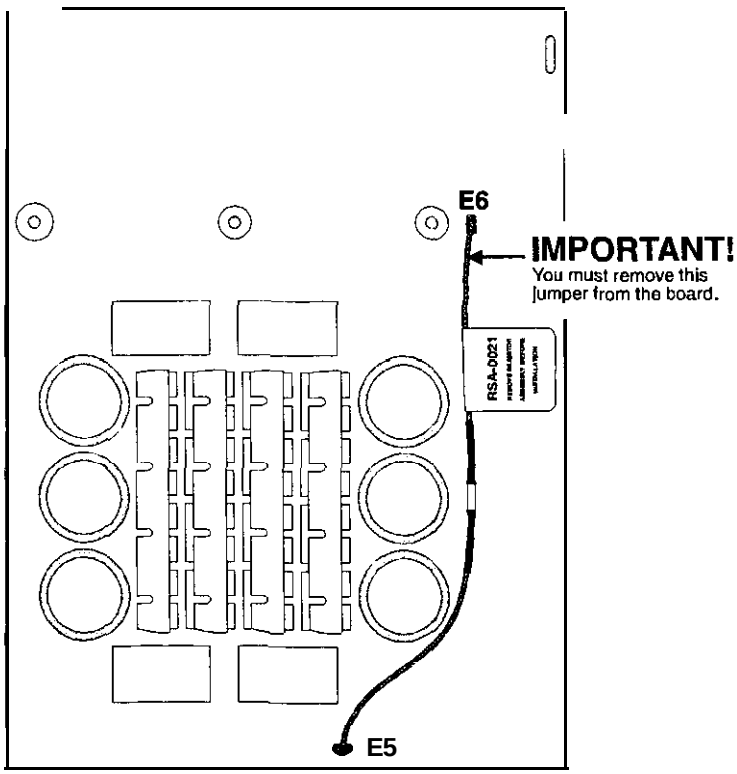

Figure 5

☐ 500-2. Seat the bottom of the new board in the mounting grooves and the upper corners of the board on the mounting notches.

☐ 500-3. Secure the board to the DC bus bar with the three washers and bolts

☐ 500-4. Place the two positive (+) battery cables onto the post labeled W1 (+BATT) and replace the washer and nut.

☐ 500-5. Place transformer lead #16 onto the post labeled W3 (VOSENS-) and replace the washer and nut.

☐ 500-6. Place transformer lead #15 onto the post labeled W2 (VOSENS+) and replace the washer and nut.

☐ 500-7. Reconnect the following on the inverter board:

- Fast-on connector to E5
- Plug (from fan) to J3
- Plug P5 to J2
- Ribbon cable to J1.

☐ 500-S. Slide the fan shroud tabs into the slots in the UPS chassis. Refasten the fan shroud to the inverter board heatsink with the flat washer and nut.

Section 600: Restarting the UPS

☐ 600-1. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the door and the chassis.

☐ 600-2. Switch on the DC switches on the external battery cabinet(s), if applicable,

☐ 600-3. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board.

☐ 600-4. At the front of the unit, reconnect the top DC connector and replace the bolt

☐ 600-5. Reapply AC line.

☐ 600-6. Perform the procedure in BEST publication UTY 601, "Verifying the Basic Operation of the Single-Phase UNITY/I UPS."

Before shipping the old inverter board back to BEST (if applicable): (1) Make sure that the jumper (RSA-0021) is installed between E5 and E6 on the old board; (2) Place the old board in the ESD-protective bag; and (3) Pack the board properly. Write the RMA number on the outside of the package.

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UTY 646
May1995

Replacing the AC Board in UNITY/I™ Model UT8K

This document explains how to remove and replace the AC board in UNITY/I model UT8K. This procedure must be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at l-800-356-5737 (U.S.A. and Canada) or your local BEST office.

☞ **IMPORTANT!** BEST publication **UTY 601 is required** as part of this procedure.

Tools required (use insulated tools):

Phillips screwdriver	ESD strap	Pliers (optional)
7/16" and 3/8" nut drivers	BEST publication UTY 601	1/4" nut driver (optional)
DC voltmeter	Personal safety equipment as required by local code'	

⚠ WARNING

1. These procedures must be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal block connections 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.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for qualified technicians servicing the UPS:

a. Remove rings, watches, and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized **unit** with the cover removed, electric shock is possible. Follow all local safety codes.

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-l. If there is an external bypass switch, use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off

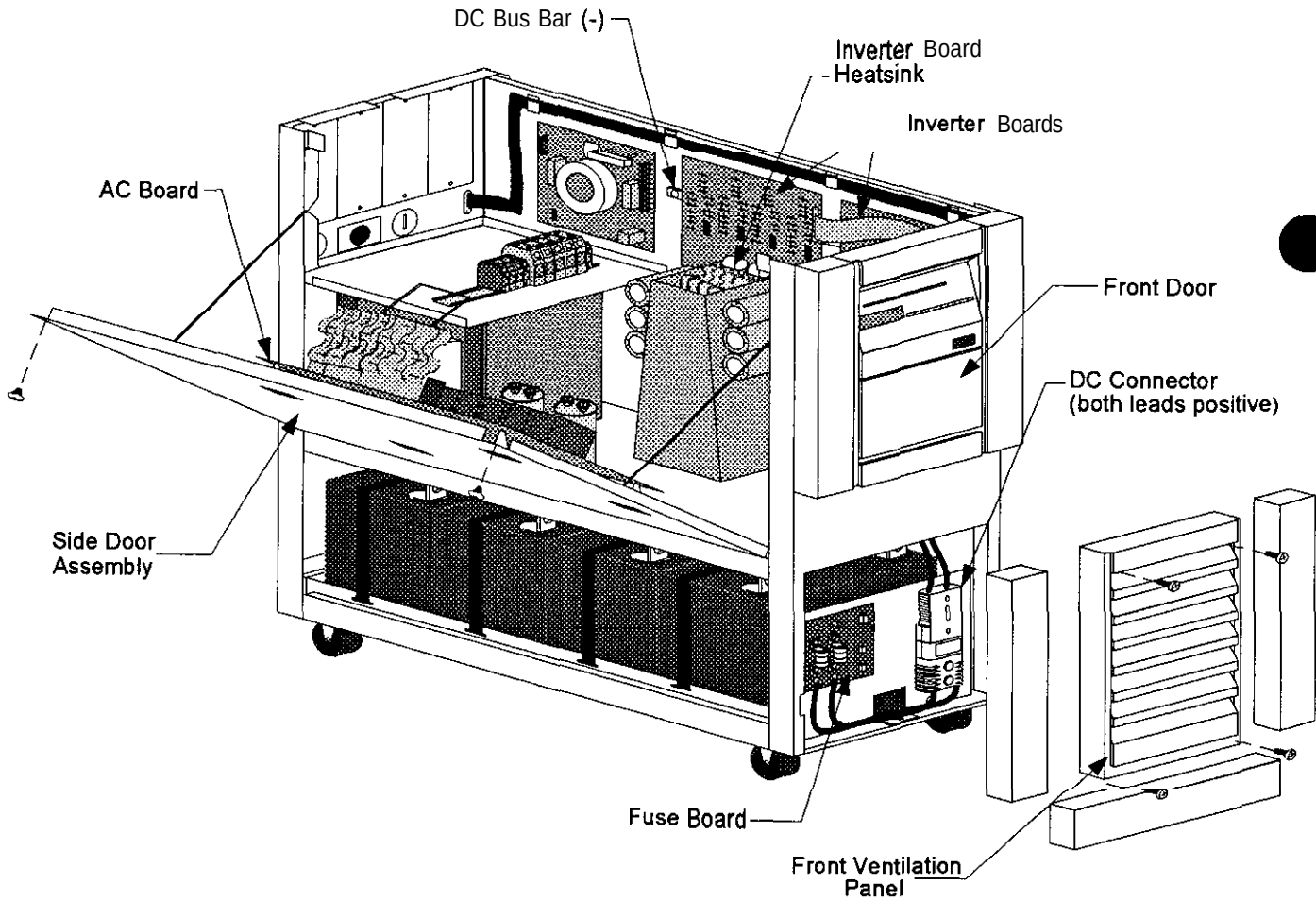

Figure 1

☐ 100-3. Remove AC input to the **UPS.** (Turning the key switch "Off" is **not sufficient.)**

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

☐ 100-5. Remove the screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1).

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2).

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the pre-charge switch after it is disconnected.

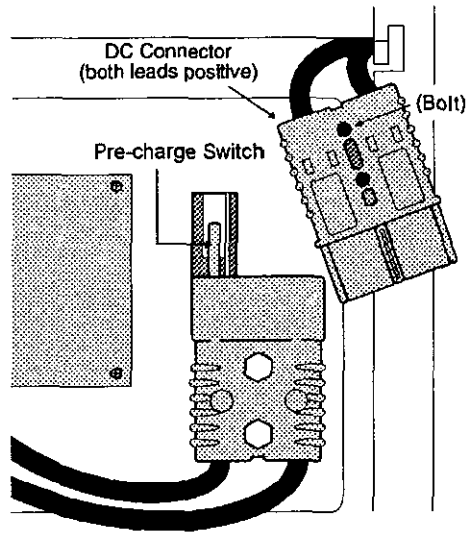

Figure 2

⚠ WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 200-l. Remove the seven screws from the side covers. Three ***screws*** are located on top of the unit, and two on each side panel.

☐ **200-2.** Lift each side cover **straight up, then** off.

Section 300: Discharging the Capacitors

- ❑ 300-l. With AC and DC power disconnected (see Section 100), turn the UPS key switch to "Auto" for at least five seconds. **Note:** The fans may come on and A-17 and A-13 alarms may be displayed. This is a normal indication.

- ☐ 300-2. Turn the UPS key switch back to "Off."

- ❑ 300-3. To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar **(-)** and one of the **outside** heatsinks on each inverter board (+), as shown in Figure 3. Measure the voltage on **both** inverter board heatsinks

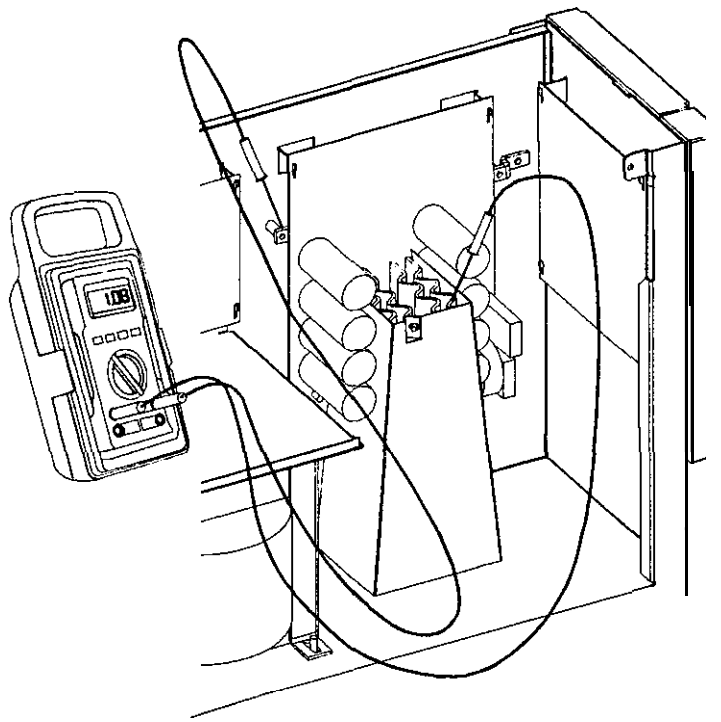

Figure 3

- ☐ 300-4. If the reading in step **300-3** is greater **than 5** volts, **wait five minutes** to allow the capacitors to discharge. Then, repeat steps 300-3 and 300-4 before continuing.

- ❑ 300-S. Remove the fast-on connector from E5 in the upper right comer of the fuse board. (See Figure 1 for the location of the fuse board).

Section 400: Removing the AC Board

⚠ WARNING

Make sure that AC is **completely removed** from the UPS input. If AC is present at the UPS input, sections of the AC board will be energized, even if the UPS key switch is turned "Off."

TEST BEFORE TOUCHING!

☐ 400-I. On the side door assembly, remove the three hex head screws that secure the AC boards nylon standoffs to the door (see Figure 4).

☐ 400-2. Remove the screws from the upper comers of the side door assembly that secure the door. (See Figure 4). Open the side door assembly.

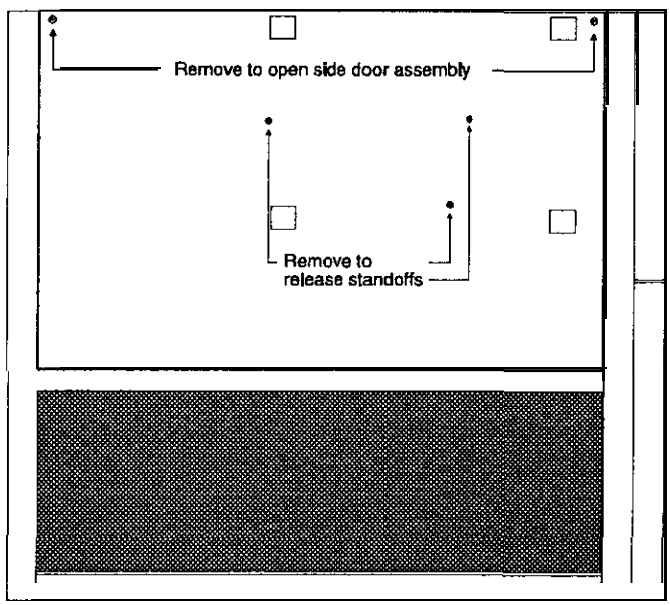

Figure 4

⚠ CAUTION

Wear an ESD strap to avoid damage to the circuit board!

☐ 400-3. Remove and label the following connectors from the AC board (see Figure 5) To release a locking connector, squeeze the sides of the connector while pulling away from the board.

- P1 from J1.
- P2 from J2.
- P3 from J3.
- Ribbon cable from J4.
- Locking connector from J5.
- Locking connector from J6.
- Locking connector from J7.
- Locking connector from J8.

❑ 400-4. Remove the screw and washer located near the large blue capacitor.

☐ 400-5. Carefully slide the board toward the top of the door and unseat it from the mounting notches, Remove the board from the unit.

Section 500: Replacing the AC Board

Refer to Figure 5 for board connections.

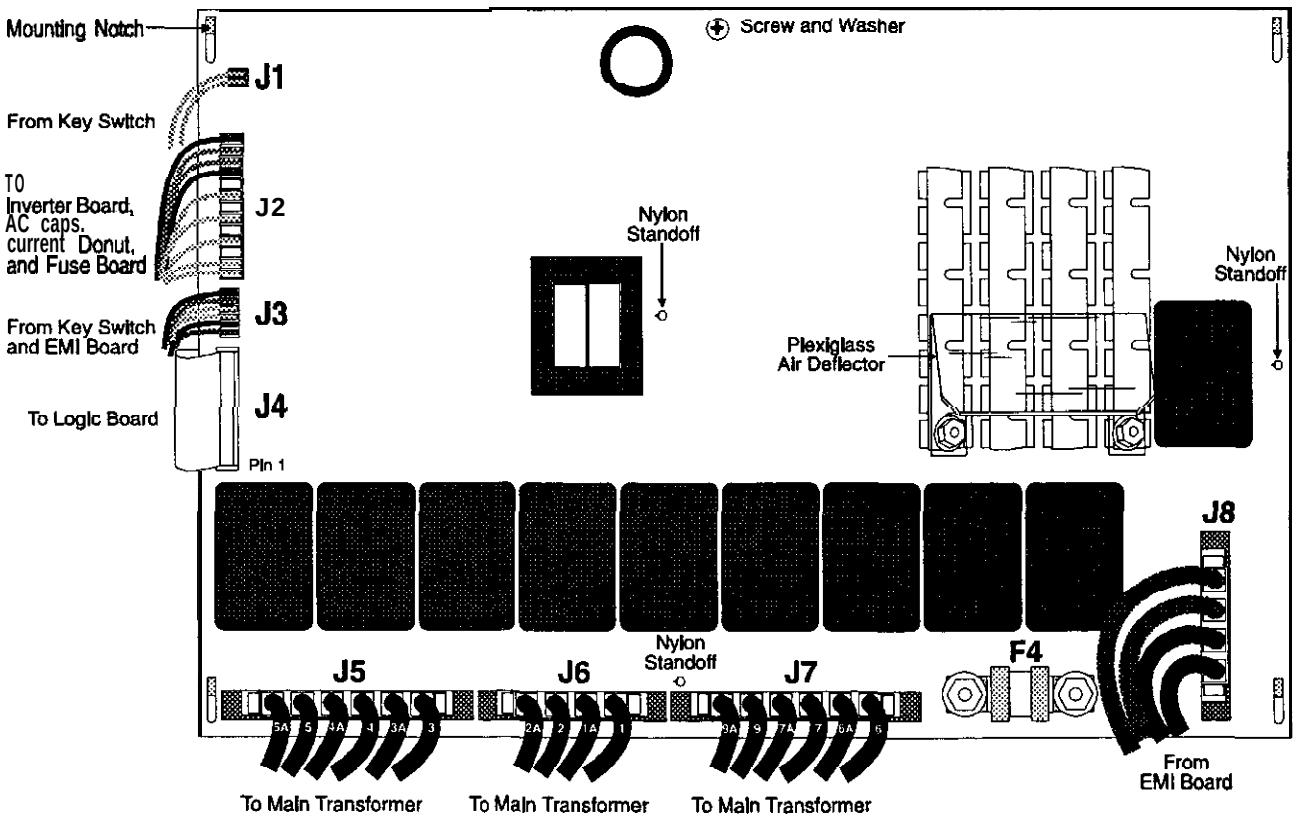

Figure 5

☐ 500-l. Remove the nylon standoffs from the old board

☐ 500-2. Put the nylon standoffs on the new board

☐ 500-3. Remove the plexiglass air deflector from the old board

☐ 500-4. Put the plexiglass air deflector on the new board

☐ 500-5. Mount the new board onto the side door. Be careful not to trap any of the connectors underneath the board.

☐ 500-6. Replace the washer and screw.

Cl 500-7. Reconnect the following:

- Locking connectors to J5, J6, J7, and J8.
- Ribbon cable to J4. Align the red stripe on the ribbon cable with pin 1 on J4.
- P3 to J3.
- P2 to J2.
- P1 to J1.

☐ 500-S. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the door and the chassis.

☐ 500-9. Replace the three hex head screws to secure the nylon standoffs to the side door.

Section 600: Restarting the UPS

☐ 600-1. Switch on the DC disconnect switches on the external battery cabinets (if applicable).

☐ 600-2. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board.

☐ 600-3. At the front of the unit, reconnect the top DC connector and secure it with the bolt.

☐ 600-4. Replace the front ventilation panel and secure it with the screws.

☐ 600-5. Reapply AC line

• i600-6. Perform the procedure in BEST publication UTY 601, "Verifying the Basic Operation of the Single-Phase UNITY/I UPS."

Best Power
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OWER SYSTEMS

UTY 647
June 1995

Replacing the Inverter Board in the UNITY/I™ UT8K

This document describes how to remove and replace the inverter board in the UNITY/I model UT8K. This procedure should be performed by a qualified service technician only. If you have any questions while performing this procedure, call BEST's Technical Support Center at I-800-356-5737 (U.S.A. and Canada) or your local BEST office.

IMPORTANT! BEST publication UTY 601 is **required** as part of this procedure

Tools required (use insulated tools):

Phillips screwdriver	DC voltmeter
7/1 6" nut driver	Personal safety equipment as required by local code
3/8" nut driver	ESD wrist strap
5/16" nut driver	BEST publication UTY 601

WARNING

1. These procedures should be performed by a qualified service technician only.

2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**

3. UPS batteries are high current sources. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage and injury A short circuit can cause a battery to explode.

This unit contains components that are sensitive to electrostatic discharge (ESD). If you do not follow proper ESD procedures, severe damage to electronic components may occur.

BEST recommends the following for the qualified technician servicing the UPS:

3. Remove rings, watches and other jewelry before servicing the UPS.
b. Always wear protective clothing and eye protection and use insulated tools when working near batteries.
c. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

UN-0647A

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Contents

Section 100: Disconnecting AC and DC Power

☐ 100-1. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "OR".

☐ 100-3. Completely remove the AC input to the UPS. (Note: Turning the key switch to "Off' is not sufficient.)

☐ 100-4. If you have one or more external battery cabinets, shut off the DC disconnect switches on all of the cabinets.

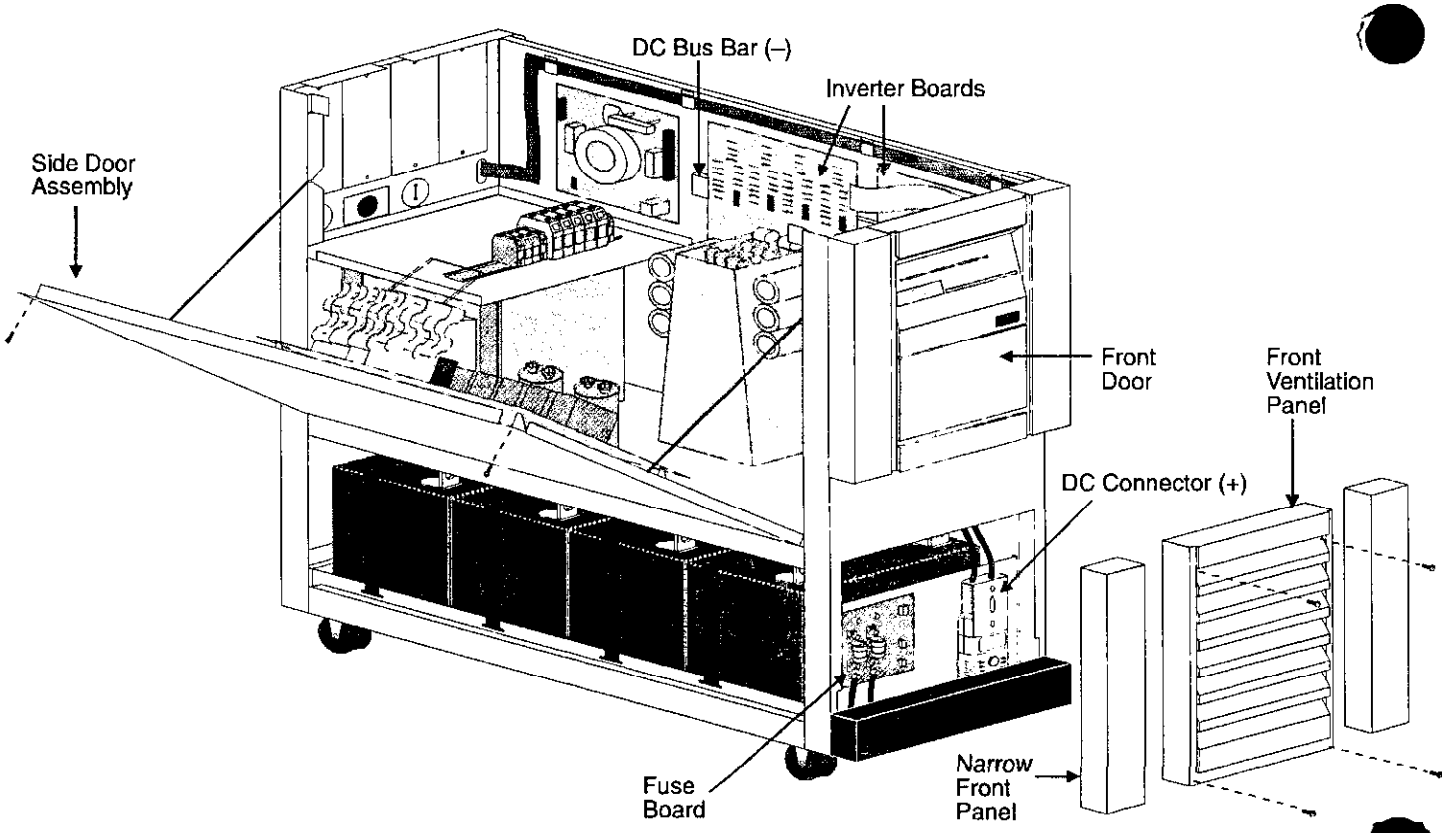

Figure 1: UNITY/I Model UT8K, Covers Removed

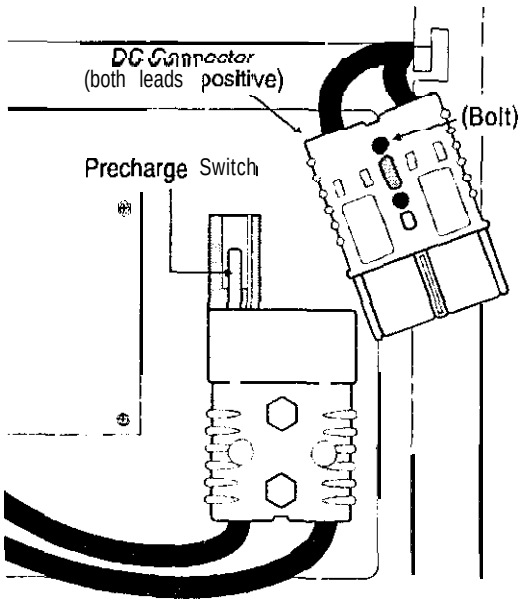

Figure 2: DC Connector

❑ 100-5. Remove the screws at the corners of the front ventilation panel and remove the panel from the unit (see Figure I). Also, remove the bottom narrow front panels.

☐ 100-6. Remove the bolt from the top DC connector (see Figure 2).

☐ 100-7. Disconnect the top DC connector (see Figure 2). Make sure that the connector does not contact the pre-charge switch after it is disconnected.

WARNING

There is still power inside the UPS! Do not service the unit until you have discharged the capacitors as instructed in Section 300.

Section 200: Removing the Side Covers

☐ 200-l. Remove the seven screws from the side covers. Three screws are located on top of the unit, and two on each side panel.

☐ 200-2. Lift each side cover **straight up,** then off.

☐ 200-3. Remove the screws in the upper corners of the side door assembly. Open the side door assembly (see Figure 1).

Section 300: Discharging the Capacitors

☐ **300-l.** **With AC and DC power disconnected** (see Section 100), turn the UPS key switch to "Auto" for at least five seconds.

NOTE: The unit will display A-17 and A-13 alarms. This is normal.

☐ 300-2. Turn the UPS key switch back to "Off."

❑ 300-3. To verify that the capacitors are discharged, use a voltmeter to measure the DC voltage between the DC bus bar (-) and one of the **outside** heatsinks on the inverter board (+), as shown in Figure 3.

NOTE: Check **each** inverter board to verify that the capacitors on each board are discharged.

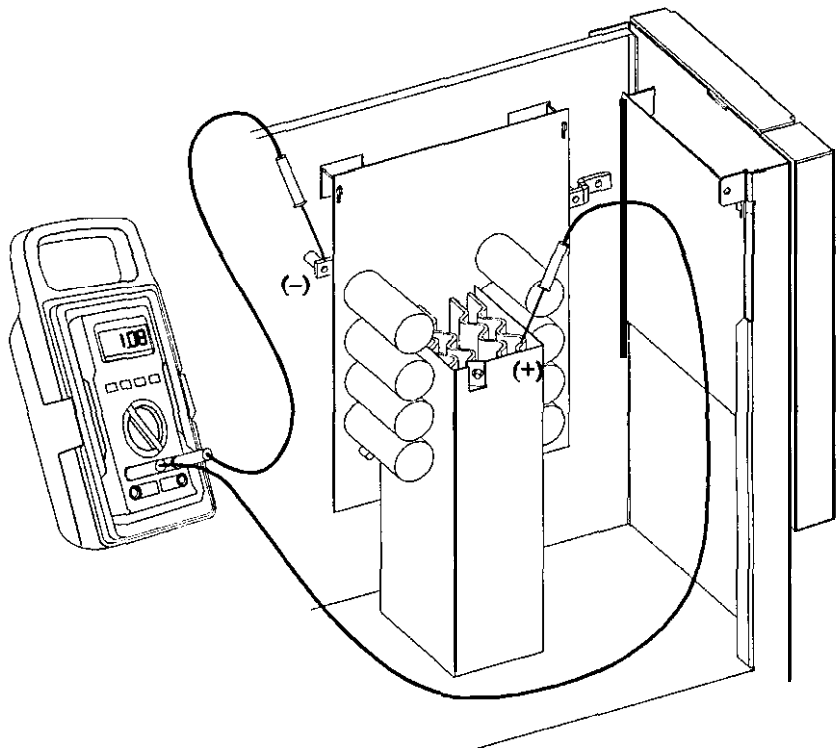

Figure 3: Verifying Capacitor Discharge

☐ 300-4. If the reading in step 300-3 is greater than 5 volts, wait five minutes to allow the capacitors to discharge. Then, repeat step 300-3 before continuing.

☐ 300-5. Remove the fast-on connector from E5 in the upper right comer of the fuse board. See Figure 1 for fuse board location.

Section 400: Removing the Inverter Board

WARNING

Before continuing, make sure that you have discharged the inverter board capacitors as instructed in Section 300. Failure to do so could result in personal injury or component damage.

There are two inverter boards in the UT8K. You can use the instructions below to remove one or both boards. Refer to Figure 4 for inverter board connections

☐ 400-l. Remove the nut and flat washer securing the fan shroud to the inverter board heatsink. Remove the fan shroud from the unit.

☐ 400-2. Disconnect the following from the inverter board:

- Ribbon cable from J1
- Plug P5 from J2 (left-hand inverter board only).
- Plug from J3.
- Fast-on connector from ES.

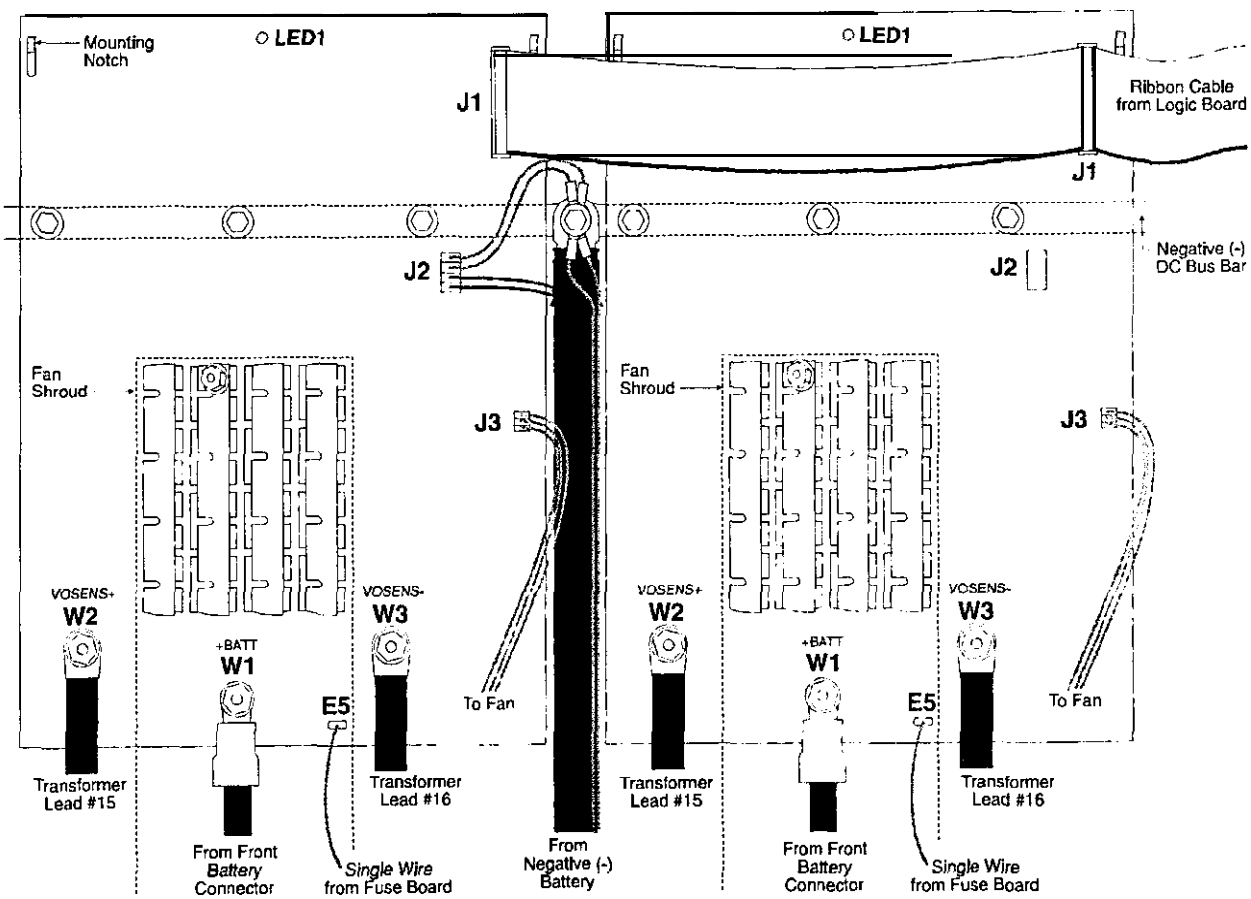

Figure 4: Znverter Board Connections

☐ 400-3. Remove the nut, flat washer, and transformer lead #16 from W3 (VOSENS-).

☐ 400-4. Remove the nut, flat washer, and transformer lead #15 from W2 (VOSENS+).

☐ 400-5. Remove the nut, flat washer, and battery cable from W1 (+BATT).

☐ 400-6. Remove the three bolts and flat washers securing the board to the DC bus bar.

☐ 400-7. You must wear an ESD wrist strap for the rest of this procedure. See the ESD warning on page 1.

☐ 400-S. Remove the board from the unit.

Section 500: Replacing the Inverter Board

Refer to Figure 4 for connection locations.

☐ 500-l. On the new board, there is a jumper connecting E5 to E6 (see Figure 5). **Remove the jumper from the board.**

☐ 500-2. Install the jumper (P/N RSA-0021) between E5 and E6 **on the old board** and place the old board in the ESD-protective bag. (The jumper keeps the inverter board capacitors discharged during shipment.)

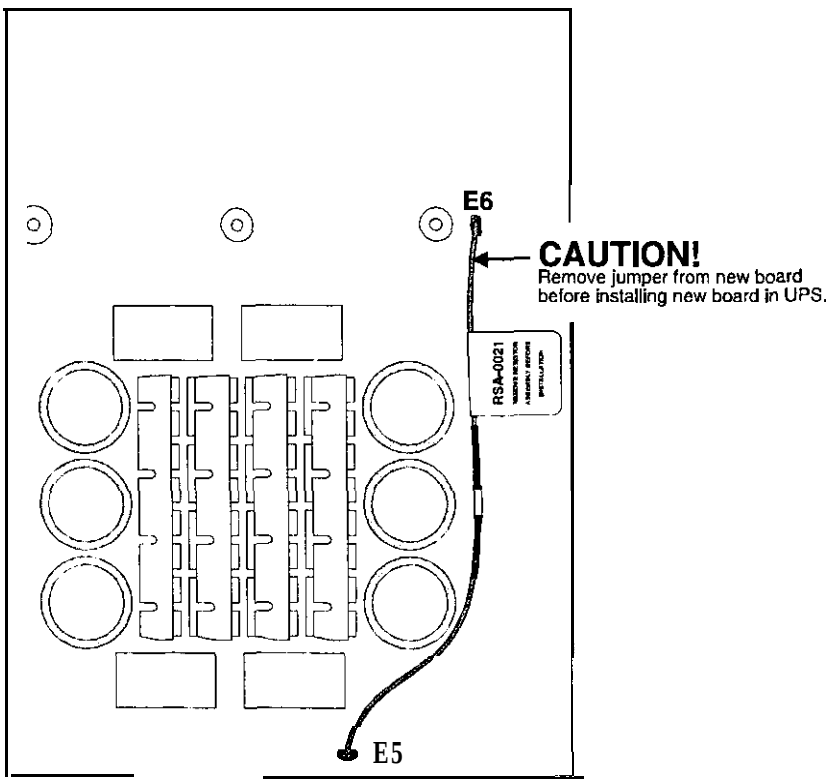

Figure 5: Jumper MA-0021 (remove before installing board)

☐ 500-3 Place the bottom edge of the new board in the mounting grooves and the upper corners of the board on the mounting notches.

☐ 500-4 Secure the board to the DC bus bar with the three washers and bolts,

☐ 500-5 Place the battery cable onto W1 (+BATT) and replace the washer and nut.

☐ 500-6. Place transformer lead #16 onto W3 (VOSENS-) and replace the washer and nut.

☐ 500-7. Place transformer lead #15 onto W2 (VOSENS+) and replace the washer and nut.

☐ 500-s. Reconnect the following on the inverter board:

- Fast-on connector to E5.
- Plug (from fan) to J3.
- Plug P5 to J2 (left-hand inverter board only).
- Ribbon cable to J1.

☐ 500-9. Slide the fan shroud tabs into the slots in the UPS chassis. Fasten the fan shroud to the inverter board heatsink with the flat washer and nut.

Section 600: Restarting the UPS

☐ 600-I. Close the side door assembly and secure it with the two screws. Make sure that no wires are pinched between the door and the chassis.

☐ 600-2. Switch on the DC switch(es) on the external battery cabinet(s), if applicable.

☐ 600-3. At the front of the unit, reconnect the fast-on connector to E5 on the fuse board.

☐ 600-4. At the front of the unit, reconnect the top DC connector and replace the bolt.

☐ 600-5. Replace the bottom narrow front panels and front ventilation panel.

☐ 600-6. Reapply AC line.

☐ 600-7. Perform the procedure in BEST publication UTY 601, "Verifying the Basic Operation of the Single-Phase UNITY/1 UPS."

Before shipping the old inverter board back to BEST (if applicable): (1) Make sure that the jumper (RSA-0021) is installed between E5 and E6 on the old board; (2) Place the old board in the ESD-protective bag; and (3) Pack the board properly. Write the RMA number on the outside of the package.

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TIP 410
01U
February 3, 2000

Operating the **Make-Before-Break** (MBB) Bypass Switch for FERRUPS®, BEST-Lites", ILS, Fortress@, and UNITY/I'" Installations

⚠ CAUTION

To avoid equipment damage, follow these instructions EVERY TIME you switch the MBB bypass switch from "UPS" to "LINE" or from "LINE" to "UPS." Equipment damage will result if you do not follow these instructions.

Contents

Section 100: FERRUPS, BEST-Lites, or ILS Systems

To switch the MBB bypass switch from "UPS" to "LINE" (or vice versa) with a FERRUPS, BEST-Lites, or Integrated Life Safety (ILS) system, **the UPS must be operating on AC line, and there mast be UPS output.**

Look at the front panel lights on your UPS:

DO NOT SWITCH if...

- AC LINE light is OFF
  and/or
- BATTERY POWER light is ON

NOTE: If a "DO NOT SWITCH" condition exists, see Section 400 for instructions.

OK TO SWITCH if...

- AC LINE light is ON
  and
- BATTERY POWER light is OFF
  and
- There is AC output power from the UPS (see note below).

NOTE: To determine if there is AC output power: (1) If the READY light is ON, there is output. (2) If the CHARGING light is ON, there is output. (3) If the unit has a control panel, check the output voltage **by** pressing [DISPLAY] [2] [ENTER]. (4) If a terminal is connected to the unit's communication port, check the output voltage by typing the command **D 2 <RETURN>.**

LPT-0410E

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Section 200: Fortress

To switch the MBB bypass switch from "UPS" to "LINE" (or vice versa) with a Fortress UPS, **the UPS must be running on AC line, and there must be UPS output.**

Look at the UPS front panel lights:

DO NOT SWITCH if one or more of the following conditions exists:

- BATTERY light is ON.
- BATTERY light is blinking.
- LINE light is OFF.
- LINE light is blinking.

NOTE: If a "DO NOT SWITCH" condition exists, see Section 400 for instructions.

OK TO SWITCH if...

- AC LINE light is ON (steady, not blinking)
  and
- BATTERY POWER light is OFF.

Section 300: UNITY/I Single-Phase

To switch the MBB bypass switch from "UPS" to "LINE" (or vice versa) with a UNITY/I single-phase UPS, **the UPS must be operating in BYPASS mode** (the BYPASS light must be ON).

To operate the bypass switch, enter the BYPASS mode by following the instructions below:

1. Enter the user password (377):
   a. Hold down the [CANCEL] and [RUNTIME] keys; release the keys when the display shows "P-00."
   b. Press [CANCEL]. The display should show "0."
   c. Press and hold the [%LOAD] key until the display shows "377." (If you go past "377," press [VOUT] to scroll backwards.)
   d. Press [RUNTIME]. The display should show "1."

2. Program parameter 62 (nominal input voltage):
   a. Press [CANCEL] to toggle-to the p&meter number. The display should show "P-00."
   b. Press [%LOAD] to scroll up to "P-62." (If you go past "P-62," press [VOUT] to scroll backwards.)
   c. Press [CANCEL] to toggle to the parameter value.
   d. Set the value to the nominal input voltage (200, 208, 220, 230, or 240). Press [%LOAD] to increase the setting or [VOUT] to decrease the setting.
   e. Press [RUNTIME] to enter the value. The new value should remain on the display.

3. Program parameter 63 to "1":
   a. Press [CANCEL] to toggle to the parameter number. The display should show "P-62."
   b. Press [%LOAD] to go to parameter 63 (P-63).
   c. Press [CANCEL]. The display should show "0."
   d. Press [%LOAD] to change the parameter value to "I."

e. Press [RUNTIME] to enter the new value. The display should still show "1," and the BYPASS light should be on; if not, repeat steps 1 - 3.

4. **If the BYPASS light will not come** on: When input line is bad, the UPS will not transfer to bypass mode, and the BYPASS light will not come on. Follow these steps:
   a. Turn off the load equipment.
   b. Turn the UPS keyswitch to "OFF."
   c. Turn the AC Disconnect switch to "OFF."
   d. Turn the MBB bypass switch to "LINE."
   e. Turn on the load equipment.

5. If the BYPASS light came on, you can safely operate the MBB bypass switch. Quickly turn the bypass switch from "UPS" to "LINE."

To switch from "LINE" back to "UPS":

6. Before continuing:
   a. If you disconnected AC input, reapply AC line,
   b. Turn the UPS key switch to "AUTO."
   c. Look at the UPS front panel lights:
      - The ALARM light should be ON (to indicate an Auto Bypass alarm).
      - The BYPASS light should be ON.

   IMPORTANT! If either the ALARM or BYPASS light is OFF, repeat steps 1 and 3 before continuing.

7. Quickly turn the bypass switch back to "UPS."

8. Enter the user password (377). (See step 1.)

9. Program parameter 63 back to "0":
   a. Press [CANCEL] to toggle to the parameter number. The display should show "P-00."
   b. Press [%LOAD] to scroll to "P-63." (Use [VOUT] to scroll backwards if you go past "P-63.")
   c. Press [CANCEL]. The display should show "1."
   d. Press [VOUT] to change the value to "0."
   e. Press [RUNTIME]. The display should show "0," and the BYPASS and ALARM lights should now be OFF.

   If the BYPASS light will **not turn off:** When input line is bad, the UPS will not transfer out of bypass mode, and the BYPASS light will stay on. If this occurs, you must wait until input AC line is good. If the BYPASS light stays on for an extended period of time, have an electrician check your AC line or call Best Power Worldwide Service at 1-800-356-5737 or 1-608-565-2100.

10. Press [VLINE] twice to exit the parameter mode.

The load equipment is now protected by the UPS

Section 400: What to do if a "DO NOT SWITCH" Condition Exists

The instructions in this section are for FERRUPS, BEST-Lites, ILS, and Fortress units only. (For UNITY/1 Single-Phase UPS, **always** follow the step-by-step instructions in Section 300.)

If the front panel lights on your UPS indicate a **DO NOT SWITCH** condition:

- If the bypass switch is presently in the "LINE" position, **do not switch** the bypass switch. Call Worldwide Service* for assistance to determine the condition of the UPS.
- If the bypass switch is presently in the "UPS" position, follow the instructions below to safely switch from "UPS" to "LINE."

1. Turn off the load equipment.
2. Shut off the UPS. Follow the shutdown procedure in your User Manual.
3. Turn off the circuit breaker at the main service panel to disconnect AC line input to the bypass switch and the UPS.
4. If applicable, turn the AC Disconnect switch OFF.
5. Turn the bypass switch to "LINE."
6. To power the load equipment from the bypass source:
   a. Turn on the circuit breaker at the main service panel.
   b. If applicable, turn the AC Disconnect switch ON.
   c. Turn on the load equipment.

   NOTE: While the load equipment is powered from the bypass source, the UPS does not protect the loads.
7. To return from "LINE" to "UPS," see Section 100 (FERRUPS, BEST-Lites, or ILS System) or Section 200 (Fortress). If a "DO NOT SWITCH" condition still exists, call Worldwide Service* for assistance.

* Best Power Worldwide Service: 1-800-356-5737 (U.S.A. or Canada) or 1-608-565-2100
Dual-Lite Worldwide Service: 1-800-848-6439 (U.S.A. or Canada only).

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Connecting External Battery Pack(s) to the UNITY/I Single-Phase UPS Models UT3K, UT4K, UT5K and UTSK

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

If you have any questions or problems while performing this procedure, call Best Power's Worldwide Service center at l-800-356-5737 (U.S. and Canada), or l-608-565-2100, or call the nearest Best Power office.

Tools required (use insulated tools):

Wire cutter
Phillips screwdriver, 1/4-inch nutdriver or wrench
7/1 6-inch nutdriver or wrench
UNITY/I User and Installation Manuals
Personal safety equipment as required by local code

SAFETY INFORMATION

Follow these important safety instructions when installing external battery packs

⚠ CAUTION

Full voltage and current are always present at the battery terminals. Keep unauthorized personnel away from batteries.

The batteries used in this system can produce dangerous voltages, extremely high currents and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). Be extremely careful to avoid contacting battery terminals during battery installation. Do not touch uninsulated battery terminals.

A qualified service person who is familiar with battery systems and required precautions must service the batteries. Batteries must be replaced with Best Power battery number BAT-XXXX or equivalent. Best Power's batteries come with a one-year warranty. Using batteries not supplied by Best Power invalidates any Best Power service agreement.

FSS-0393C

9/14/98

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Service: 1-800-356-5737 / Fax: 1-608-565-2509 / Fax-On-Demand: 1-800-487-6813

⚠ CAUTION

1. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated. Released electrolyte is harmful to the skin and eyes. It may be toxic. Wear protective clothing and eye wear. Remove rings and metal wristwatches or other jewelry. Do not carry metal objects in your pockets; these objects could fall into the battery cabinet or UPS. Disconnect battery cabinets from each other before servicing.

I. Tools must be insulated so that they will not short battery terminals. Do not allow a tool to short a battery terminal to another battery terminal or to the cabinet. Do not lay tools or metal parts on top of the batteries.

3. The grounding bolt on the back of the UPS must be connected to the grounding wire from the battery pack. This connects the battery pack's chassis (ground to earth) to the UPS chassis (ground to earth). Ground additional battery packs to each other.

4. If you are replacing batteries or repairing battery connections, shut off the UPS, and remove both AC and DC input power. Follow the procedures for shutting down power found in the *UNITY/I User Manual*. For information on battery replacement, call Best Power's Worldwide Service or the nearest Best Power office.

- **The UNITY/I weighs from 215lbs/98kg to 490lbs/222kg depending on model. External battery packs are also heavy.**
  See Section 500 in the *UNITY/I User Manual* for UPS weights and dimensions, and ask your sales representative for battery cabinet weights. Make sure that you are prepared for these weights before you unload or move the UPS or batteries.

- **The temperature should be below 77 ° F (25" C) for the best battery performance.**
  Batteries will be less efficient at temperatures below 65" F (18° C), and high temperatures will reduce battery life. Typically, at about 95" F (35" C), battery life will be one-half of what it would be at a normal temperature of 77" F (25" C). At about 113° F (45" C), battery life will be one-fourth of normal.

  Make sure that heaters, sunlight, air conditioners, or outside air vents arc not directed toward the batteries. These can make temperatures within battery strings vary, which can cause differences in tbe batteries' voltages. Eventually, this could affect battery performance.

- **Use the Same Number and Type of Battery.**
  To ensure continued superior performance of your UPS and to maintain proper battery charger operation, you must replace the batteries in the UPS or its battery cabinets with the same number of **batteries.** These batteries must be the same type as the original batteries: valve-regulated, low-maintenance. The replacement batteries should have the same voltage and ampere hour rating as the original batteries. Any battery used with this UPS shall comply with the applicable requirements for batteries in the standard for emergency lighting and power equipment, UL 924. The installation must conform to national and local codes.

- **Do You Need to Remove Ground from the Battery Terminal?**
  If your local or national code requires you to ground either battery terminal, remove the connection from the terminal to ground (earth) before you service the batteries. If any battery terminal is inadvertently grounded, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. An electric shock will be less likely if you disconnect the ground connection before you service the batteries

- **Dispose of batteries properly.**
  Assume that old batteries are fully charged. Use the same precautions you would use when handling a new battery. Do not dispose of battery or batteries in a fire. The battery may explode. Batteries contain lead. Many state and local governments have regulations for disposing of batteries.

External Battery Pack Installation

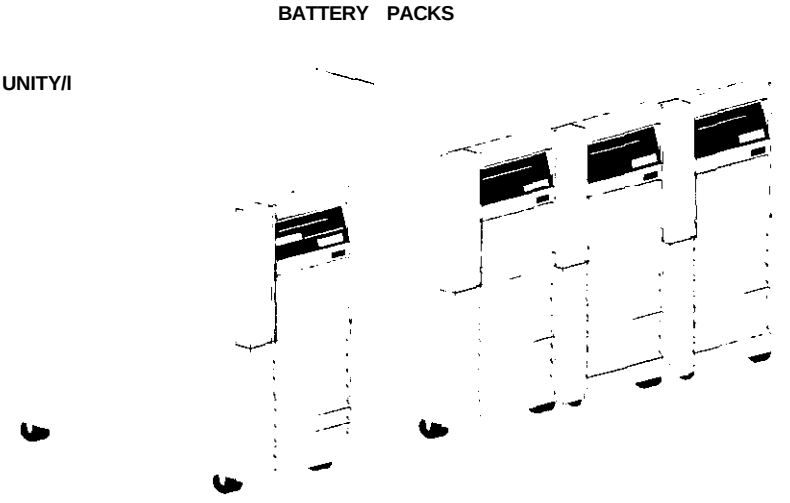


Figure 1: UNITY/I UPS and Battery Packs

1 Make sure the key switch inside the front door of the UPS is turned to "OFF." Plug in the UPS to establish a ground connection. If you have a hardwired unit, see Section 206 of the *UNITY/I User Manual* for proper shutdown procedures.

2 Place the battery pack(s) next to the UPS (see Figure 1). Leave at least 4 inches (100 mm) of space at the rear and top of the battery pack(s) for ventilation, and 36 inches (910mm) at the front, Leave 4 inches (100mm) between the battery pack and the UPS. Best Power also recommends a 36 inch (910mm) service clearance on the right side of the battery pack(s).

3 Installation of the stabilizer bracket is required to meet TÜV requirements, per standards EN 60 950 and EN 50091-l.

a. Place the battery pack near its permanent location. You will need access to the back of the unit. The battery pack is easier to move before the stabilizer bracket is attached.

b. Place the stabilizer bracket flat against the back panel of the battery pack. The base of the stabilizer bracket will rest on the floor.

c. Use the bolts that came with your battery pack to secure the bracket to the back of the battery pack (see Figure 2).

d. Repeat for additional battery packs.

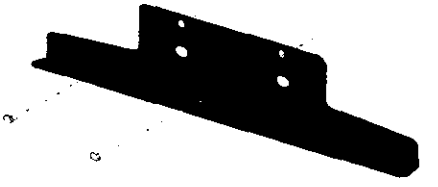


Figure 2: Stabilizer Bracket

4 Attach the ground cable:

a. The ground cable (green) is tie-wrapped with the DC cables on the back of the UPS. Use a wire cutter to cut the section of tie-wrap which is threaded through the ring connector (see Figure 3). The ring connector is attached to the end of the ground cable.

NOTE: Be careful not to cut the cables. Do not cut any of the other tie-wraps.

b. Pull the DC box out of the back of the battery pack (see Figure 4). Remove the packing material from behind the box.

c. Remove the bolt, labeled with the ground symbol, from the back **of the UPS (see** Figure 5).

d. Put the bolt you removed from the UPS into the ring connector at the end of the grounding cable.

e. Use the bolt to attach the ground cable to the UPS (see Figure 5).

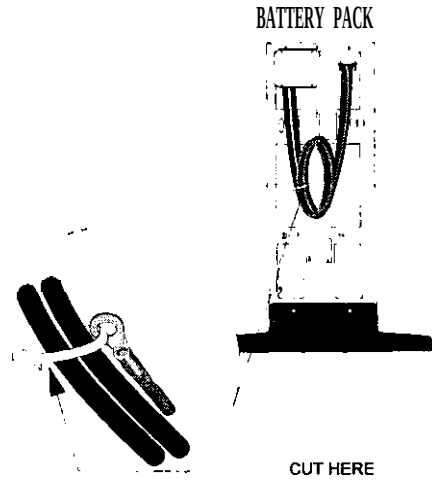


Figure 3: Tie-wrap

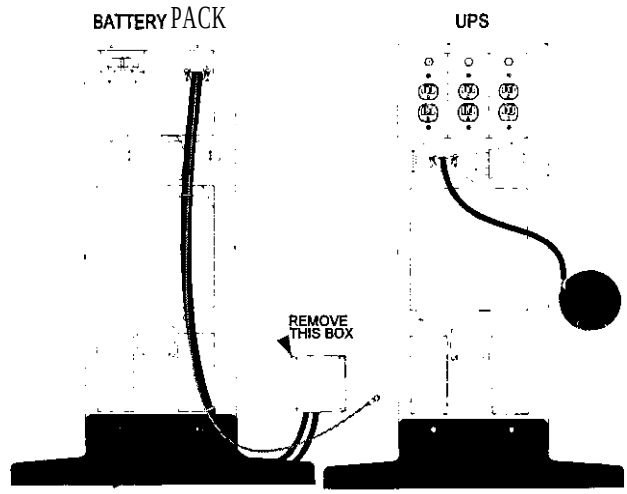


Figure 4: Remove DC Box

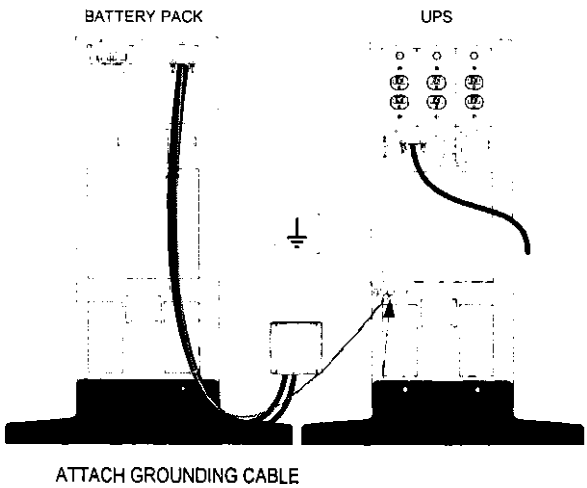


Figure 5: Attach Ground Cable

f. If you have more than one battery pack, connect the ground cable of the second battery pack to the bolt on the first battery pack. Repeat for additional battery packs (see Figure 9).

5 **Connect the DC cable:**

a. Remove the two screws holding the metal plate to the back of the UPS (see Figure 6). You may discard these screws.

b. Insert the DC box into the back of the UPS (see Figure 7).

If your UPS has **more than one** external battery pack, go to step d (skip step c).

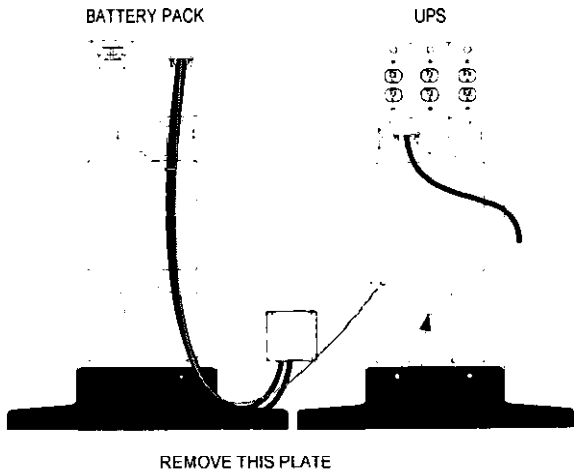


Figure 6: Remove metal plate

c. If your UPS has **one** external battery pack, attach the metal plate to the back of the battery cabinet (see Figure 7). Use the two screws attached at the base of the opening where you removed the DC box (see Figure 8). You are finished connecting the cables; go to step 6.

d. If your UPS has **more than one** external battery pack, put the DC box from the second battery pack into the connector on the back of the first battery pack (see Figure 9).

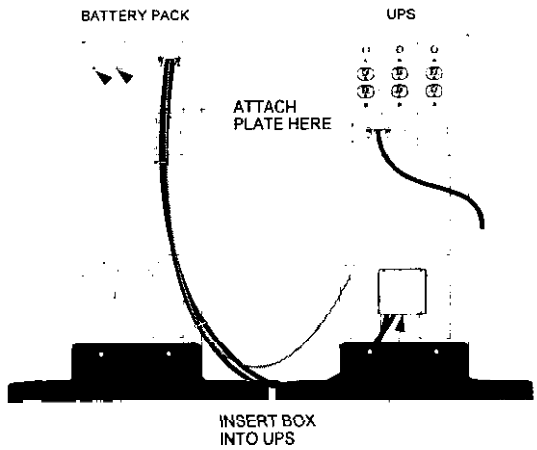


Figure 7: Connect DC

e. Put the DC box from the third battery pack into the connector on the back of the second battery pack (see Figure 9).

f. Unscrew the two screws, at the base of the opening where you removed the DC box, on the back of the last battery pack (see Figure 8). Use these screws to attach the metal plate to the back of the last battery cabinet.

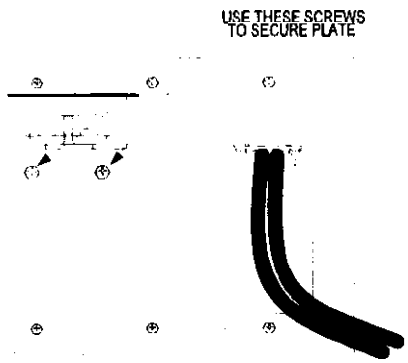


Figure 8: Secure Plate

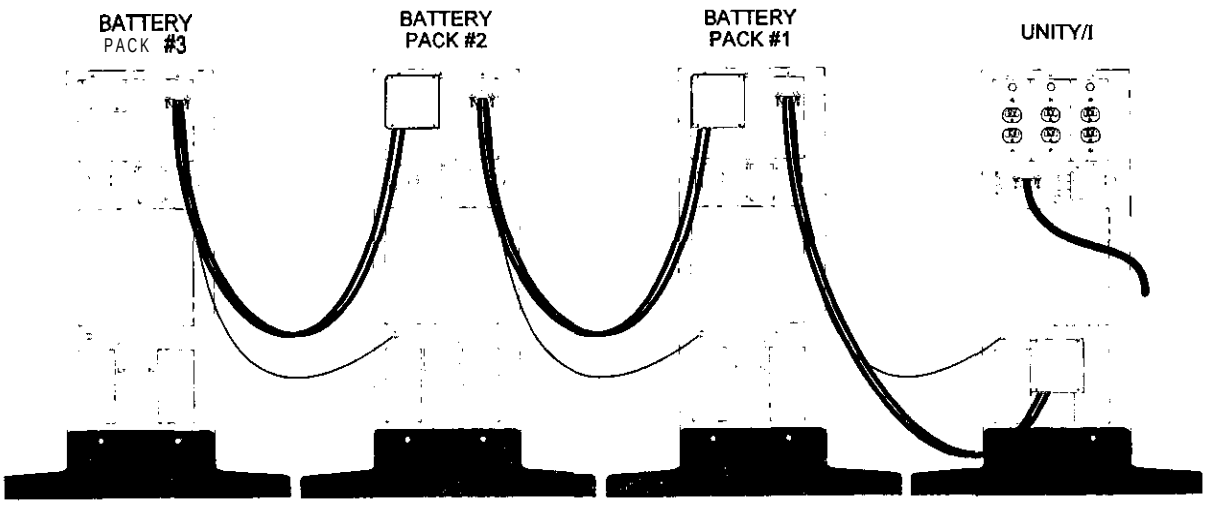


Figure 9: Connecting Two or Three Battery Packs to the UNITY/I UPS

6 **You have finished connecting the external batteries.**

a. Hold down the Precharge switch on the front of the battery cabinet for five seconds (see Figure 10).

b Insert the key into the main DC switch on the front of the battery cabinet. Turn it clockwise. then pull the switch out, toward you&elf. The ON-LINE LED will light on the battery pack cabinet.

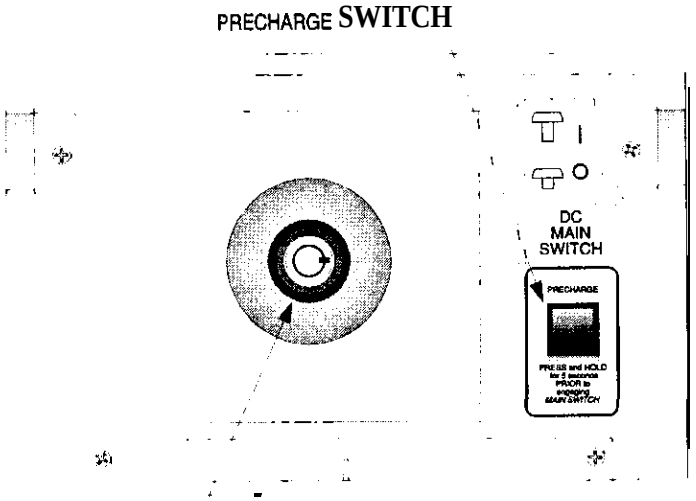


Figure 10: Battery Pack Front Panel

c Turn the key switch inside the front door of the UPS to "AUTO." The yellow BATTERY light will turn on briefly, then the green LINE light will turn on.

If the red ALARM light is on: See Section 204 in the *UNITY/I* User *Manual* before continuing. Do not continue until the green LINE light has come on.

NOTE: **If this is the initial installation of a hardwired unit,** turn to the "Voltage and Phase Check" section in the *UNITY/I Installation Manual.* Then, continue with step 7 of this document to set the UPS parameters for increased battery capacity.

7

Because the UNITY/I UPS is operating with increased battery capacity, three UPS parameters must be set. The parameters to be changed are P-55 (Battery Capacity), P-57 (Runtime Constant I), and P-58 (Runtime Constant 2).

If **you** have **more than one** external battery pack, or if your UPS **does not have internal batteries, see** the tables in Appendix A to find the correct parameter value

To set these parameters:

a. Determine the model number of the UPS and battery pack(s). The model number of the UPS is **on** the label by the key switch on the front of the UPS. The model number of the battery pack(s) is on a label by the power cable on the back of the battery pack cabinet.

b. Determine if your UNITY/I UPS has standard internal batteries.

c. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two seconds. Release the keys when the display shows P - 0 0. Then, press [CANCEL]. The display will read 0.

d. Enter the password 2639. Use the [%LOAD] key to increase the display to 2 6 3 9. If you scroll past the number, use the [VOUT] key to decrease the value.

e. **Press** [RUNTIME] to enter the password. The display should show 2.

NOTE: If the display is inactive (no keys are pressed) for five minutes, the password reverts back to level "0" and you must re-enter the password.

f. Press [CANCEL] to return to the parameter number display (P-XX). The [CANCEL] key allows you to toggle between the parameter number and parameter value.

g. Use the [%LOAD] to step to the parameter that you wish to change (P-55, P-57, or P-58). Use the [VOUT] key if you need to decrease the number. Then, press [CANCEL] to display the parameter value.

See Tables l-3 to determine the correct setting for Parameters 55, 57, and 58. Tables l-3 are for units **with internal batteries** and **one** external battery pack.

- Press [%LOAD] to increase the setting, [VOUT] to decrease the setting.

h. To enter the new value, press [RUNTIME]. The UPS beeps to indicate that the new value has been entered. If you do *not* wish to save a change that you have made, press [VLINE] and the value will remain at its original setting.

i. To change the remaining parameters, repeat steps f - h.

j. To escape parameter mode, press [VLINE] twice.

Table 1: Parameter 55 (Battery Capacity)

Battery Pack	UT3K	UT4K	UT5K	UT8K
EBPUT1	66	66	66	108
EBPUT2 EBPUT2W EBPUT3W	99	99	99	141
EBPUT21 EBPUT6	108	108	108	150

*Internal extended runtime.

Table 2: Parameter 57 (K1)

Battery Pack	UT3K	UT4K	UT5K	UT8K
EBPUTI	1.91	1.00	0.40	0.00
EBPUT2 EBPUT2W EBPUT3W	3.17	1.50	0.60	0.00
EBPUT21 EBPUT6	4.09	1.86	0.75	0.00

*Internal extended runtime.

Table 3: Parameter 58 (K2)**

Battery Pack	UT3K	UT4K	UT5K	UT8K
EBPUTI	1C43	D70	FAO	1C4B
EBPUT2 EBPUT2W EBPUT3W	2EEA	1428	1770	23E2
EBPUT21 EBPUT6	3C7B	190A	1D1E	2968

*Internal extended runtime.
**Parameter 58 is represented as a hexadecimal number.

APPENDIX A: Additional Parameter Tables

If you have **more than** one external battery pack, **or** if your UPS **does not have internal batteries,** use the following tables to determine the correct parameter settings for your system If there are more than three battery cabinets in a system, parameters will have to be calculated individually; call Best Power Worldwide Service for more information.

Use Table A to add up the amp-hours of each battery pack along with the amp-hours of the internal batteries to arrive at the total amp-hours for the system. For example, a UT5K with internal batteries, a EBPUT2, and an EBPUT1, would have a system amp-hour of **33 + 66 + 33** = 132A•h.

After determining the system amp-hours, set parameter 55 (Battery capacity) to this value. For information on setting battery parameters, see step 7 of this document.

You can use this value with the following tables to determine the values for parameters 57 (Kl) and 58 (K2). Tables B-D correspond to a particular UPS model. The system amp-hours are in the first column. The row shows the values to input for P-57 and P-58.

Table A: Battery Amp-hours for all UNITY/I models

Model number	Battery A•h
UT3K without internal batteries	0
UT3K	33
UT4K without internal batteries	0
UT4K	33
UT5K without internal batteries	0
UT5K	33
UT8K without internal batteries	0
UT8K	75
EBPUT1	33
EBPUR	66
EBPUT2W	66
EBPUT3W	66
EBPUT6	75
EBPUT7	150
EBPUT21	75
EBPUT22	150

To determine P-57 and P-58 for the previous example (a UT5K with internal batteries, an EBPUT2, and an EBPUT1), use the table for a UT5K with 33A•h batteries. Find the system A•h (132) in the first column. The row shows the value for P-57 is 0.80; the value for P-58 is 1F40.

NOTE: Parameter 58 is shown as a hexadecimal number. If your unit has software v1.00-v. 1.03, call Best Power Worldwide Service for information on converting hexadecimal to decimal notation.

able B: UT3K/UT4K with 33A•h batteries or no internal batteries

System A•h	P-57	P-58	System A•h (continued)	P-57	P-58
0	0.00	0000	255	3.86	33EB
33	0.50	06B8	270	4.09	36F9
66	1.00	0D70	279	4.23	38CE
90	1.36	1253	303	4.59	3DB1
99	1.50	1428	312	4.73	3F86
123	1.86	190B	336	5.09	4469
132	2.00	1AE0	345	5.23	463E
156	2.36	1FC3	360	5.45	494C
165	2.50	2198	369	5.59	4B21
180	2.73	24A6	393	5.95	5004
189	2.86	267B	426	6.45	56BC
198	3.00	2850	450	6.82	5B9F
213	3.23	2B5E	459	6.95	5D74
222	3.36	2D33	483	7.32	6257
231	3.50	2F08	540	8.18	6DF1
246	3.73	3216	573	8.68	74A9

Table C: UT5K with 33A•h batteries or no ernal batteries

System A•h	P-57	P-58	System A•h (continued)	P-57	P-58
0	0.00	0000	255	1.55	3C5F
33	0.20	07D0	270	1.64	3FEC
66	0.40	0FA0	279	1.69	420D
90	0.55	154F	303	1.84	47BC
99	0.60	1770	312	1.89	49DD
123	0.75	1D1F	336	2.04	4F8C
132	0.80	1F40	345	2.09	51AD
156	0.95	24EF	360	2.18	553A
165	1.00	2710	369	2.24	575C
180	1.09	2A9D	393	2.38	5D0A
189	1.15	2CBF	426	2.58	64DA
198	1.20	2EE0	450	2.73	6A89
213	1.29	326D	459	2.78	6CAA
222	1.35	348F	483	2.93	7259
231	1.40	36B0	540	3.27	7FD7
246	1.49	3A3D	573	3.47	87A7

Table D: UT8K with 75A•h batteries or no internal batteries

System A•h	P-57	P-58	System A•h (continued)	P-57	P-58
0	0.00	0000	300	0.00	52D0
75	0.00	14B4	375	0.00	6784
150	0.00	2968	450	0.00	7C38
225	0.00	3EIC	525	0.00	90EC

Best Power
NINTERRUPTIBLE
JWER SYSTEMS

UTY 320
November 19.1996

Connecting Customer-Supplied External Battery Packs to the Single-Phase UNITY/P UT8K

This document supplements the battery installation instructions in your UNITY/I Installation Manual. The instructions in the manual explain how to connect Best Power-supplied battery cabinets; this document (UTY 320) provides guidelines for customers who are supplying their own battery packs. This procedure must be performed by a qualified service person only. If you have any questions, call Best Power's Worldwide Service at l-800-356-5737 (U.S.A. or Canada) or l-608-565-2100, or call the nearest Best Power office.

NOTE: UNITY/I models come with one of two internal chargers: 1) the standard charger or 2) the optional auxiliary charger. If you did not order the auxiliary charger, the UPS cannot charge battery strings of more than 200AH to full capacity. If you are using an external charger, please call Best Power for assistance. The nominal voltage of your battery system should be 48 VDC.

Tools **required (use insulated tools):**

Phillips screwdriver
Personal safety equipment required by local codes
7/16-inch Nutdriver
DC voltmeter

⚠ CAUTION

1. **This procedure must only be performed by a qualified service person who is familiar with battery systems and required precautions. The installation must conform to national and local codes.**
2. UPS units are designed to provide power under a variety of operating conditions. Dangerous voltages may be present even if input AC line or DC voltage is removed. **Remove all AC and DC power sources. TEST BEFORE TOUCHING!**
3. **UPS batteries can produce dangerous voltage, extremely high current, and a risk of electric shock. They may cause severe injury if the terminals are shorted together or to ground (earth). Be extremely careful to avoid electric shock and burns caused by contacting battery terminals or shorting terminals when you connect the battery packs. Do not touch uninsulated battery terminals. Shorting battery terminals or DC terminal strip terminals can cause severe arcing, equipment damage, and injury. A short circuit can cause a battery to explode When working near batteries, always wear protective clothing and eye protection, and use insulated tools.**
4. Where conductors may be exposed to physical damage, protect the conductors in accordance with NEC NFPA 70 or local or national codes.

Best Power recommends the following for qualified service personnel who are connecting the batteries:

a. Remove rings, watches, and other jewelry before connecting the batteries.
b. When working near batteries, always wear protective clothing and eye protection, and use insulated tools. Batteries contain caustic acids and toxic materials and can rupture or leak if mistreated.
c. Do not carry metal objects in your pockets where the objects can fall onto the batteries.
d. Whenever you are servicing an energized unit with the cover removed, electric shock is possible. Follow all local safety codes.

UN-0320A

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

Contents

Section 100: Disconnecting AC Power

Complete AC installation before installing the external batteries. After AC installation, use this section to make sure all AC power to the UPS is off.

☐ 100-1. If there is an external bypass switch, you may use it to bypass the UPS. Otherwise, shut down the load equipment.

☐ 100-2. Open the front door of the UPS. Turn the key switch to "Off."

☐ 100-3. Remove AC input to the UPS by shutting off the breaker at the service panel. (Turning the UPS key switch to "Off' is **not sufficient.)**

☐ 100-4. Remove the four screws at the comers of the front ventilation panel and remove the panel from the unit (see Figure 1). Then, remove the three narrow front panels shown by sliding them off of the UPS.

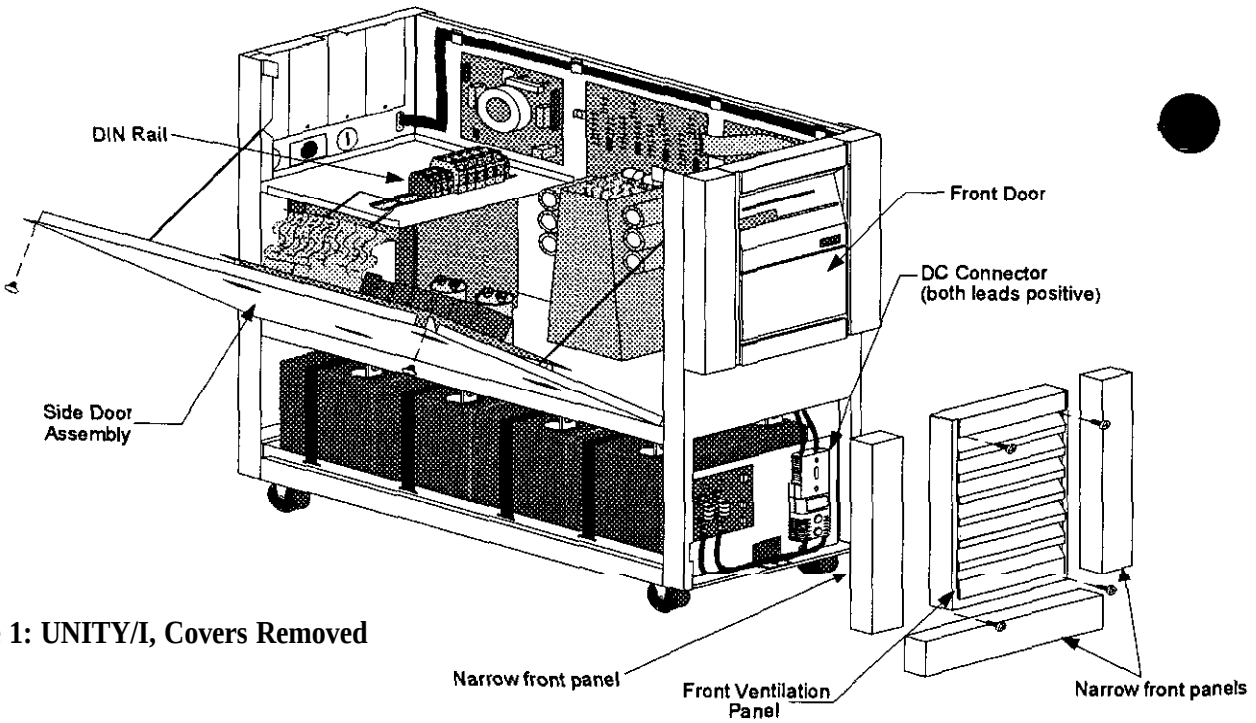


Figure 1: UNITY/I, Covers Removed

☐ 100-5. Remove the bolt from the top DC connector (see Figure 2 on the next page).

☐ 100-6. Disconnect the top DC connector (see Figure 2 on the next page). Make sure that the connector does not contact the pre-charge switch after it is disconnected.

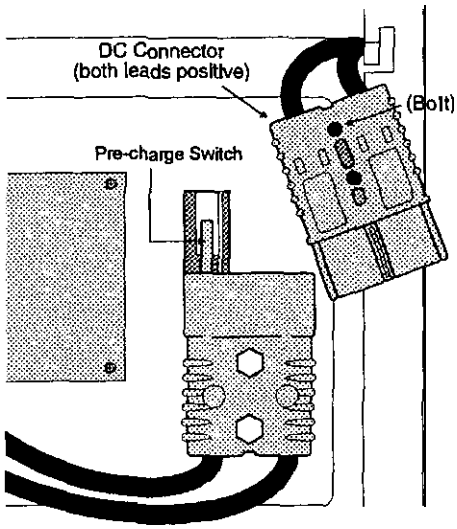


Figure 2: DC Connector

Section 200: Removing the Side Covers

☐ 200-I. Remove the seven screws from the side covers. Three of these screws are on tap of the unit, and two are on each side panel.

☐ 200-2. Lift each side cover **straight up, then off.**

☐ 200-3. Remove the two screws in the upper comers of the side door assembly as shown in Figure 1. Open the side door assembly.

Section 300: Connecting the External Batteries

☐ 300-l During AC installation, you should have removed a knockout in the back panel of the UPS so you can route the battery cables into the UPS. (See the Installation Manual.)

Note: Wherever conductors may be exposed to physical damage, you must protect the conductors in accordance with National Electrical Code NFPA 70 (in the U.S.; in other areas, follow local codes). This includes battery cables between **the** UPS and **the battery** cabinet **and cables between** battery cabinets

☐ 300-2 Your battery system should **be** installed and **ready** to **connect** to the UPS. Your battery pack should have positive (+) and negative (-) cables that you can connect to the UPS DIN rail terminals. If your battery pack requires a ground connection to the UPS, you must also have a ground wire from the **battery** pack that can be connected to the UPS DIN rail terminals. Pull the cables through the knockout you removed from the back of the UPS.

❑ 300-3 Find the DIN rail toward the back of the UPS. (See Figure 1.) Figure 3 shows the DIN rail.

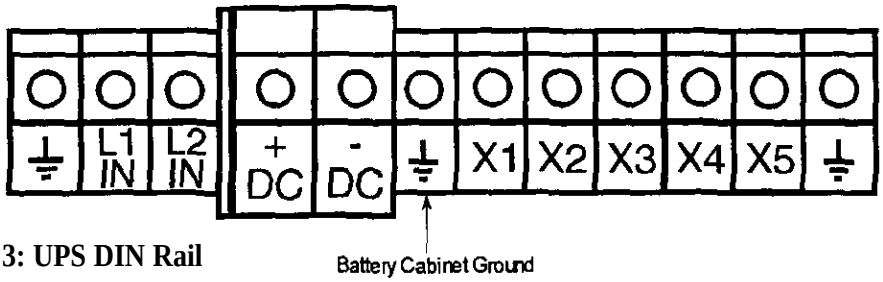


Figure 3: UPS DIN Rail

☐ 300-4. If your battery pack requires a ground connection to the UPS, connect the ground wire to the ground (earth) DIN rail terminal that is next to the negative (-) DC terminal. The ground (earth) terminal block has the ground symbol shown in Figure 3.

☐ 300-5. Strip 0.5 inches (13 mm) of insulation off the UPS end of the positive (+) and negative (-) battery a

☐ 300-6. Connect the negative (-) battery cable to the negative (–) DC terminal on the UPS DIN rail. Connect the positive (+) battery cable to the positive (+) DC terminal on the UPS DIN rail.

☐ 300-7. Use the DC voltmeter to check for the proper nominal DC voltage at the UPS DC terminals. The nominal DC voltage should be 48 VDC. Make sure the polarity agrees with the markings on the UPS DC terminals.

☐ 300-8. Close the side door assembly and secure it with the two screws. Make sore that no wires are pinched between the side door and the chassis.

☐ 300-9. At the front of the unit, reconnect the top DC connector. Secure it with the bolt.

☐ 300-10 Reattach the bottom narrow front panel and the narrow side panels to the front of the UPS.

☐ 300-11 Use the screws you removed to reattach the front ventilation panel.

0300-12 Now that you have installed the AC wiring and connected the batteries, the installing electrician should complete the voltage and phase check in the Installation Manual. Then, return to the steps below to complete parameter changes.

❑ 300-13 Put each side cover in place by bringing it straight down into position.

☐ 300-14 Reattach the seven screws that secure the panels: use three of the screws on top of the unit, and two each side panel.

☐ 300-15 Reapply AC line to the UPS. Turn the key switch inside the UPS' front door to "Auto." The yellow BATTERY light will turn on briefly, then the green LINE light will turn on.

☐ 300-16. If you have used an external bypass switch to bypass the UPS, you may now switch it back to "UPS."

Section 400: Changing Parameter Values

The UNITY/I has parameters set at the factory for specific battery strings. Since you are using batteries that are not supplied by Best Power, you *must* adjust the parameters to prevent calibration alarms. For customer-supplied batteries, Table 1 on the next page shows the parameters that require changing and the default values. Refer to the UNITY/I User Manual for additional parameter information; see the steps on the next page to program the parameters in Table 1.

Table 1: Customer-supplied External Battery Pack Parameter Numbers to Change

Parameter Number	Parameter Name	Settings
P-69	Normal Float Voltage	Set to 57.60 or to the voltage recommended by your battery manufacturer.
P-70	Cold Float Voltage	Set to 58.00 or to the voltage recommended by your battery manufacturer.
P-55	Battery Capacity*	Enter the Amp-hours for your battery string(s). (Battery string amp-hours x Number of strings)
P-57	Runtime Constant (K1)	This is always set to 0000.
P-58	Runtime Constant (K2)	Hexadecimal number. To determine this value, take the value of P-55, divide by 90, and multiply this number by 5300. Convert to hexadecimal number and enter this into the parameter setting.

*If battery capacity is more than 200 AH, the standard UPS charger does not have enough capacity to fully charge the batteries; make sure your UPS has the internal auxiliary charger. If you plan to use an external charger, call Best Power for assistance.

Make sore that you FULLY understand a parameter before attempting to change it. Improper setting of certain parameters may cause the UPS to function other than expected.

☐ 400-1. Simultaneously hold down the [CANCEL] and [RUNTIME] keys for two seconds. Release the keys when the display shows P- 0 0. Then, press [CANCEL]. The display should read 0.

☐ 400-2. The Service password is 2639. To enter it, follow the steps below.

❑ a. Use the [%LOAD] or the [VOUT] key to change the display reading to 2 6 3 3

Note: To scroll the display more quickly, hold down the [%LOAD] or [VOUT] key

❑ b. Press [RUNTIME] to enter the password. The display should read 2 (for password level 2).

Note: If the display is left unattended (no keys are pressed) for five minutes, the password reverts back to level "0" and you must re-enter the password.

☐ 400-3. Press [CANCEL] to return to the parameter number display (P-XX)

Note that the [CANCEL] key allows you to toggle between the parameter number and parameter value

☐ 400-4. Use the [%LOAD] or the [VOUT] key to step to the parameter that you wish to change. Then, press [CANCEL] to display the parameter value.

☐ 400-5. Whenever a parameter value is displayed, you can use these keys to change the setting:

- Press [%LOAD] to increase the setting.
- Press [VOUT] to decrease the setting.

Note: The UPS will not allow you to change a parameter if the parameter requires a password higher than that entered in step 1.

☐ 400-6. To enter the new value, press [RUNTIME]. The UPS beeps to indicate that the new value has been entered. If you wish not to save a change that you have made, press [VLINE] and the value will remain at its original setting.

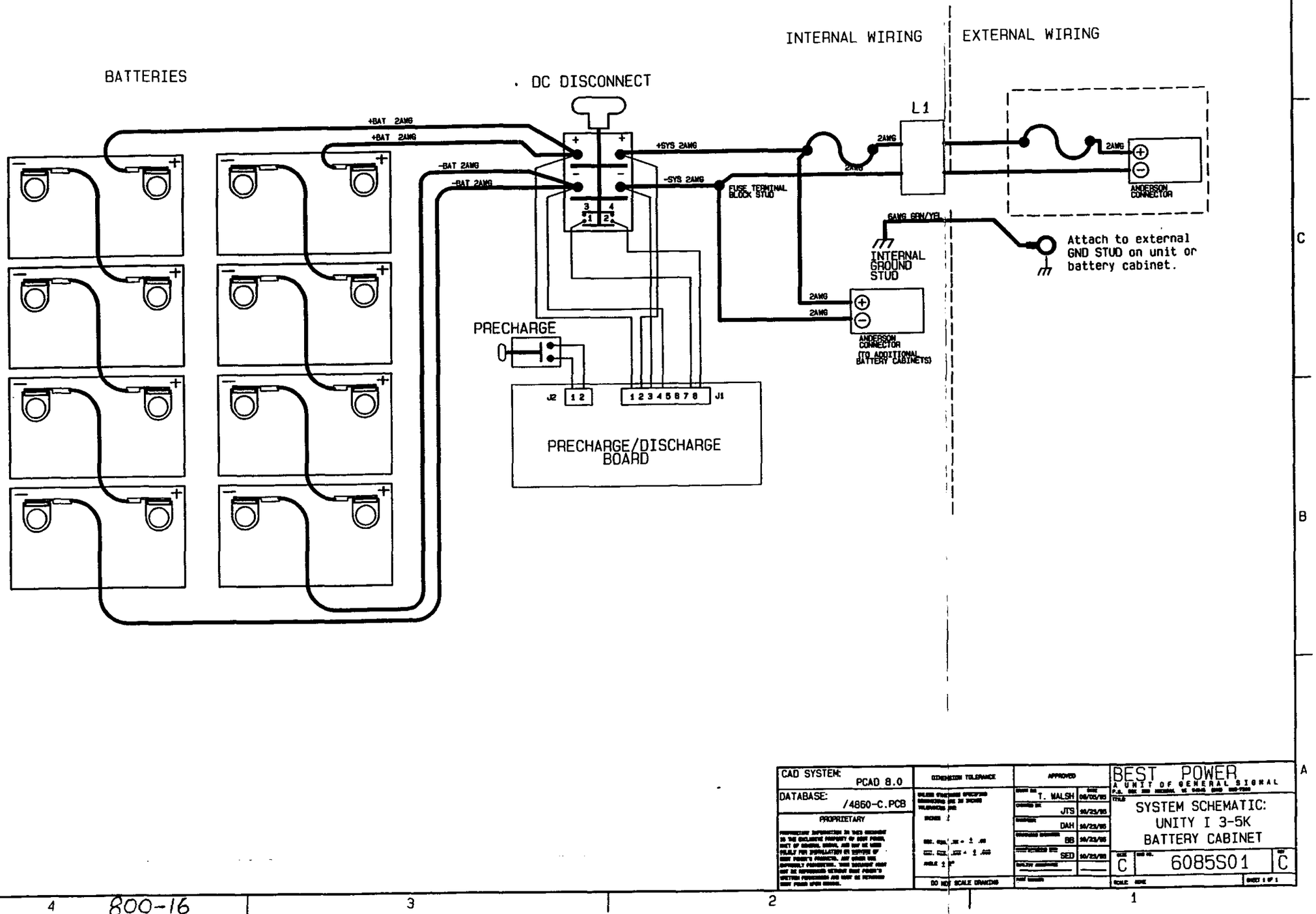
☐ 400-7. Repeat steps 400-4 to 400-6 to change the other parameters listed in Table 1

☐ **400-S.** To escape parameter mode, press **[VLINE] twice.**

DWG NO.	6085S01	SH 1	REV C

REVISIONS

REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
1	XXX-0000	SYSTEM SCHEMATIC	09/05/95	TMW		
A	PCN-1210	RELEASED TO PRODUCTION.	10/19/95	RS	JTS	DAH
B	ECN-3882	CHANGED PER ECN.	12/22/95	RS	JTS	DAH
C	ECN-4083	CHANGED PER ECN. ADD L1 INDUCTOR.	04/01/96	RS	JTS	DAH



CAD SYSTEM: PCAD 8.0	DIMENSION TOLERANCE	APPROVED	BEST POWER A UNIT OF GENERAL SIGNAL
DATABASE: /4860-C.PCB	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:	T. WALSH 08/05/95	SYSTEM SCHEMATIC: UNITY I 3-5K BATTERY CABINET
PROPRIETARY	INCHES ±	JTS 08/23/95	
PROPRIETARY INFORMATION IN THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL, AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE IMPROPERLY FURNISHED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED BEST POWER UPON REQUEST.	.XX = ± .03 .XXX = ± .005 ANGLE ± 1°	DAH 08/23/95	
		BB 08/23/95	
		SED 08/23/95	
	DO NOT SCALE DRAWING		SIZE C DWG NO. 6085S01 REV C
			SCALE NONE SHEET 1 OF 1

800-16

DWG NO.	4874S01	SH 1	REV B

REVISIONS

REV	CHARGE NO.	DESCRIPTION	DATE	BY	CHKD	ENGR
A		RELEASE TO PRODUCTION	09/07/94	RS	JTS	DAH
B	ECN-5385	CHANGES PER ECN	02/04/98	TMH		

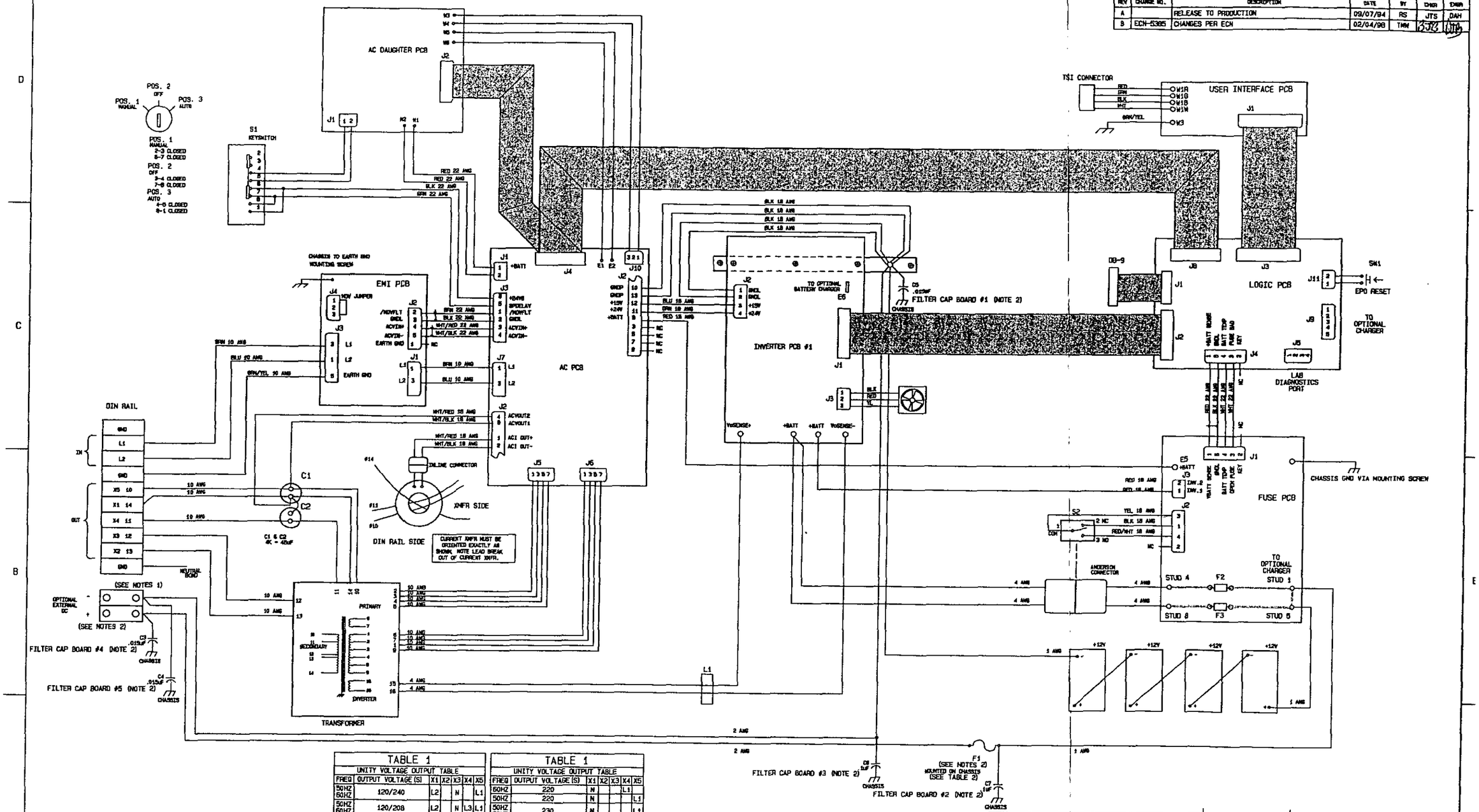


TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L1	
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L1	
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L1	
60HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION = NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2
FUSE F1

EXTERNAL BATTERY	125 AMP
UBS	125 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

CAD SYSTEM:	PCAD 8.61
DATABASE:	/4874-B.PCB

PROPRIETARY

DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
INCHES
XXX. DIM. .XX = ± .03
XXX. DIM. .XXX = ± .010
ANGLE ± 0°

DO NOT SCALE DRAWING

APPROVED		
DRWG BY	R. STUREK	09/07/94
ENGINEER	JTS	09/13/94
DRAFTING	DAH	09/13/94
MANUFACTURING ENGR	BB	09/13/94
MANUFACTURING MGR	SED	09/12/94
QUALITY ASSURANCE	AM	09/12/94
P.C. PART NUMBER (NON-SERVICED)	N/A	

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280 NECEDAH, WI 54646 (608) 565-7200

TITLE: UNITY I SYSTEM SCHEMATIC 3 KVA STANDARD & WITH EXTERNAL DC OPTION

SIZE	DWG NO.	REV
D	4874S01	B

SCALE: NONE SHEET 1 OF 1

800-17

DWG NO	4874S01	SH	1	REV	C

REVISIONS

REV	CHANGE NO	DESCRIPTION	DATE	BY	CHKR	ENGR
A		RELEASE TO PRODUCTION	09/07/94	RG	JTS	DAH
B	ECN-5385	CHANGES PER ECN	02/04/98	TMN	DAH	DAH
C	ECN-5582	CHANGES PER ECN	04/07/98	RS	BJB	DTB

AC DAUGHTER PCB

POS 2 OFF
POS 1 MANUAL
POS 3 AUTO

POS 1
MANUAL
2-3 CLOSED
6-7 CLOSED

POS 2
OFF
3-4 CLOSED
7-8 CLOSED

POS 3
AUTO
4-5 CLOSED
8-1 CLOSED

S1 KEYSWITCH

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB

DIN RAIL

GND
L1
L2
GND
X5 10
X1 14
X4 11
X3 12
X2 13
GND
IN
OUT
NEUTRAL BOND

C1
C2
C1 & C2 4K = 45uF

#14
INLINE CONNECTOR
#11
#10
DIN RAIL SIDE
XMFR SIDE

CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.

PRIMARY
SECONDARY
INVERTER
TRANSFORMER

AC PCB

L3

TSI CONNECTOR

USER INTERFACE PCB

LOGIC PCB

SW1
EPO RESET

TO OPTIONAL CHARGER

LAB DIAGNOSTICS PORT

INVERTER PCB #1

TO OPTIONAL BATTERY CHARGER

C5 .015uF FILTER CAP BOARD #1 (NOTE 2)

CHASSIS

BUSS-BAR

FUSE PCB

CHASSIS GND VIA MOUNTING SCREW

TO OPTIONAL CHARGER

STUD 4
STUD 3
STUD 8
STUD 5

3-4K (WIA 1860)
5K (WIA 1073)

(WIA 11192)

F1 WIRE STUD

FUSE HOLDER MOUNTED ON CHASSIS

(SEE NOTES 1)

OPTIONAL EXTERNAL DC

ANDERSON CONNECTION

ANDERSON CONNECTION

+12V +12V +12V +12V

TABLE 2
FUSE F1

UNIT	FUSE
3K	FUS-0367
4K	FUS-0368
5K	FUS-0362

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N			L1
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N			L1
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L3	
50HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION - NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY REFER TO TABLE 1 CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

800-18

CAD SYSTEM:	PCAD B 61
DATABASE:	/4874-C.PCB

PROPRIETARY

PROPRIETARY INFORMATION IN THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE EXPRESSLY PROHIBITED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED TO BEST POWER UPON DEMAND.

DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±
DEC PLS. XX = ± .02
DEC PLS. XXX = ± .010
ANGLES ± 2°

DO NOT SCALE DRAWING

APPROVED		DATE
DRAWN BY	R STUREK	09/07/94
CHECKED BY	JTS	09/13/94
ENGINEER	DAH	09/13/94
STANDARDS ENGINEER	BB	09/13/94
MANUFACTURING ENG.	SED	09/12/94
QUALITY ASSURANCE	AM	09/12/94

P.C. PART NUMBER NOW STUFFED: N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280, NECEDAH, WI 54646 (608) 565-7200
TITLE
UNITY I SYSTEM SCHEMATIC
3 KVA STANDARD & WITH
EXTERNAL DC OPTION

SIZE	DWG NO	REV
D	4874S01	C

SCALE: NONE SHEET 1 OF 1

Dwg no.	04874S02	SH 1	REV A

REVISIONS

REV	CHG NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELASE TO PRODUCTION	9/7/94	RS	JTS	

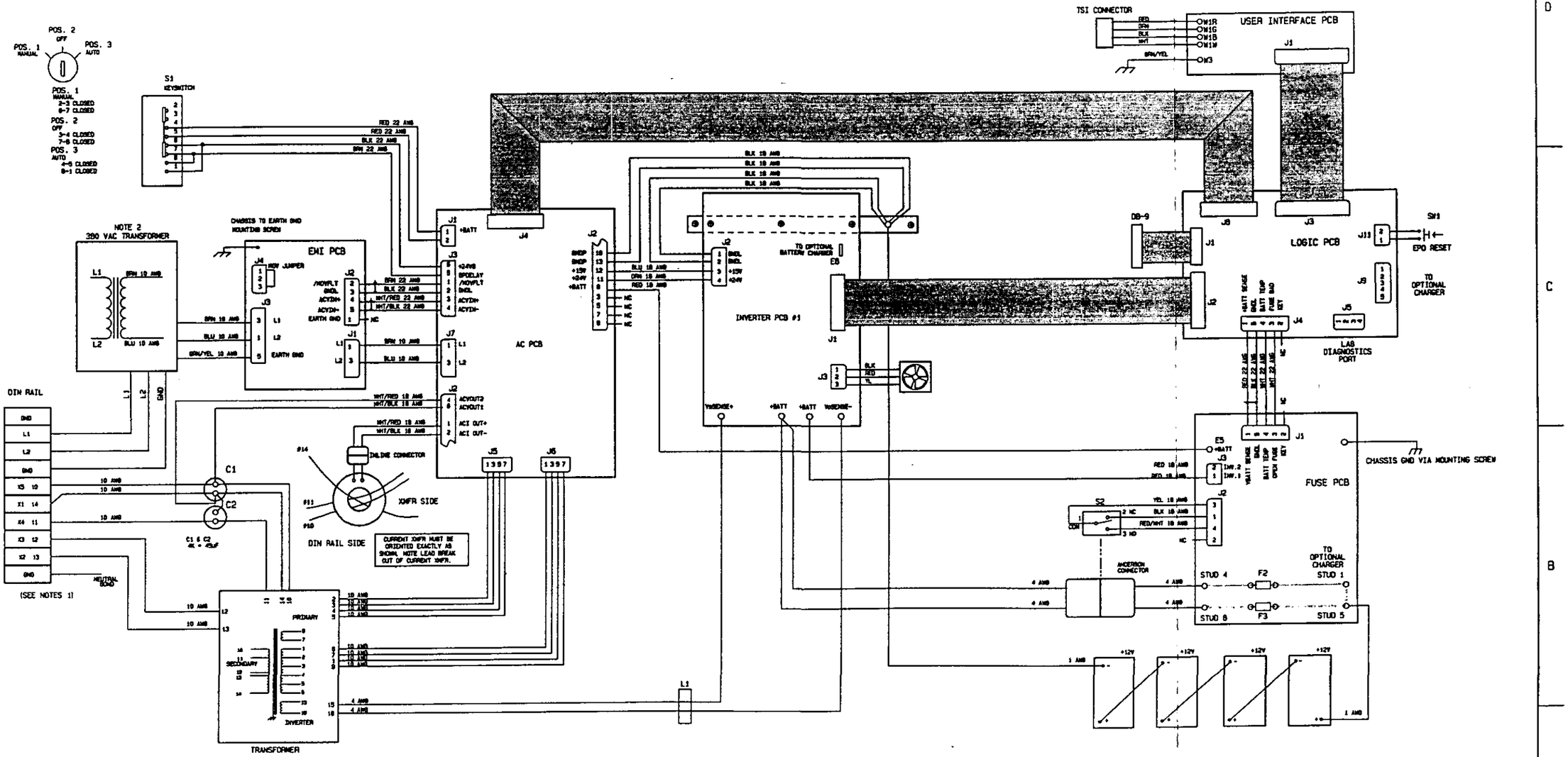


TABLE 1							
UNITY VOLTAGE OUTPUT TABLE							
FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L1	
60HZ	127/220	L2		N	L3	L1
50HZ	110/220	L2	N		L3	
50HZ	127/254	L2		N		L3
50HZ 60HZ	208	L2			L3	
50HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1							
UNITY VOLTAGE OUTPUT TABLE							
FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION = NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
INCHES +/-
FRAC. DIM. +/- 1/16
DEC. DIM. .XX +/- .02
DEC. DIM. .XXX +/- .010
ANGLES +/- 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS ( ) TOLERANCES ARE: MILLIMETERS +/-
DEC. DIM. .X +/- .5
DEC. DIM. .XX +/- .25
ANGLES +/- 2

DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY:	R. STUREK	9/7/94
CHECKED BY:	JTS	9/7/94
ENGINEER:	DMH	9-7-94
STANDARDS ENGINEER:		9/7/94
MANUFACTURING ENGINEER:		9/7/94
QUALITY ASSURANCE:		9-7-94
PCM NO.		

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

TITLE
UNITY 1 SYSTEM
SCHEMATIC 3 KVA
380 VAC OPTION ONLY

SIZE	DWG NO.	REV
D	D4874S02	A

SCALE: NONE SHEET 1 OF 1

8 800-19

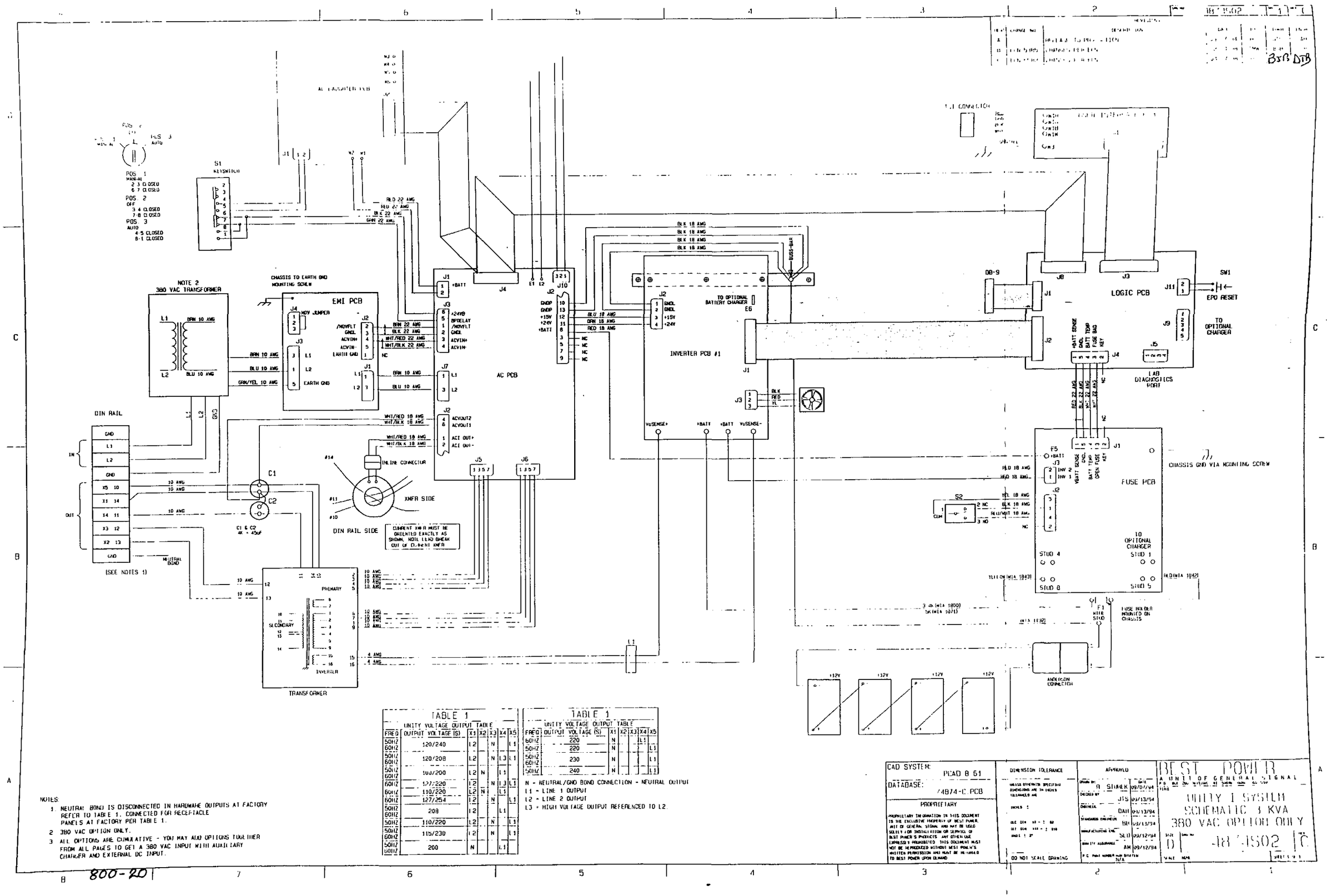


TABLE 1

UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ	120/240	L2		N		L1
60HZ						
50HZ	120/208	L2		N	L3	L1
60HZ						
50HZ	100/200	L2	N		L1	
60HZ						
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L1	
60HZ	127/254	L2		N		L1
50HZ	208	L2			L1	
60HZ						
50HZ	110/220	L2		N		L1
50HZ	115/230	L2		N		L1
60HZ						
50HZ	200	N			L1	
60HZ						

TABLE 1

UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ	230	N				L1
60HZ						
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION - NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

CAD SYSTEM: PCAD 8.51
DATABASE: 74874-C.PCB

PROPRIETARY

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
INCHES ±
DO NOT SCALE DRAWING

APPROVED
DRAWN BY: A. STARUCK 09/07/94
CHECKED BY: JTS 09/13/94
ENGINEER: DAH 09/13/94
STANDARDS ENGINEER: BH 09/13/94
MANUFACTURING ENG: SLD 09/12/94
QUALITY ASSURANCE: AM 09/12/94
P.C. PART NUMBER NOW SHOWN: N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
TITLE: UNITY 1 SYSTEM SCHEMATIC 3 KVA 380 VAC OPTION ONLY
SIZE: D
DWG NO: 74874-C
REV: C
SCALE: NONE
SHEET 1 OF 1

800-20

Dwg no.	Sh	Rev
D4645S01	1	E

REVISIONS

REV	CHG. NO.	ZONE	DESCRIPTION	DATE	BY	CHK'R	ENG'R
A			RELASE TO PRODUCTION	2/16/94	BKB		
B			CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
C			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
D			CHANGED PER ECN-3227	7/18/94	RS	JTS	DAH
E			CHANGED PER ECN-3275	8/16/94	JLC	JTS	DAH

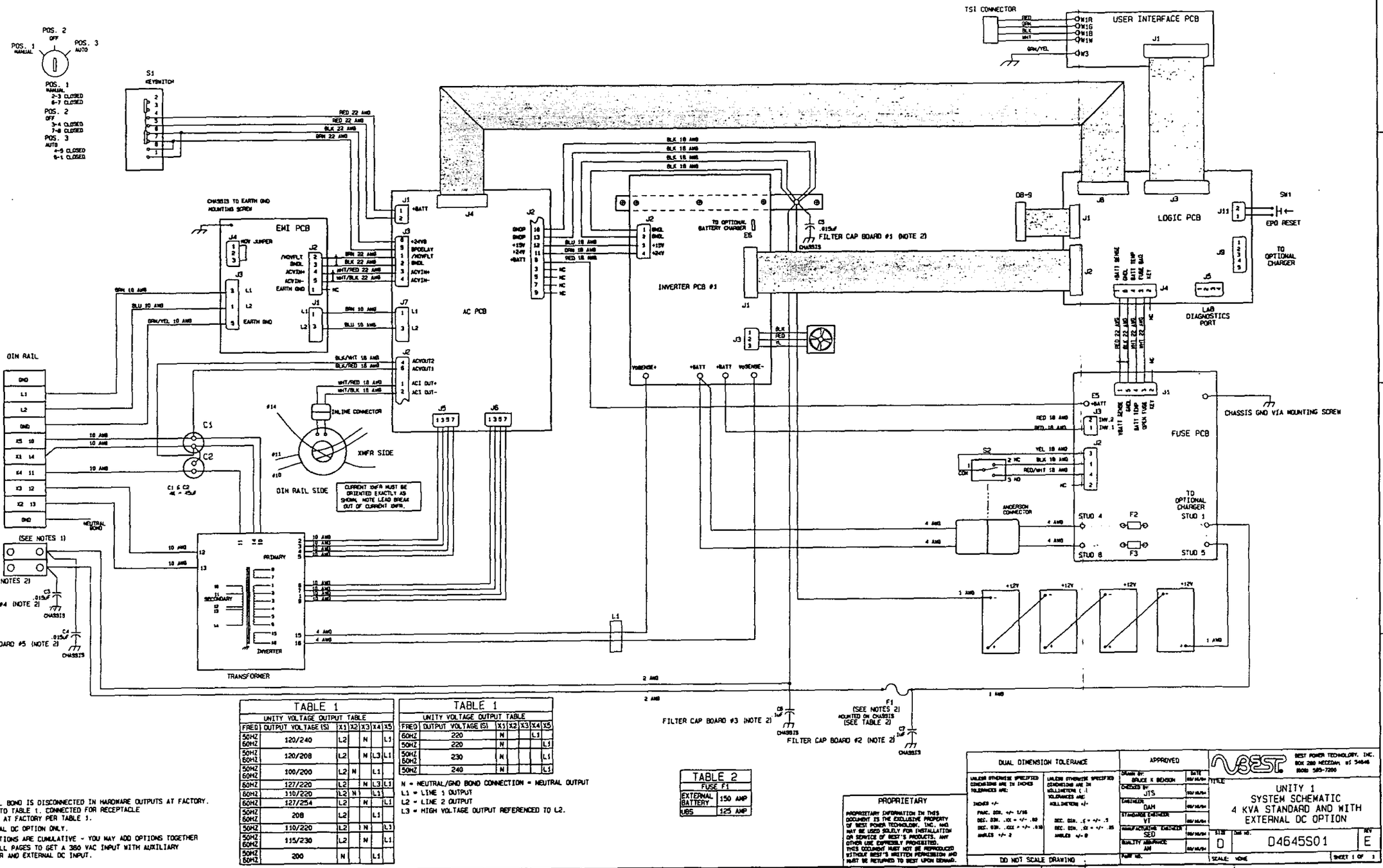


TABLE 1 UNITY VOLTAGE OUTPUT TABLE							
FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L1	
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L1	
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L1	
50HZ	110/220	L2		N		L3
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1 UNITY VOLTAGE OUTPUT TABLE							
FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L3	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION = NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2 FUSE F1	
EXTERNAL BATTERY	150 AMP
UBS	125 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: INCHES +/- FRAC. DEN. +/- 1/16 DEC. DEN. .XX = +/- .02 DEC. DEN. .XXX = +/- .010 ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS ( ) TOLERANCES ARE: MILLIMETERS +/- DEC. DEN. .X = +/- .5 DEC. DEN. .XX = +/- .25 ANGLES +/- 0
DO NOT SCALE DRAWING

APPROVED

		DATE
Drawn By:	BRUCE K BENSON	mm/dd/yy
Checked By:	JTS	mm/dd/yy
Engineer:	DAH	mm/dd/yy
Standards Engineer:	VT	mm/dd/yy
Manufacturing Engineer:	SED	mm/dd/yy
Quality Assurance:	AM	mm/dd/yy
Part No.		

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

TITLE: UNITY 1 SYSTEM SCHEMATIC 4 KVA STANDARD AND WITH EXTERNAL DC OPTION

SIZE	Dwg no.	REV
D	D4645S01	E

SCALE: NONE SHEET 1 OF 1

800-21

REV	CHANGE NO	DESCRIPTION
B	ECN 3800	CHANGED PER ECN
C	ECN 3873	CHANGED PER ECN
D	ECN-3927	CHANGED PER ECN
E	ECN-3975	CHANGED PER ECN
F	ECN 5385	CHANGED PER ECN
G	ECN-5582	CHANGED PER ECN

DATE	BY	CHKR	ENGR
05/09/94	RS	JTS	DAH
06/10/94	RS	JTS	DAH
07/18/94	RS	JTS	DAH
08/16/94	J.C	JTS	DAH
02/04/98	TH	BJB	BJB
03/26/98	RS	BJB	DJS

AC DAUGHTER PCB

POS 2 OFF
POS 1 MANUAL
POS 3 AUTO

POS 1
MANUAL
2-3 CLOSED
6-7 CLOSED

POS 2
OFF
3-4 CLOSED
7-8 CLOSED

POS 3
AUTO
4-5 CLOSED
8-1 CLOSED

SW1 01/5
S1
KEYSWITCH

BAA 0459

RED 22 AWG
RED 22 AWG
BLK 22 AWG
GRN 22 AWG

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB
PCP-0030
MOV JUMPER
/MOVFLT
GNDL
ACVIN+
ACVIN-
EARTH GND
NC
HRS-0260

BAA-0454

BRN 10 AWG
BLU 10 AWG
GRN/YEL 10 AWG

BRN 22 AWG
BLK 22 AWG
WHT/RED 22 AWG
WHT/BLK 22 AWG

BAA-0453

DIN RAIL
DRA-0013
GND
L1
L2
GND
X5 10
X1 14
X4 11
X3 12
X2 13
GND
IN
OUT

10 AWG
10 AWG
10 AWG

C1
C2
C1 & C2
4K - 45uF CPR-0481

NEUTRAL BOND W1A-0424

#14
#11
#10
INLINE CONNECTOR
XMFR SIDE
HTH-0005
DIN RAIL SIDE

CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.

AC PCB
PCP-0175

+24VB
BPDELAY
/MOVFLT
GNDL
ACVIN+
ACVIN-

ACVOUT2
ACVOUT1
ACI OUT+
ACI OUT-

BLK/WHT 18 AWG
BLK/RED 18 AWG
WHT/RED 18 AWG
WHT/BLK 18 AWG

J5 1357
J6 1357

PRIMARY
SECONDARY
INVERTER
TRANSFORMER
4K THH-0771

10 AWG
4 AWG

L1

BLK 18 AWG
BLK 18 AWG
BLK 18 AWG
BLK 18 AWG

GNDP
GNDP
+15V
+24V
+BATT
BLU 18 AWG
ORN 18 AWG
RED 18 AWG

NC
NC
NC
NC

HRS-0260

INVERTER PCB #1
PCP-0193

GNDL
GNDL
+15V
+24V

TO OPTIONAL BATTERY CHARGER
E6

BUSS-BAR

C5
.015uF
FILTER CAP BOARD #1 (NOTE 2)
CHASSIS

BAA-0433

BLK
RED
YEL

FAN-0043

VoSENSE+
+BATT
+BATT
VoSENSE-

BAA-0452

USER INTERFACE PCB
PCP 0017
SW1R
SW1G
SW1B
SW1W
SW3
GRN/YEL

BAA-0436

DB-9
LOGIC PCB
PCP-0165
SW1
EPO RESET
TO OPTIONAL CHARGER

+BATT SENSE
GNDL
BATT TEMP
FUSE BAD
KEY

LAB DIAGNOSTICS PORT

RED 22 AWG
BLK 22 AWG
WHT 22 AWG
WHT 22 AWG

BAA-0451

E5
+BATT
RED 18 AWG
RED 18 AWG

SENSE
GNDL
TEMP
FUSE
KEY

CHASSIS GND VIA MOUNTING SCREW

FUSE PCB
PCP 0185

4K F2-- F3-160A FUS-0213
5K F2-100A FUS-0212 F3-100A FUS-0212

S2
SW1-0156
COM
2 NC
3 NO
YEL 18 AWG
BLK 18 AWG
RED/WHT 18 AWG
HRS-0258

TO OPTIONAL CHARGER

STUD 4
STUD 8
STUD 1
STUD 5

YELLOW (W1A-1843)
RED (W1A-1842)

3-4K (W1A-1800)
5K (W1A-1071)
(W1A-1192)

F1
WIRE STUD
FUSE HOLDER MOUNTED ON CHASSIS
(SEE NOTES 1)
OPTIONAL EXTERNAL DC
ANDERSON CONNECTOR

+12V
+12V
+12V
+12V
ANDERSON CONNECTOR

TABLE 2
FUSE F1

UNIT	FUSE
3K	FUS-0367
4K	FUS-0368
5K	FUS-0362

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L1	
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L1	
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L1	
50HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION = NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. ~~EXTERNAL DC OPTION ONLY.~~
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

800-22

CAD SYSTEM: PCAD 8 61
DATABASE: /4645-G PCB
PROPRIETARY
PROPRIETARY INFORMATION IN THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE EXPRESSLY PROHIBITED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED TO BEST POWER UPON DEMAND.

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
XX=±
.XXX=±
ANGLE ±
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY	BRUCE K BENSON	02/16/94
CHECKED BY	JTS	02/16/94
ENGINEER	DAH	02/16/94
ST ENGINEER ENGINEER	VT	02/16/94
MANUFACTURING ENG	SED	02/16/94
QUALITY ASSURANCE	AK	02/16/94

P.C. PART NUMBER NOW STOCKED N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280, NECEDAH, WI 54646 (608) 565-7200

TITLE
UNITY I SYSTEM SCHEMATIC
4 KVA STANDARD & WITH
EXTERNAL DC OPTION

SIZE D | DWG NO 4645S01 | REV G
SCALE: NONE | SHEET 1 OF 1

Dwg no.	Sh	Rev
D4645S02	1	E

REVISIONS

REV	CHG. NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELASE TO PRODUCTION	2/16/94	BKB		
B			CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
C			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
D			CHANGED PER ECN-3227	7/18/94	RS	JTS	DAH
E			CHANGED PER ECN-3275	8/15/94	JLC		

POS. 2 OFF
POS. 1 MANUAL
POS. 3 AUTO

POS. 1 MANUAL
2-3 CLOSED
6-7 CLOSED
POS. 2 OFF
3-4 CLOSED
7-8 CLOSED
POS. 3 AUTO
4-5 CLOSED
8-1 CLOSED

S1 KEYSWITCH

NOTE 2
380 VAC TRANSFORMER

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB
MOV JUMPER

DIN RAIL
GND
L1
L2
GND
X5 10
X1 14
X4 11
X3 12
X2 13
GND
IN
OUT
(SEE NOTES 1)
NEUTRAL BOND

C1
C2
C1 & C2 .4K - .45uF

INLINE CONNECTOR
XMFR SIDE
DIN RAIL SIDE
CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.

PRIMARY
SECONDARY
INVERTER
TRANSFORMER

AC PCB
J1 +BATT
J3 +24VS, BPDELAY, /MOVFLT, GNDL, ACVIN+, ACVIN-
J6 /MOVFLT, GNDL, ACVIN+, ACVIN-, EARTH GND, NC
J7 L1, L2
J2 ACVOUT2, ACVOUT1, ACI OUT+, ACI OUT-
J5 1357
J6 1357

INVERTER PCB #1
J2 GNDP, GNDP, +15V, +24V, +BATT
J1 GNDL, GNDL, +15V, +24V
TO OPTIONAL BATTERY CHARGER E6
J3 BLK, RED, YEL
VoSENSE+, +BATT, +BATT, VoSENSE-

TSI CONNECTOR
RED, ORN, BLK, WHT, BRN/YEL
W1R, W1G, W1B, W1W, W3

USER INTERFACE PCB
J1

LOGIC PCB
DB-9
J6
J1
J3
J11
SW1
EPO RESET
J9
TO OPTIONAL CHARGER
J5
LAB DIAGNOSTICS PORT
J4
+BATT SENSE, GNDL, BATT TEMP, FUSE BAD, KEY
RED 22 AWG, BLK 22 AWG, GRN 22 AWG, WHT 22 AWG, NC

FUSE PCB
E5 +BATT
J3 INV.2, INV.1
J2
J1
+BATT SENSE, GNDL, BATT TEMP, FUSE BAD, KEY
RED 18 AWG, ORN 18 AWG
CHASSIS GND VIA MOUNTING SCREW

S2
YEL 18 AWG, BLK 18 AWG, RED/WHT 18 AWG
2 NC, 3 NO, COM, NC
TO OPTIONAL CHARGER
ANDERSON CONNECTOR
4 AWG
STUD 4, STUD 1, STUD 8, STUD 5
F2, F3
1 AWG
+12V, +12V, +12V, +12V

BLK 18 AWG
BLU 18 AWG
ORN 18 AWG
RED 18 AWG
BRN 22 AWG
RED 22 AWG
BLK 22 AWG
WHT/RED 22 AWG
WHT/BLK 22 AWG
BRN 10 AWG
BLU 10 AWG
BRN/YEL 10 AWG
BLK/WHT 18 AWG
BLK/RED 18 AWG
WHT/RED 18 AWG
WHT/BLK 18 AWG
10 AWG
4 AWG

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L3	
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L3	
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L3	
50HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L3	

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L3	
50HZ	220	N				L3
50HZ 60HZ	230	N				L3
50HZ	240	N				L3

N = NEUTRAL/GND BOND CONNECTION • NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
INCHES +/-
FRAC. DIM. +/- 1/16
DEC. DIM. .XX = +/- .05
DEC. DIM. .XXX = +/- .010
ANGLES +/- 2

APPROVED

DRAWN BY: BRUCE K BENSON	DATE	08/15/94
CHECKED BY: JTS		08/15/94
ENGINEER: DAH		08/15/94
STANDARDS ENGINEER: VT		08/15/94
MANUFACTURING ENGINEER: SED		08/15/94
QUALITY ASSURANCE: AM		08/15/94
PART NO.		

DO NOT SCALE DRAWING

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

TITLE: UNITY 1 SYSTEM SCHEMATIC 4 KVA 380 VAC OPTION ONLY

SIZE D | DWG NO. D4645S02 | REV E

SCALE NONE | SHEET 1 OF 1

800-231

REVISIONS						
REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
B	ECN-3100	CHANGED PER ECN	05/09/94	RS	JTS	DAH
C	ECN-3073	CHANGED PER ECN	06/10/94	RS	JTS	DAH
D	ECN-3227	CHANGED PER ECN	07/18/94	RS	JTS	DAH
E	ECN-3275	CHANGED PER ECN	08/16/94	JAC	JTS	DAH
F	ECN-5385	CHANGED PER ECN	02/04/98	IM	BJB	DB
G	ECN-5582	CHANGED PER ECN	03/26/98	RS	BJB	DB

DWG NO 4645S02 | SH 1 | REV G

AC DAUGHTER PCB

POS 1 MANUAL | POS 2 OFF | POS 3 AUTO

POS. 1 MANUAL: 2-3 CLOSED, 6-7 CLOSED
POS. 2 OFF: 3-4 CLOSED, 7-8 CLOSED
POS. 3 AUTO: 4-5 CLOSED, 8-1 CLOSED

S1 KEYSWITCH

NOTE 2
380 VAC TRANSFORMER

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB

AC PCB

DIN RAIL

(SEE NOTES 1)

C1 & C2 4K = 45uF

IN-LINE CONNECTOR

XMFR SIDE

DIN RAIL SIDE

CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.

PRIMARY / SECONDARY

INVERTER

TRANSFORMER

L1

INVERTER PCB #1

TO OPTIONAL BATTERY CHARGER

BUSS-BAR

TSI CONNECTOR

USER INTERFACE PCB

LOGIC PCB

SW1 EPO RESET

TO OPTIONAL CHARGER

LAB DIAGNOSTICS PORT

FUSE PCB

CHASSIS GND VIA MOUNTING SCREW

S2

STUD 4 / STUD 1 / STUD 8 / STUD 5

YELLOW (MTA-1843) | RED (MTA-1842)

3-4K (MTA-1900) 5K (MTA-1071)

(MTA-1192)

F1 WIRE STUD

FUSE HOLDER MOUNTED ON CHASSIS

ANDERSON CONNECTOR

+12V +12V +12V +12V

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50HZ 60HZ	120/240	L2		N		L1
50HZ 60HZ	120/208	L2		N	L3	L1
50HZ 60HZ	100/200	L2	N		L1	
60HZ	127/220	L2		N	L3	L1
60HZ	110/220	L2	N		L1	
60HZ	127/254	L2		N		L1
50HZ 60HZ	208	L2			L1	
50HZ	110/220	L2		N		L1
50HZ 60HZ	115/230	L2		N		L1
50HZ 60HZ	200	N			L1	

TABLE 1
UNITY VOLTAGE OUTPUT TABLE

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
60HZ	220	N			L1	
50HZ	220	N				L1
50HZ 60HZ	230	N				L1
50HZ	240	N				L1

N = NEUTRAL/GND BOND CONNECTION = NEUTRAL OUTPUT
L1 = LINE 1 OUTPUT
L2 = LINE 2 OUTPUT
L3 = HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE - YOU MAY ADD OPTIONS TOGETHER FROM ALL PAGES TO GET A 380 VAC INPUT WITH AUXILIARY CHARGER AND EXTERNAL DC INPUT.

800-24

CAD SYSTEM: PCAD 8.61
DATABASE: /4645-G.PCB
PROPRIETARY

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .X ± .02 .XX ± .010 .XXX ± .005
ANGLES ± 2°

DO NOT SCALE DRAWING

APPROVED		
DRAWN BY	BRUCE K BENSON	02/16/94
CHECKED BY	JTS	02/16/94
ENGINEERING	DAH	02/16/94
MANUFACTURING ENGINEERING	YT	02/16/94
MANUFACTURING MGR.	SED	02/16/94
QUALITY ASSURANCE	AM	02/16/94
P.E. PART NUMBER SPECIFICATION	N/A	

BEST POWER
A UNIT OF GENERAL SIGNAL
TITLE: UNITY I SYSTEM SCHEMATIC 4 KVA 380 VAC OPTION ONLY

SIZE D | DWG NO 4645S02 | REV G | SCALE: NONE | SHEET 1 OF 1

Dwg no. 4678S01	Sh 1	REV E

REVISIONS

REV	J.NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/18/94	BKB	JTS	DAH
B	ECN/3000		RENUMBERED DIN RAIL	3/10/94	BKB		
C	ECN/3100		CHANGED PER ECN-3100	5/9/94	RB	JTS	DAH
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
E			CHANGED PER ECN-3238. CREATED DRAWING 4678S01 FROM DRAWING 4678 REVD.	7/29/94	RS	JTS	DAH

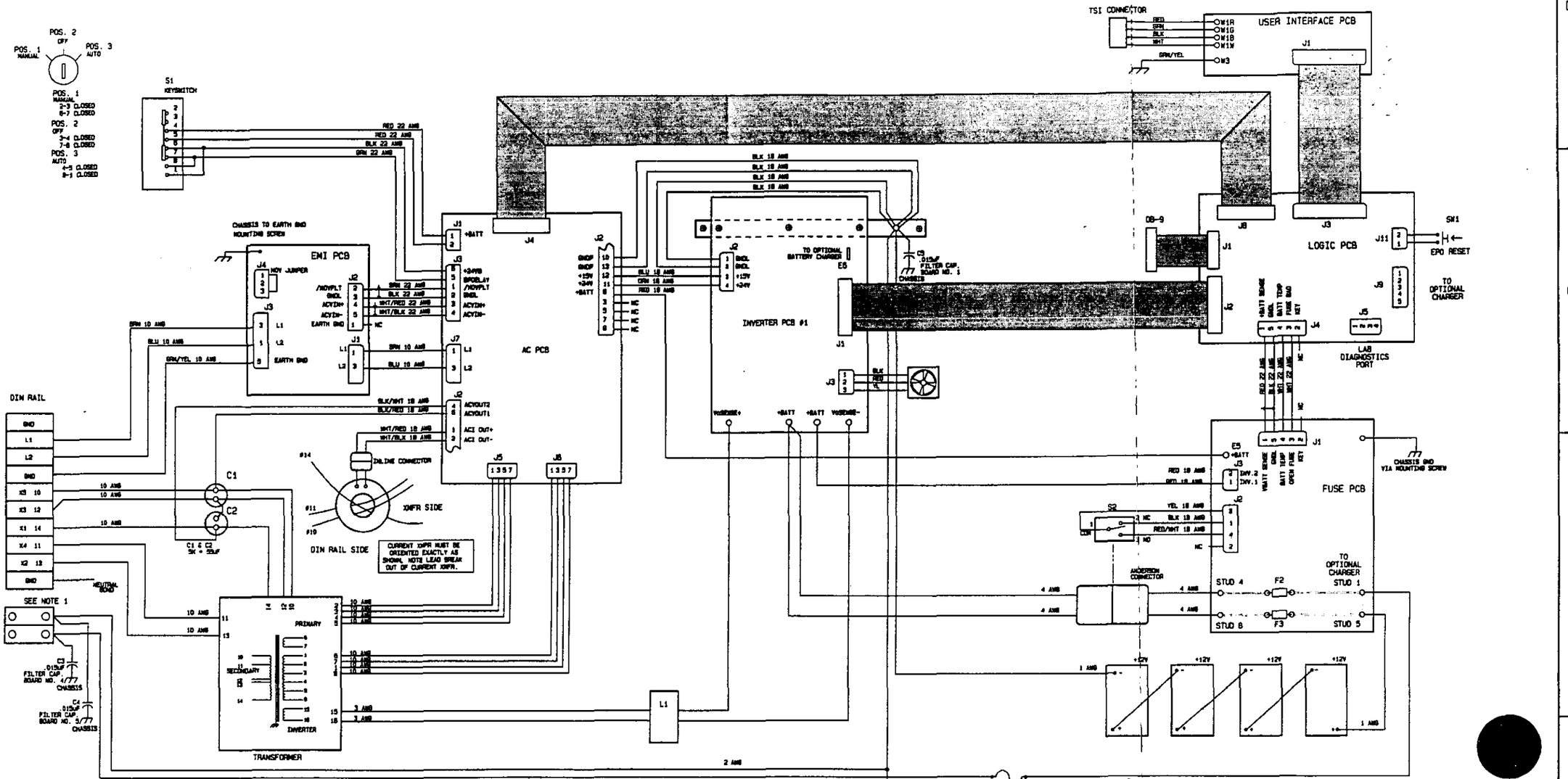


TABLE 1 UNITY VOLTAGE OUTPUT						
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L3	L1
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2 F1 FUSE	
EXT BATT OPTION	200 AMP
LBB OPTION	150 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

HISTORY
REPLACED BY LATER REV

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
INCHES +/-
MACH. DIM. +/- 1/32
DEC. DIM. .XX +/- .03
DEC. DIM. .XXX +/- .010
ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS [ ]
TOLERANCES ARE:
MILLIMETERS +/-
DEC. DIM. .X +/- .5
DEC. DIM. .XX +/- .05
ANGLES +/- 2
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY	BRUCE K BENSON	MM/DD/YY
CHECKED BY	JTS	MM/DD/YY
ENGINEER	DAH	MM/DD/YY
ENGINEERING MANAGER	VT	MM/DD/YY
MANUFACTURING ENGINEER	BRD	MM/DD/YY
QUALITY ASSURANCE	AR	MM/DD/YY
PART NO.		

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

TITLE: UNITY 1 5 KVA SYSTEM SCHEMATIC STD AND WITH EXT DC OPTION

SIZE	DWG NO.	REV
D	4678S01	E

SCALE: NONE SHEET 1 OF 1

800-25

DWG NO	4678S01	SH 1	REV G

REVISIONS

REV	CHANGE NO	DESCRIPTION	DATE	BY	CHKR	ENGR
D	ECN-3073	CHANGED PER ECN	06/10/94	RS	JTS	DAH
E	ECN-3236	CHANGED PER ECN	07/29/94	RS	JTS	DAH
F	ECN-5385	CHANGED PER ECN	02/05/98	TMW	BJB	DJB
G	ECN-5582	CHANGED PER ECN	03/31/98	RS	BJB	DJB

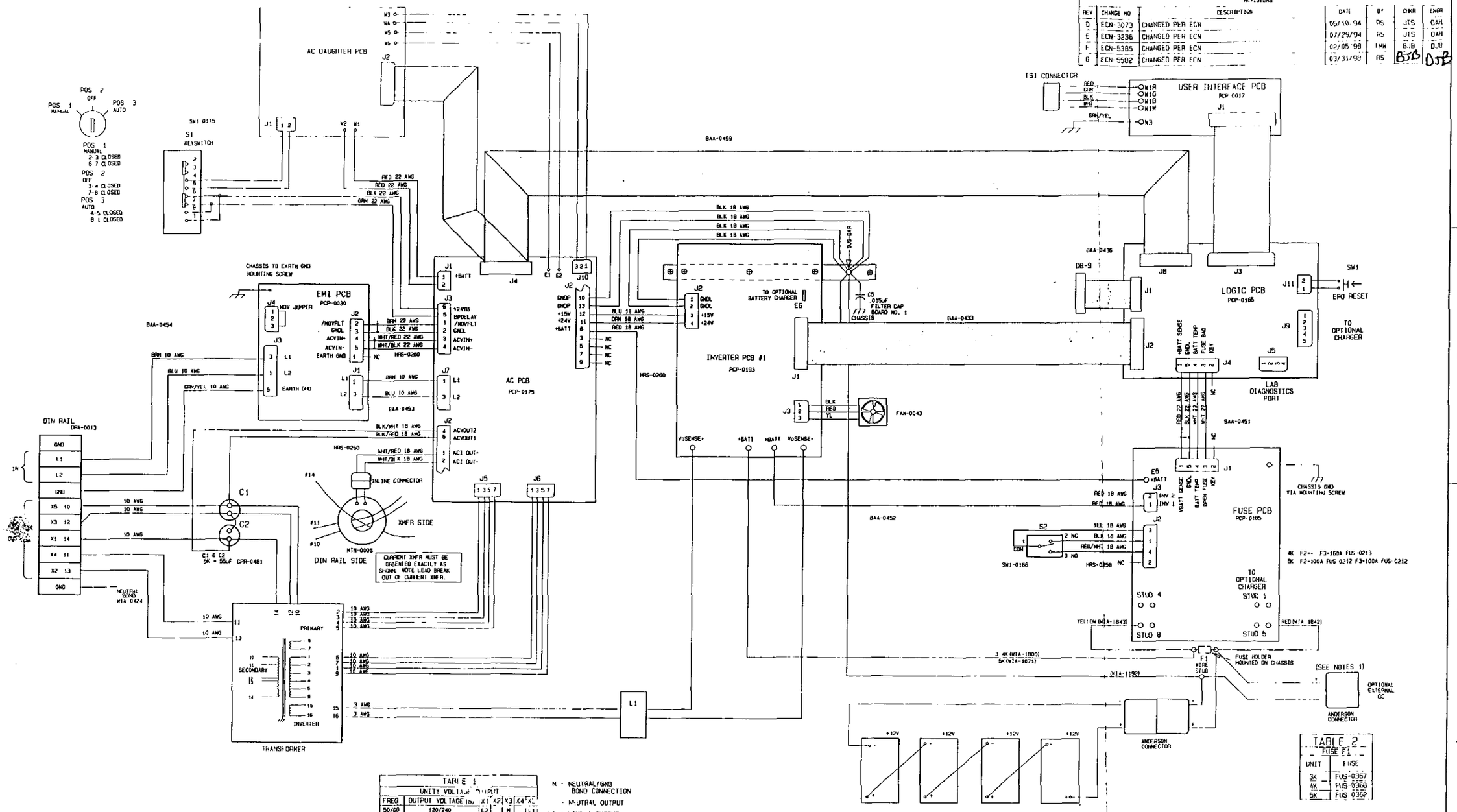


TABLE 1
UNITY VOLTAGE OUTPUT

FREQ	OUTPUT VOLTAGE	X1	X2	X3	X4	X5
50/60	120/240	L2	-	N		L1
50/60	120/208	L2	-	N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2	-	N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2	-	N		L1
50/60	208	L2	-		L1	
50	110/220	L2	-	N		L1
50/60	115/230	L2	-	N		L1
50/60	200	N	-		L1	
60	220	N	-		L1	
50	220	N	-			L1
50/60	230	N	-			L1
50	240	N	-			L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2
FUSE F1

UNIT	FUSE
3K	FUS-0367
4K	FUS-0360
5K	FUS 0362

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1
2. EXTERNAL DC OPTION ONLY
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT

CAD SYSTEM: PCAD 8.61	DIMENSION TOLERANCE	APPROVED	BEST POWER A UNIT OF GENERAL SIGNAL
DATABASE: /4678-G.PCB	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE .XX=±0.01 .XXX=±0.005 ANGLE ±2°	BRUCE K BENSON 02/16/94	TITLE: UNITY I 5 KVA SYSTEM SCHEMATIC STD & WITH EXT DC OPTION
PROPRIETARY		JTS 02/16/94	SIZE D DWG NO 4678S01 REV G
PROPRIETARY INFORMATION IN THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL, AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE EXPRESSLY PROHIBITED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED TO BEST POWER UPON DEMAND.	DO NOT SCALE DRAWING	DAH 02/16/94 VI 02/16/94 SEQ 02/16/94 AM 02/16/94 P.C. PWR NUMBER NON-SHIPPER N/A	SCALE: NONE SHEET 1 OF 1

800-26

REVISIONS							
REV	CHG.NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/16/94	BKB	JTS	DAH
B	ECN/3000		RENUMBERED DIN RAIL	3/10/94	BKB		
C	ECN/3100		CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
E			CHANGED PER ECN-3236. CREATED DRAWING 4678S02 FROM DRAWING 4678 REVD.	7/29/94	RS	JTS	DAH

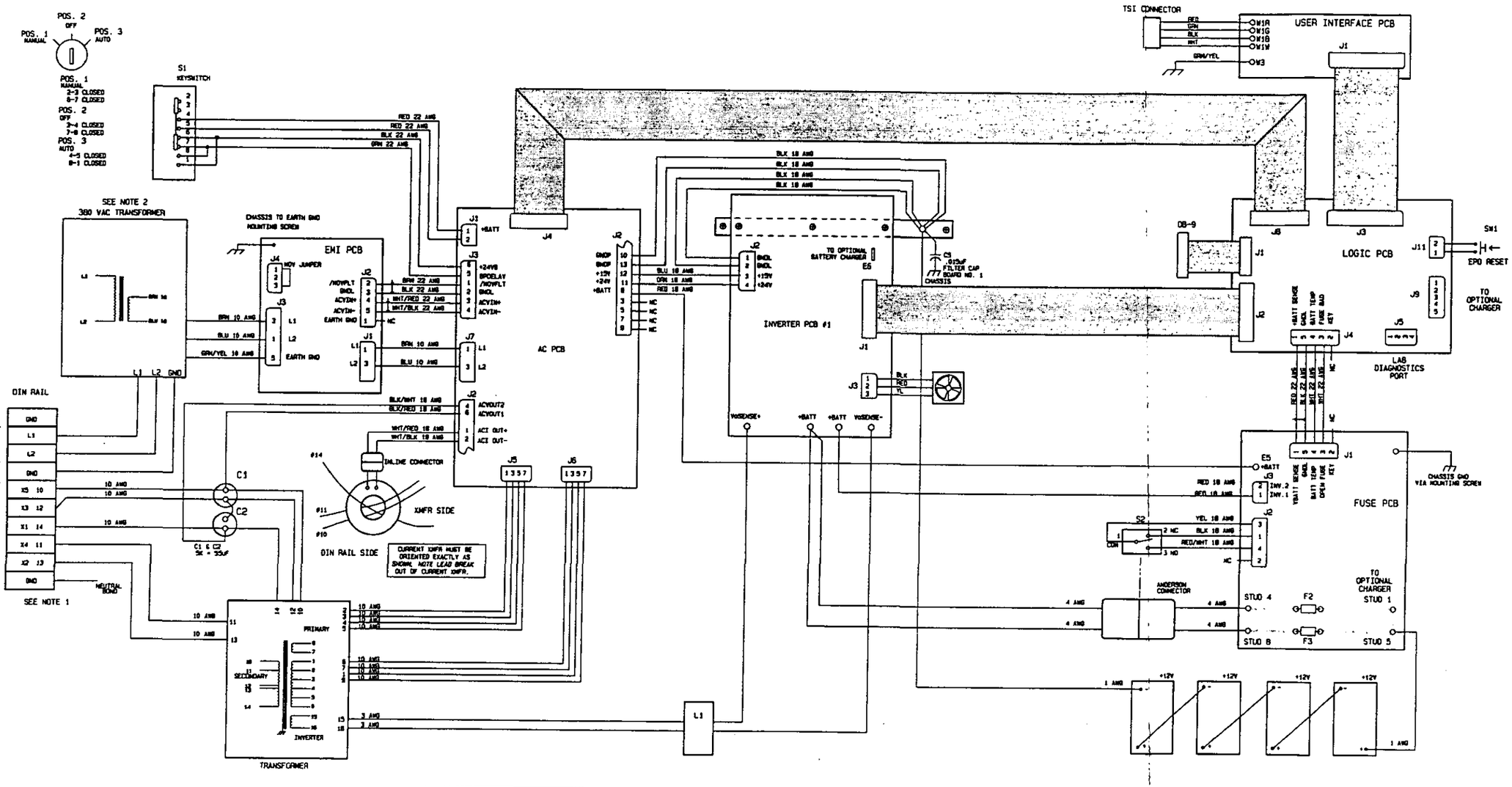


TABLE 1						
	UNITY VOLTAGE OUTPUT					
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	208	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO INSTALLATION MANUAL. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER MANUAL.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
INCHES +/-
FRAC. DEM. +/- 1/32
DEC. DEM. .XX = +/- .02
DEC. DEM. .XXX = +/- .010
ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS ( ) TOLERANCES ARE: MILLIMETERS +/-
DEC. DEM. .X = +/- .5
DEC. DEM. .XX = +/- .25
ANGLES +/- 2
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY:	BRUCE K BENSON	00/00/94
CHECKED BY:	JTS	00/00/94
ENGINEER	DAH	00/00/94
STRUCTURE ENGINEER	YT	00/00/94
MANUFACTURING ENGINEER	SED	00/00/94
QUALITY ASSURANCE:	AH	00/00/94
PART NO.		

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

TITLE: UNITY 1 5 KVA SYSTEM SCHEMATIC WITH 380 VAC OPTION ONLY

SIZE	DWG NO.	REV
D	4678S02	E

SCALE: NONE | SHEET 1 OF 1

8 800-271

DWG NO	4678S02	SH 1	REV G

REVISIONS

REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
A		RELEASE TO PRODUCTION	02/16/94	BKB	JTS	DAH
B	ECN-3000	CHANGE PER ECN (RENUMBED DIN RAIL)	03/10/94	BKB	JTS	DAH
C	ECN-3100	CHANGED PER ECN	05/09/94	RS	JTS	DAH
D	ECN-3173	CHANGED PER ECN	06/10/94	RS	JTS	DAH
E	ECN-3236	CHANGED PER ECN (CREATED 4678S02)	07/29/94	RS	JTS	DAH
F	ECN-5385	CHANGED PER ECN	02/05/98	TMW	BKB	DJB
G	ECN-5582	CHANGED PER ECN	03/31/98	RS	BKB	DJB

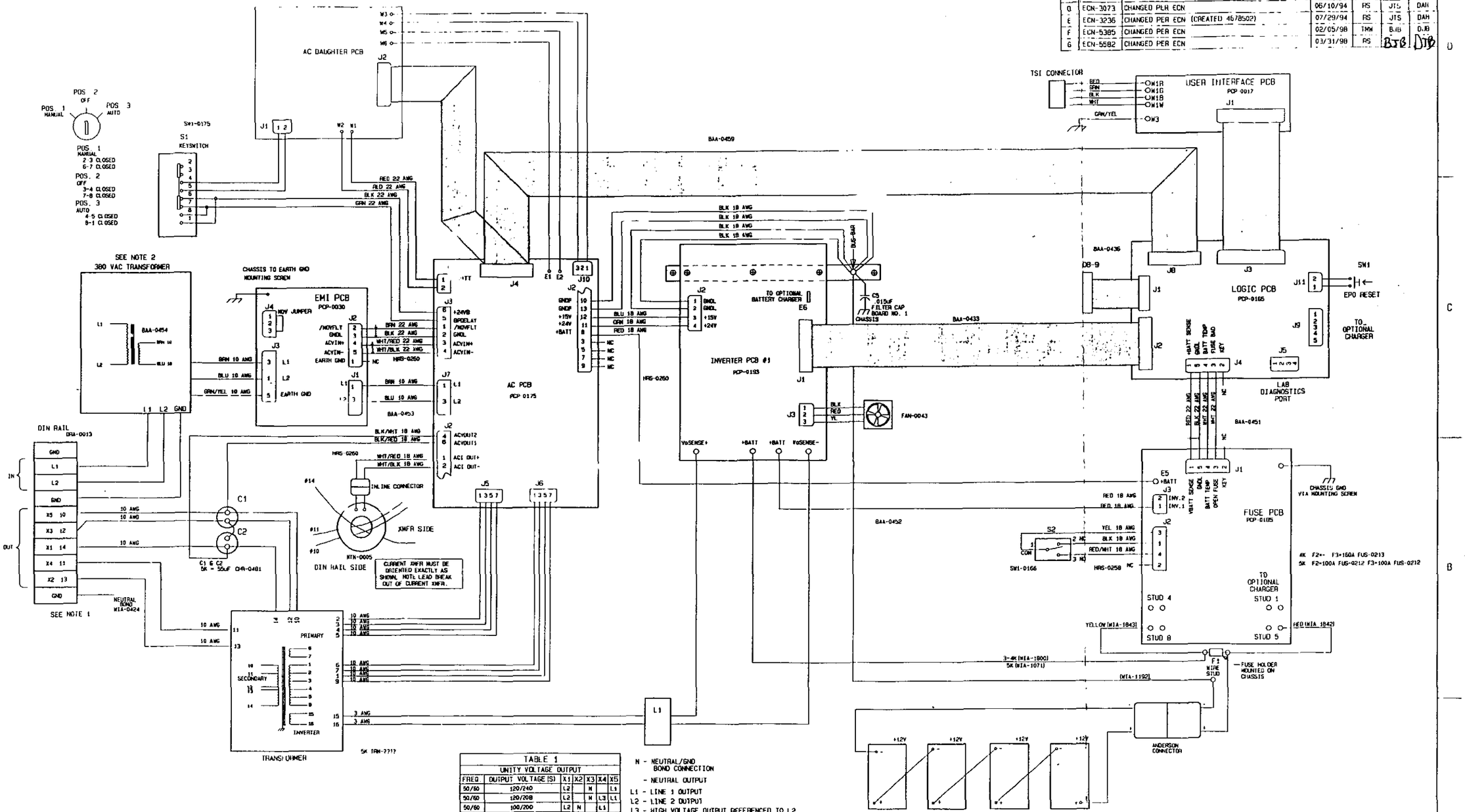


TABLE 1							
UNITY VOLTAGE OUTPUT							
FREQ	OUTPUT VOLTAGE(S)	X1	X2	X3	X4	X5	
50/60	120/240	L2		N		L3	
50/60	120/208	L2		N	L3	L1	
50/60	100/200	L2	N		L1		
60	127/220	L2		N	L3	L1	
60	110/220	L2	N		L1		
60	127/254	L2		N		L1	
50/60	208	L2			L1		
50	110/220	L2		N		L3	
50/60	115/230	L2		N		L3	
50/60	200	N			L3		
60	220	N			L3		
50	220	N				L3	
50/60	230	N				L1	
50	240	N				L1	

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO INSTALLATION MANUAL. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER MANUAL.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL OC INPUT.

CAD SYSTEM: PCAD 8.61	DIMENSION TOLERANCE	APPROVED	BEST POWER A UNIT OF GENERAL SIGNAL
DATABASE: /4678-G.PCB	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:	DRAWN BY: BRUCE K BENSON 02/16/94	
PROPRIETARY	INCHES ±	CHECKED BY: JTS 02/16/94	TITLE: UNITY I 5 KVA SYSTEM SCHEMATIC WITH 380 VAC OPTION ONLY
PROPRIETARY INFORMATION IN THIS DOCUMENT IS THE EXCLUSIVE PROPERTY OF BEST POWER, UNIT OF GENERAL SIGNAL AND MAY BE USED SOLELY FOR INSTALLATION OR SERVICE OF BEST POWER'S PRODUCTS. ANY OTHER USE EXPRESSLY PROHIBITED. THIS DOCUMENT MUST NOT BE REPRODUCED WITHOUT BEST POWER'S WRITTEN PERMISSION AND MUST BE RETURNED TO BEST POWER UPON DEMAND.	.XX DIM. ± .03 .XXX DIM. ± .010 ANGLES ± 2°	ENGINEER: DAH 02/16/94 MFG/MFG ENGINEER: VT 02/16/94 MANUFACTURING ENG: SED 02/16/94 QUALITY ASSURANCE: AM 02/16/94	SIZE D DWG NO 4678S02 REV G
DO NOT SCALE DRAWING		P.C. PART NUMBER NON-STANDARD N/A	SCALE: NONE SHEET 1 OF 1

B 800-281

REVISIONS							
REV	CHG. NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/15/94	BKB	JTS	DAH
B	ECN/3000		RENUMBERED DIN RAIL	3/10/94	BKB		
C	ECN/3100		CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
E			CHANGED PER ECN-3236. CREATED DRAWING 4678S03 FROM DRAWING 4678 REVD.	7/29/94	RS	JTS	DAH

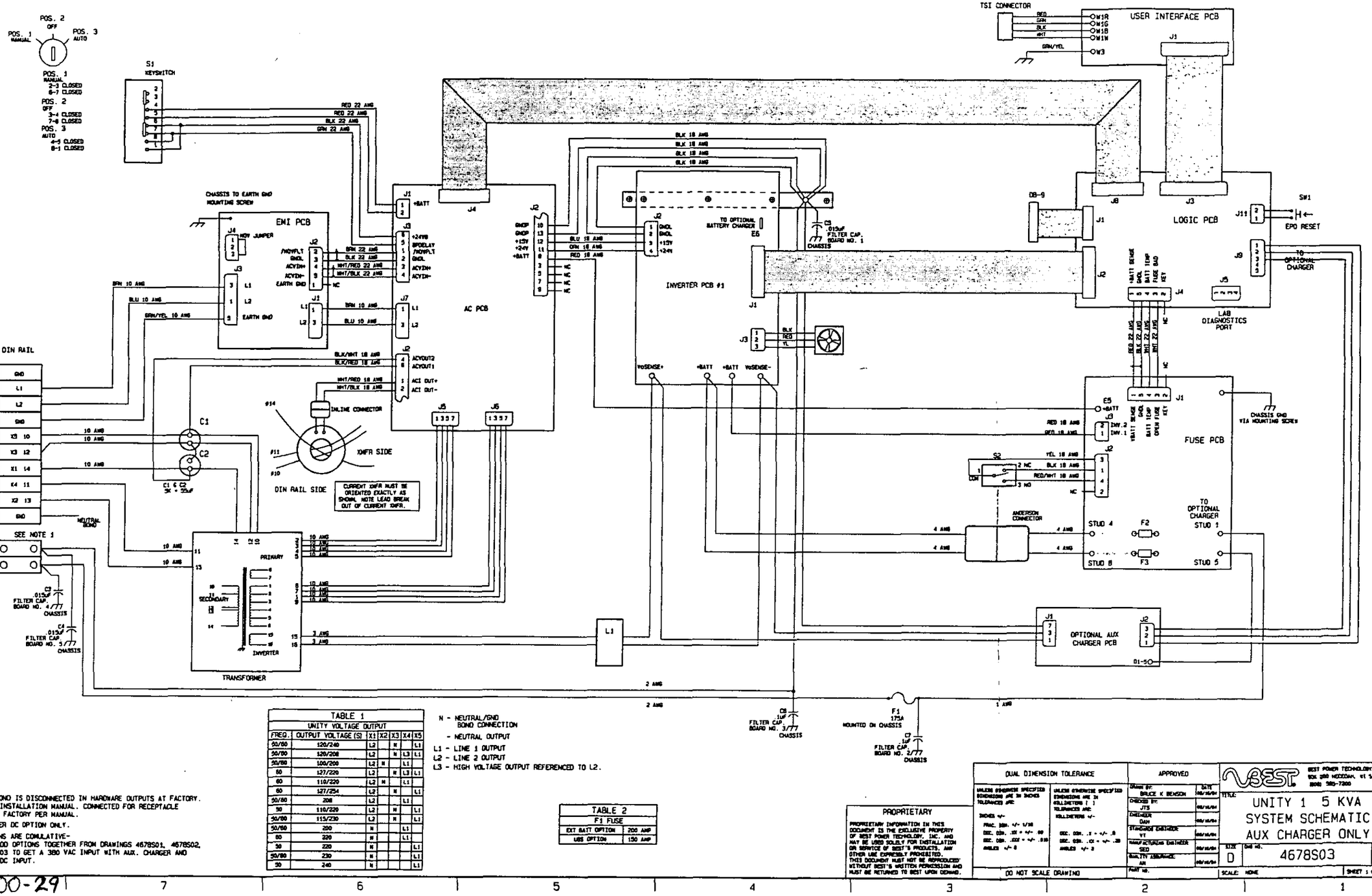


TABLE 1							
UNITY VOLTAGE OUTPUT							
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5	
50/60	120/240	L2		N		L1	
50/60	120/208	L2		N	L3	L1	
50/60	100/200	L2	N		L1		
60	127/220	L2		N	L3	L1	
60	110/220	L2	N		L1		
60	127/254	L2		N		L1	
50/60	208	L2			L1		
50	110/220	L2		N		L1	
50/60	115/230	L2		N		L1	
50/60	200	N			L1		
60	220	N			L1		
50	220	N				L1	
50/60	230	N				L1	
50	240	N				L1	

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2	
F1 FUSE	
EXT BATT OPTION	200 AMP
UBS OPTION	150 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO INSTALLATION MANUAL. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER MANUAL.
2. AUX CHARGER DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
INCHES +/-
FRAC. DEM. +/- 1/16
DEC. DIM. .XX +/- .02
DEC. DIM. .XXX +/- .010
ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS ! ! TOLERANCES ARE: MILLIMETERS +/-
DEC. DIM. .X +/- .5
DEC. DIM. .XX +/- .25
ANGLES +/- 2
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY:	BRUCE K BENSON	mm/dd/yy
CHECKED BY:	JTS	mm/dd/yy
ENGINEER:	DAH	mm/dd/yy
STANDARDS ENGINEER:	VI	mm/dd/yy
MANUFACTURING ENGINEER:	SED	mm/dd/yy
QUALITY ASSURANCE:	AR	mm/dd/yy
PART NO.		

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

TITLE: UNITY 1 5 KVA SYSTEM SCHEMATIC AUX CHARGER ONLY

SIZE: D | DWG NO.: 4678S03 | REV: E

SCALE: NONE | SHEET 1 OF 1

DWG NO.	4678S03	SH	1	REV	G

REVISIONS

REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
B	ECN-3000	CHANGED PER ECN (RENUMBERED DIN RAIL)	03/10/94	BKB	JTS	DAH
C	ECN-3100	CHANGED PER ECN	05/09/94	RS	JTS	DAH
D	ECN-3073	CHANGED PER ECN	06/10/94	RS	JTS	DAH
E	ECN-3236	CHANGED PER ECN (CREATED 4678S03 DWG)	07/29/94	RS	JTS	DAH
F	ECN-5385	CHANGED PER ECN	02/04/98	TMW	BJB	DJB
G	ECN-5582	CHANGED PER ECN	03/31/98	RS	BJB	DJB

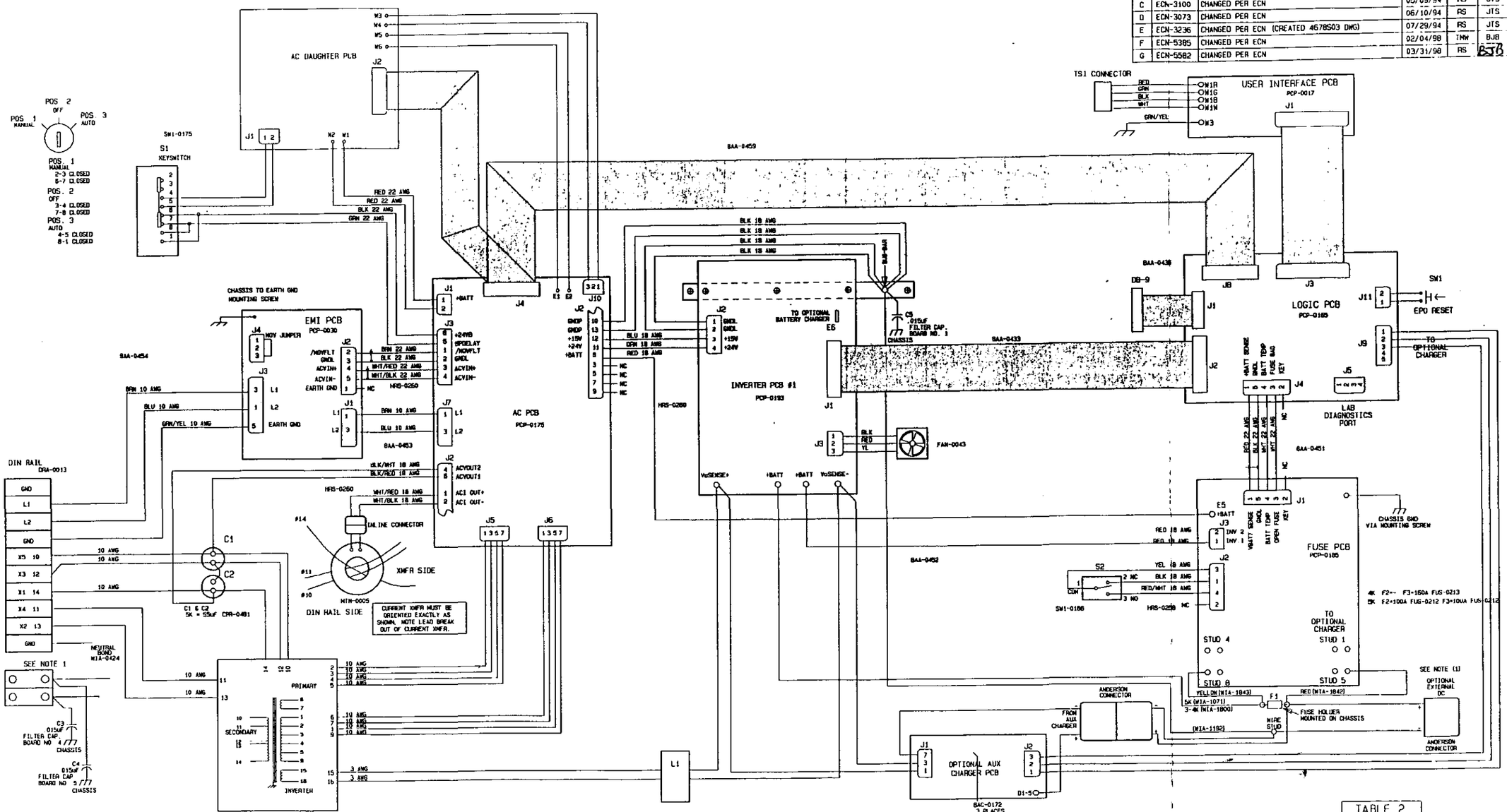


TABLE 1						
UNITY VOLTAGE OUTPUT						
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2	
F1 FUSE	
EXT BATT OPTION	200 AMP
UBS OPTION	150 AMP

TABLE 2	
FUSE F1	
UNIT	FUSE
5K	FUS-0362

NOTES.
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO INSTALLATION MANUAL. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER MANUAL.
2. AUX CHARGER DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4678S01, 4678S02, AND 4678S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

800-30

CAD SYSTEM: PCAD 8.61
DATABASE: /4678-G PCB

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMALS: .XX = ± .02 .XXX = ± .010
ANGLES ± 2°
DO NOT SCALE DRAWING

APPROVED		
DRAWN BY	BRUCE K BENSON	02/16/94
CHECKED BY	JTS	02/16/94
ENGINEER	DAH	02/16/94
MANUFACTURING ENGINEER	VI	02/16/94
MANUFACTURING ENG.	SED	02/16/94
QUALITY ASSURANCE	AM	02/16/94
P.C. PWB NUMBER AND SHIFTER	N/A	

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280 NECEDAH, WI 54646 (608) 565-7200

TITLE:
UNITY I 5 KVA
SYSTEM SCHEMATIC
AUX CHARGER ONLY

SIZE	DWG NO	REV
D	4678S03	G

SCALE: NONE SHEET 1 OF 1

REVISIONS						
REV	ECN NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/16/94	BKB	JTS	DAM
B	ECN-3006		RENUMBERED CT PINS	3/10/94	BKB		
C	ECN-3100		CHANGED PER ECN-3100	5/9/94	RS	JTS	DAM
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAM
E			CHANGED PER ECN-3236. CREATED DRAWING 4646S01 FROM DRAWING 4646 REVD.	8/1/94	RS	JTS	DAM

DWG NO. 4646S01 SH 1 REV E

POS. 2 OFF
POS. 1 MANUAL
POS. 3 AUTO

POS. 1 MANUAL
2-3 CLOSED
6-7 CLOSED
POS. 2 OFF
3-4 CLOSED
7-8 CLOSED
POS. 3 AUTO
4-5 CLOSED
8-1 CLOSED

S1 KEYSWITCH

TSI CONNECTOR
RED
GRN
BLK
WHT
GRN/YEL
W1R
W1G
W1B
W1W
W3

USER INTERFACE PCB
J1

ENI PCB
CHASSIS TO EARTH GND MOUNTING SCREW
J4 HOV JUMPER
J2 /MOVFLT, GNDL, ACVIN+, ACVIN-, EARTH GND
J3 L1, L1, L2, L2, EARTH GND, EARTH GND
J1 L1, L2, L3, L3
J6 L1, L2, L3, L3
J2 ACVOUT2, ACVOUT1, ACT OUT+, ACT OUT-

AC PCB
J1 +BATT
J3 +24VB, BPDELAY, /NOVFLT, GNDL, ACVIN+, ACVIN-
J4
J2 GNDP, GNDP, +15V, +24V, +BATT

INVERTER PCB #1
J2 GNDL, GNDL, +15V, +24V
TO OPTIONAL BATTERY CHARGER E6
C3 .015UF CHASSIS FILTER CAP BRD NO. 1
J3
J1 VoSENSE+, +BATT, +BATT, VoSENSE-

INVERTER PCB #2
J1 VoSENSE+, +BATT, +BATT, VoSENSE-
J3

LOGIC PCB
J8-9
J1
J6
J3
J11 SW1 EPO RESET
J9 TO OPTIONAL CHARGER
J2
J5 LAB DIAGNOSTICS PORT
J4 +BATT SENSE, GNDL, BATT TEMP, FUSE BAD, KEY
J1

FUSE PCB
E5 +BATT
J3 INV.2, INV.1
J1 +BATT SENSE, GNDL, BATT TEMP, OPEN FUSE, KEY
CHASSIS GND VIA MOUNTING SCREW
S2 NC, COM, NO
J2
ANDERSON CONNECTOR
STUD 4, STUD 8, F2, F3, STUD 1, STUD 5
TO OPTIONAL CHARGER
+12V, +12V, +12V, +12V

DIN RAIL
GND, L1, L2, GND, X5 10, X1 14, X4 11, X3 12, X2 13, GND
IN
OUT
NEUTRAL BOND
(SEE NOTE 1)
OPTIONAL EXTERNAL DC
C1 70uF
C2 70uF
#14, #10, #11
INLINE CONNECTOR
XMFR SIDE
DIN RAIL SIDE
CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR.
J7 1 3 5 7 9 11
J5 1 3 5 7 9 11
J6 1 3 5 7
C2 .015uF FILTER CAP BOARD NO. 4 CHASSIS
C4 .015uF FILTER CAP BOARD NO. 5 CHASSIS
PRIMARY
SECONDARY
INVERTER
TRANSFORMER
L1 AND L2
L3 AND L4
C5 .015uF FILTER CAP BOARD NO. 3 CHASSIS
F1 250A MOUNTED ON CHASSIS
C7 .015uF FILTER CAP BOARD NO. 2 CHASSIS

TABLE 1
UNITY VOLTAGE OUTPUT

FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
50	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2
F1 FUSE

EXT BATT OPTION	300 AMP
UBS OPTION	250 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646S01, 4646S02, AND 4646S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
INCHES +/-
FRAC. DEC. +/- 1/16
DEC. 0.XX. .01 = +/- .02
DEC. 0.XX. .005 = +/- .010
ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS [ ]
TOLERANCES ARE:
MILLIMETERS +/-
DEC. 0.XX. .5 = +/- .5
DEC. 0.XX. .XX = +/- .25
ANGLES +/- 2

DO NOT SCALE DRAWING

APPROVED		
Drawn by: BRUCE K BENSON		DATE 08/16/94
CHECKED BY: JTS		08/16/94
ENGINEER: DAM		08/16/94
STANDARDS ENGINEER: VT		08/16/94
MANUFACTURING ENGINEER: SEO		08/16/94
QUALITY ASSURANCE: AM		08/16/94
PART NO.		

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

TITLE: UNITY 1 8 KVA SYSTEM SCHEMATIC STANDARD AND WITH EXT DC OPTION

SIZE D | DWG NO. 4646S01 | REV E

SCALE: NONE | SHEET 1 OF 1

800-311

DWG NO.	SH	REV
16-16501	1	G

REVISIONS

REV	CHANGE NO.	DESCRIPTION	DATE	BY	CHKR	ENGR
C	ECN-3100	CHANGED PER ECN	05/09/94	RS	JTS	DAH
D	ECN-3073	CHANGED PER ECN	06/10/94	RS	JTS	DAH
E	ECN-3236	CHANGED PER ECN	07/29/94	RS	JTS	DAH
F	ECN-5385	CHANGED PER ECN	02/05/98	TMW	BJB	DJB
G	ECN-5562	CHANGED PER ECN	03/30/98	RS	BJB	DJB

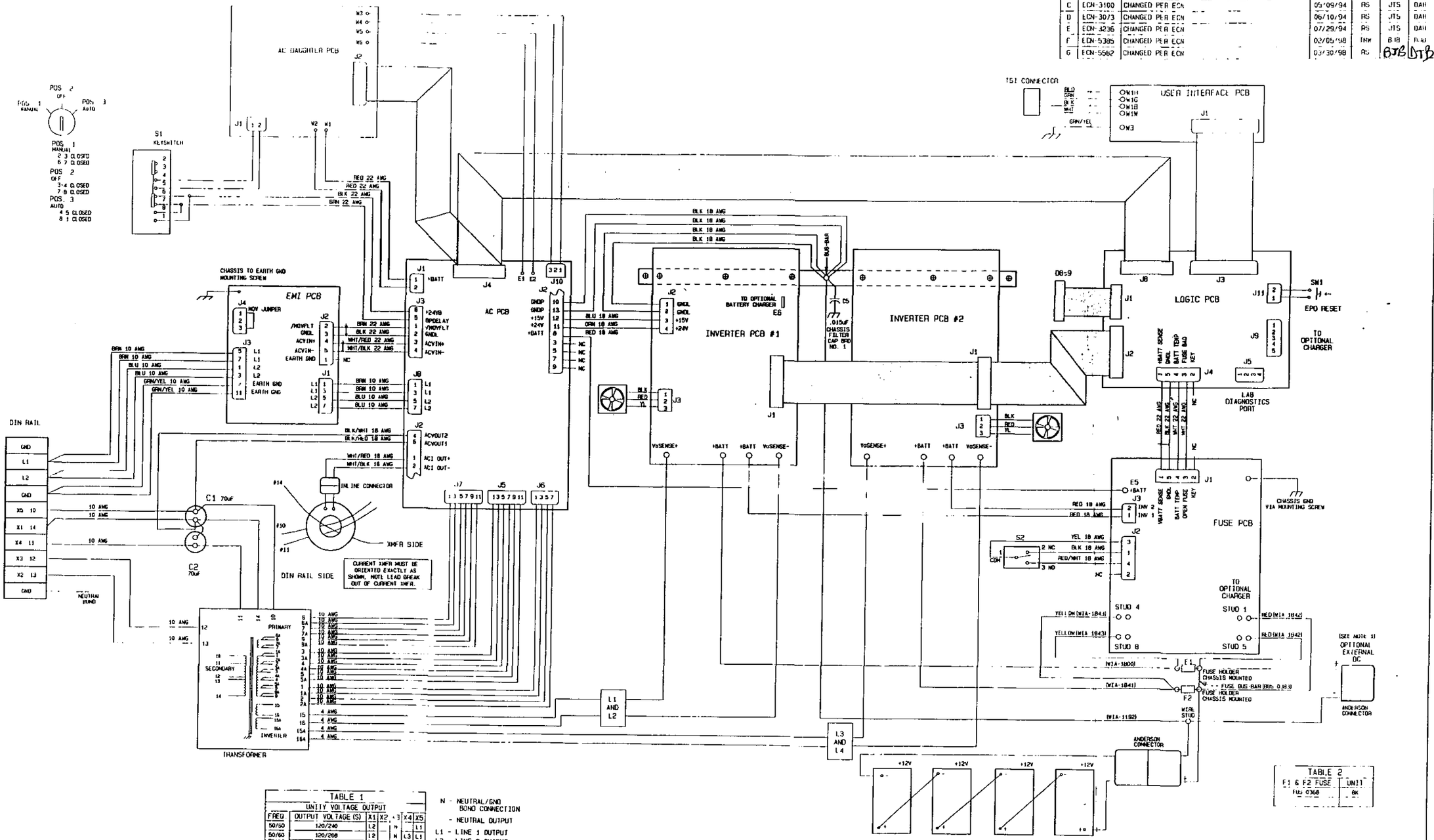


TABLE 1
UNITY VOLTAGE OUTPUT

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/50	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
50	110/220	L2	N		L1	
50	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2

F1 & F2 FUSE	UNIT
FUS-0368	8K

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. EXTERNAL DC OPTION ONLY.
3. ALL OPTIONS ARE COMMULATIVE. YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646S01, 4646S02, AND 4646S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT

800-32

CAD SYSTEM:	PCAD 8.61
DATABASE:	/4646-G.PCB

PROPRIETARY

DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
INCHES ±
DEC. DIM. .XX = ± .02
DEC. DIM. .XXX = ± .010
ANGLE ± 2°
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY:	BRUCE K BENSON	02/16/94
CHECKED BY	JTS	02/16/94
ENGINEER	DAH	02/16/94
MANUFACTURING ENGINEER	VT	02/16/94
MANUFACTURING MGR.	SED	02/16/94
QUALITY ASSURANCE	AM	02/16/94

P.C. PART NUMBER (IF ANY, SEE NOTE) N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280 NECEDAH, WI 54646 (800) 356-7299

TITLE
UNITY I 8 KVA SYSTEM SCHEMATIC STANDARD & WITH EXT DC OPTION

SIZE D | DWG NO. 4646S01 | REV G

SCALE: NONE | SHEET 1 OF 1

REVISIONS							
REV	CHG. NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/15/94	BKB	JTS	DAH
B	ECN-3000		RENUMBERED CT PINS	3/10/94	BKB		
C	ECN-3100		CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
E			CHANGED PER ECN-3235. CREATED DRAWING 4646S02 FROM DRAWING 4646 REV0.	8/1/94	RS	JTS	DAH

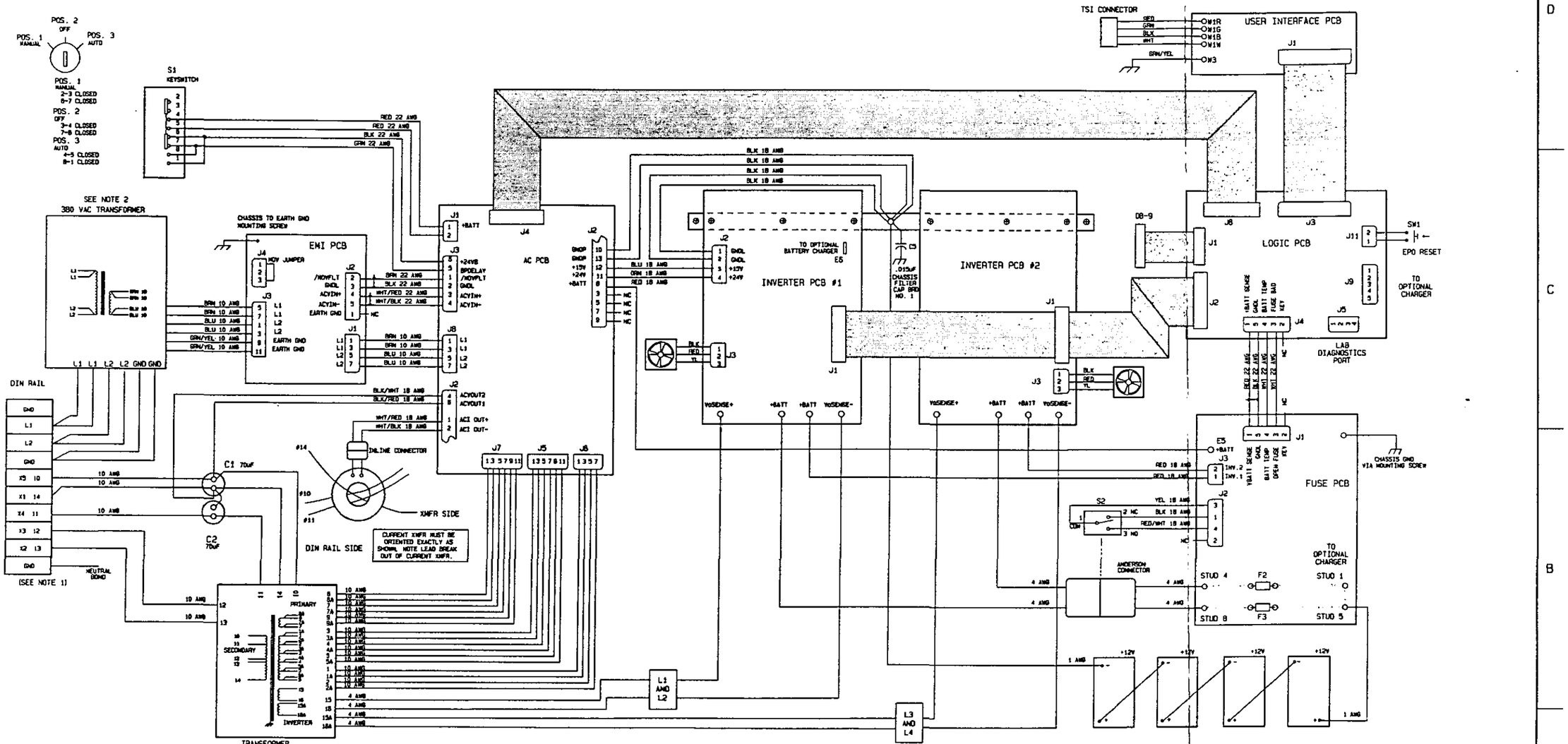


TABLE 1						
UNITY VOLTAGE OUTPUT						
FREQ.	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L3	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE CUMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646S01, 4646S02, AND 4646S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: INCHES +/- FRAC. DEC. +/- 1/16 DEC. DIN. .XX +/- .02 DEC. DIN. .XXX +/- .010 ANGLES +/- 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS [ ] TOLERANCES ARE: MILLIMETERS +/- DEC. DIN. .X +/- .5 DEC. DIN. .XX +/- .25 ANGLES +/- 2
DO NOT SCALE DRAWING

APPROVED		
DRAWN BY: BRUCE K BENSON	DATE 08/18/94	
CHECKED BY: JTS	08/18/94	
ENGINEER DAH	08/18/94	
STANDARDS ENGINEER VT	08/18/94	
MANUFACTURING ENGINEER SED	08/18/94	
QUALITY ASSURANCE AM	08/18/94	
PART NO.		

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

TITLE: UNITY 1 8 KVA SYSTEM SCHEMATIC WITH 380 VAC INPUT ONLY

SIZE D | DWG NO. 4646S02 | REV E

SCALE: NONE | SHEET 1 OF 1

8 800-331

REVISIONS						
REV	CHANGE NO	DESCRIPTION	DATE	BY	CHKR	ENGR
C	ECN 3100	CHANGED PER ECN	05/09/94	RC	JTS	DAH
D	ECN 3073	CHANGED PER ECN	06/10/94	RC	JTS	DAH
E	ECN 3236	CHANGED PER ECN	07/29/94	RC	JTS	DAH
F	ECN 5385	CHANGED PER ECN	02/05/98	TMM	BJB	DAH
G	ECN 5582	CHANGED PER ECN	03/30/98	RC	BJB	DJB

46-165O2 | SH 1 | REV G

POS 2 OFF
POS 1 MANUAL
POS 3 AUTO

POS 1 MANUAL
2 3 CLOSED
6 7 CLOSED

POS 2 OFF
3 4 CLOSED
7 8 CLOSED

POS 3 AUTO
4 5 CLOSED
8 1 CLOSED

S1 ROTARY SWITCH

AC CHARGER PCB

J1 1 2 | W2 W1

RED 22 AWG
RED 22 AWG
BLK 22 AWG
GRN 22 AWG

SEE NOTE 2
380 VAC TRANSFORMER

L1 L1 L2 L2 GND GND

CHASSIS TO EARTH GND MOUNTING SCREW

EMI PCB
J4 MOV JUMPER
J2 /MOV/ELT GND ACVIN+ ACVIN EARTH GND
J3 L1 L1 L2 L2 EARTH GND EARTH GND
J1 L1 L1 L2 L2

BRN 22 AWG
BLK 22 AWG
WHT/RED 22 AWG
WHT/BLK 22 AWG
NC

BRN 10 AWG
BRN 10 AWG
BLU 10 AWG
BLU 10 AWG
GRN/YEL 10 AWG
GRN/YEL 10 AWG

BRN 10 AWG
BRN 10 AWG
BLU 10 AWG
BLU 10 AWG

BLK/WHT 18 AWG
BLK/RED 18 AWG

WHT/RED 18 AWG
WHT/BLK 18 AWG

INLINE CONNECTOR

#14 #10 #11

XMFR SIDE

DIN RAIL SIDE

CURRENT XMFR MUST BE ORIENTED EXACTLY AS SHOWN. NOTE LEAD BREAK OUT OF CURRENT XMFR

DIN RAIL
GND
L1
L2
GND
X5 10
X1 14
X4 11
X3 12
X2 13
GND
IN
OUT
(SEE NOTE 1)

C1 70uF
C2 70uF

10 AWG
10 AWG
10 AWG

NEUTRAL BOND

TRANSFORMER
PRIMARY
SECONDARY
INVERTER

10 AWG
10 AWG
4 AWG
4 AWG
4 AWG
4 AWG

AC PCB
J1 +BATT
J3 +24VB BPDRELAY /MOV/ELT GNDL ACVIN+ ACVIN-
J8 L1 L1 L2 L2
J2 ACVOUT2 ACVOUT1 ACI OUT+ ACI OUT-
J7 J5 J6

E1 E2 | J10 | J2 GNDP GNDP +15V +24V +BATT

BLU 18 AWG
GRN 18 AWG
RED 18 AWG

NC NC NC NC

BLK 18 AWG
BLK 18 AWG
BLK 18 AWG
BLK 18 AWG

INVERTER PCB #1
J2 GNDL GNDL +15V +24V
TO OPTIONAL BATTERY CHARGER
E6
J3 BLK RED YL
J1 VSCENSE+ +BATT +BATT VSCENSE-

BLK/BLK
C5 .01uF CHASSIS FILTER CAP BRAID NO 1

INVERTER PCB #2
J3 VSCENSE+ +BATT +BATT VSCENSE-
J1

BLK RED YL

IST CONNECTOR
BLU BRN BLK WHT
GRN/YEL

USER INTERFACE PCB
J1
SW1R SW1S SW1B SW1M
SW3

LOGIC PCB
J8 J9 J11 J1 J2 J8 J5 J4
+BATT SENSE GNDL +BATT TEMP FUSE BAD KEY
NC

RED 22 AWG
BLK 22 AWG
WHT 22 AWG
WHT 22 AWG

SW1
EPO TRIP
TO OPTIONAL CHARGER

LAB DIAGNOSTICS PORT

J2

J5
L5 +BATT
J3 INV 2 INV 1
VBATT SENSE BATT TEMP OPEN FUSE KEY
J1
FUSE PCB
J2
CHASSIS GND VIA MOUNTING SCREW

RED 18 AWG
BLU 18 AWG
YEL 18 AWG
BLK 18 AWG
RED/WHT 18 AWG
NC

S2
COM 1 2 NC 3 NO

10 OPTIONAL CHARGER
STUD 4 STUD 1
STUD 8 STUD 5

YELLOW (WIA-1843)
YELLOW (WIA-1843)
RED (WIA-1842)
RED (WIA-1842)

(WIA-1839)
(WIA-1841)
(WIA-1192)

F1 FUSE HOLDER CHASSIS MOUNTED
F2 FUSE HOLDER CHASSIS MOUNTED
WIRE STUD

ANDERSON CONNECTOR

L3 AND L4

+12V +12V +12V +12V

TABLE 2

F1 & F2 FUSE	UNIT
MDL 0308	8K

TABLE 1
UNITY VOLTAGE OUTPUT

FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1
2. 380 VAC OPTION ONLY.
3. ALL OPTIONS ARE COMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646501, 4646502, AND 4646503 TO GET A J60 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT

800-34

CAD SYSTEM: PCAD 8 61
DATABASE: /4646 G PCB

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DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
INCHES ±
DEC DIM XX = ± .02
DEC DIM XXX = ± .010
ANGLE = 2°
DO NOT SCALE DRAWING

APPROVED

		DATE
DRAWN BY	BRUCE K BENSON	02/16/94
CHECKED BY	JTS	02/16/94
ENGINEER	DAH	02/16/94
STANDARDS ENGINEER	VT	02/16/94
MANUFACTURING ENG	SED	02/16/94
QUALITY ASSURANCE	AM	02/16/94

P.C. PART NUMBER NOW STARTED N/A

BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280 NECEDAH, WI 54646 (608) 565-7200

TITLE
UNITY I 8KVA SYSTEM SCHEMATIC WITH 380 VAC INPUT ONLY

SIZE D | DWG NO 46-165O2 | REV G

SCALE NONE | SHEET 1 OF 3

Dwg no. 4646S03	Sh 1	REV E

REVISIONS

REV	CHG.NO.	ZONE	DESCRIPTION	DATE	BY	CHKR	ENGR
A			RELEASED TO PRODUCTION	2/16/94	BKB	JTS	DAH
B	ECN/3000		RENUMBERED CT PINS	3/10/94	BKB		
C	ECN/3100		CHANGED PER ECN-3100	5/9/94	RS	JTS	DAH
D			CHANGED PER ECN-3073	6/10/94	RS	JTS	DAH
E			CHANGED PER ECN-3238. CREATED DRAWING 4646S03 FROM DRAWING 4646 REVD.	8/1/94	RS	JTS	DAH

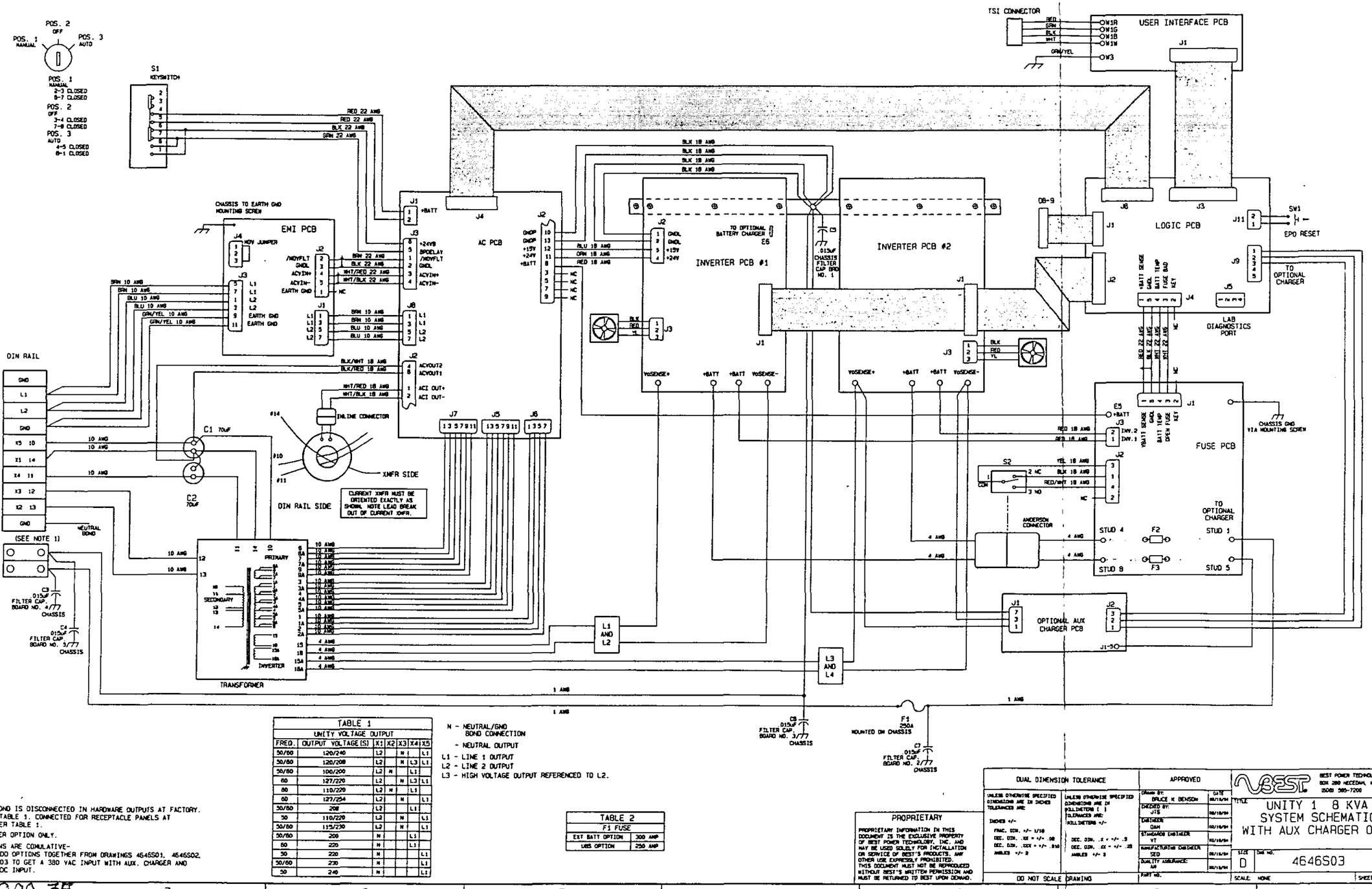


TABLE 1							
UNITY VOLTAGE OUTPUT							
FREQ.	OUTPUT VOLTAGE(S)	X1	X2	X3	X4	X5
50/60	120/240	L2		N		L1
50/60	120/208	L2		N	L3	L1
50/60	100/200	L2	N		L1	
60	127/220	L2		N	L3	L1
60	110/220	L2	N		L1	
60	127/254	L2		N		L1
50/60	208	L2			L1	
50	110/220	L2		N		L1
50/60	115/230	L2		N		L1
50/60	200	N			L1	
60	220	N			L1	
50	220	N				L1
50/60	230	N				L1
50	240	N				L1

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

TABLE 2	
F1 FUSE	
EXT BATT OPTION	300 AMP
UBS OPTION	250 AMP

NOTES:
1. NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2. AUX CHARGER OPTION ONLY.
3. ALL OPTIONS ARE COMULATIVE- YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646S01, 4646S02, AND 4646S03 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

DUAL DIMENSION TOLERANCE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
INCHES +/-
FRAC. DIM. +/- 1/16
DEC. DIM. .XX = +/- .02
DEC. DIM. .XXX = +/- .010
ANGLES +/- 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS [ ]
TOLERANCES ARE:
MILLIMETERS +/-
DEC. DIM. .X = +/- .5
DEC. DIM. .XX = +/- .25
ANGLES +/- 2

DO NOT SCALE DRAWING

APPROVED	
DRAWN BY: BRUCE K BENSON	DATE 08/15/94
CHECKED BY: JTS	08/15/94
ENGINEER DAH	08/15/94
STANDARDS ENGINEER VT	08/15/94
MANUFACTURING ENGINEER SED	08/15/94
QUALITY ASSURANCE: AM	08/15/94
PART NO.	

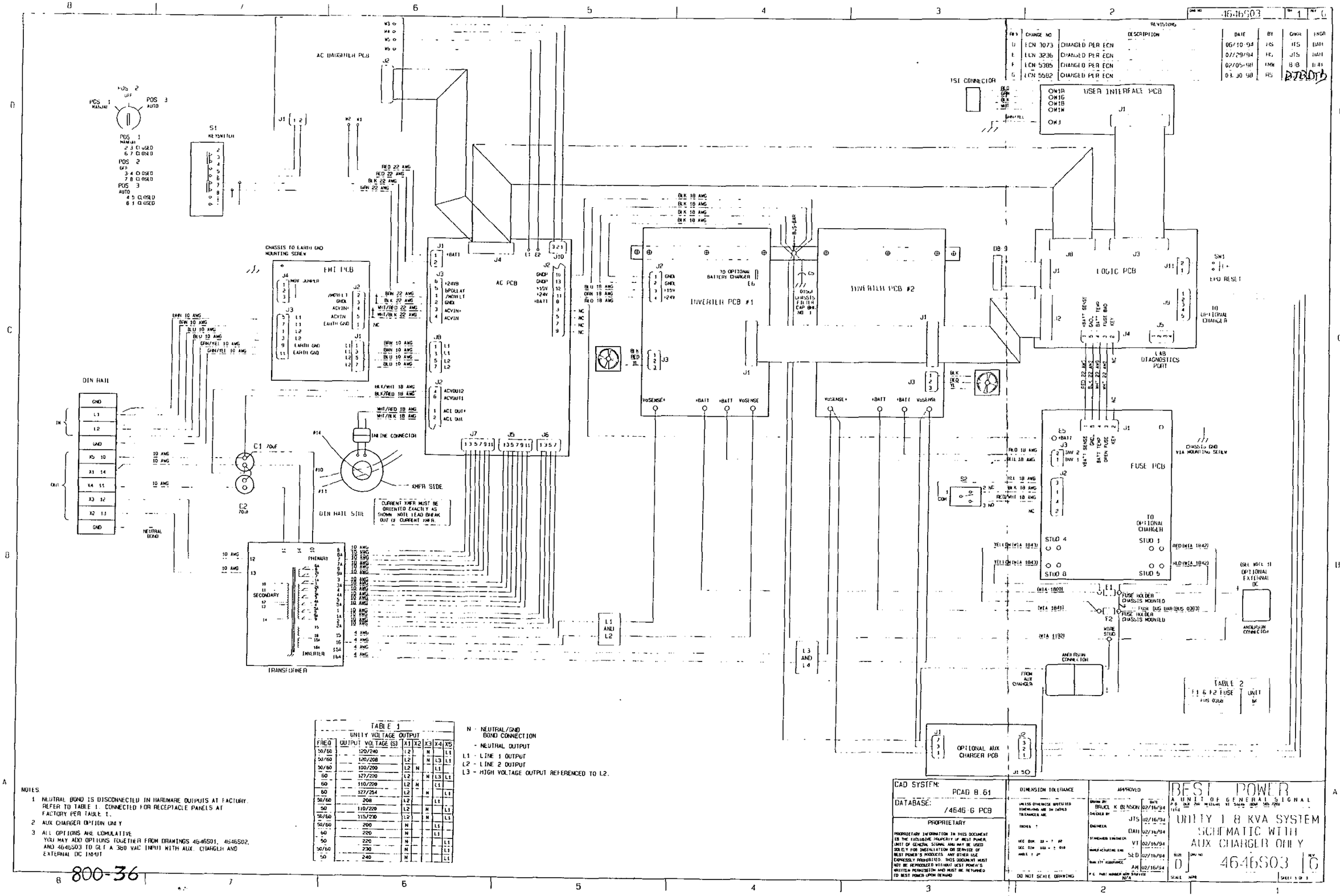
BEST POWER TECHNOLOGY, INC.
BOX 280 NECEDAH, WI 54646
(608) 565-7200

TITLE: UNITY 1 8 KVA SYSTEM SCHEMATIC WITH AUX CHARGER ONLY

SIZE	Dwg no.	REV
D	4646S03	E

SCALE: NONE | SHEET 1 OF 1

800-35



REV	CHANGE NO	DESCRIPTION	DATE	BY	CHKR	ENGR
D	ECN 3073	CHANGED PER ECN	06/10/94	RS	JTS	DAH
E	ECN 3236	CHANGED PER ECN	07/29/94	RS	JTS	DAH
F	ECN 5305	CHANGED PER ECN	02/05/98	KMH	BJB	BJBS
G	ECN 5582	CHANGED PER ECN	03 JU 98	RS	BJBS	BJBS

DWG NO 4646503 REV 1 REV G

TABLE 1

UNITY VOLTAGE OUTPUT							
FREQ	OUTPUT VOLTAGE (S)	X1	X2	X3	X4	X5	
50/60	120/240	L2		N		L1	
50/60	120/208	L2		N	L3	L1	
50/60	100/200	L2	N		L1		
60	127/220	L2		N	L3	L1	
60	110/220	L2	N		L1		
60	127/254	L2		N		L1	
50/60	208	L2			L1		
50	110/220	L2		N		L1	
50/60	115/230	L2		N		L1	
50/60	200	N			L1		
60	220	N			L1		
50	220	N				L1	
50/60	230	N				L1	
50	240	N				L1	

N - NEUTRAL/GND BOND CONNECTION
- NEUTRAL OUTPUT
L1 - LINE 1 OUTPUT
L2 - LINE 2 OUTPUT
L3 - HIGH VOLTAGE OUTPUT REFERENCED TO L2.

NOTES:
1 NEUTRAL BOND IS DISCONNECTED IN HARDWARE OUTPUTS AT FACTORY. REFER TO TABLE 1. CONNECTED FOR RECEPTACLE PANELS AT FACTORY PER TABLE 1.
2 AUX CHARGER OPTION ONLY
3 ALL OPTIONS ARE CUMULATIVE. YOU MAY ADD OPTIONS TOGETHER FROM DRAWINGS 4646501, 4646502, AND 4646503 TO GET A 380 VAC INPUT WITH AUX. CHARGER AND EXTERNAL DC INPUT.

800-36

CAD SYSTEM: PCAD 8.61
DATABASE: /4646-G PCB
PROPRIETARY
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DIMENSION TOLERANCE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE
DECIMALS .
USE DIM .XX ± .02
USE DIM .XXX ± .010
ANGLES ± 2°
DO NOT SCALE DRAWING
APPROVED
DRAWN BY BRUCE K BENSON 02/16/94
CHECKED BY JTS 02/16/94
ENGINEER DAH 02/16/94
STANDARDS ENGINEER VT 02/16/94
MANUFACTURING ENG SED 02/16/94
QUALITY ASSURANCE AM 02/16/94
P/C PART NUMBER NOT STUFFED N/A
BEST POWER
A UNIT OF GENERAL SIGNAL
P.O. BOX 280 NECEDAH, WI 54646 (608) 565-7200
TITLE
UNITY 1 & KVA SYSTEM SCHEMATIC WITH AUX CHARGER ONLY
SIZE D DWG NO 4646503 REV G
SCALE NONE SHEET 1 OF 1

UNITY/I® SINGLE-PHASE 3kVA/kW TO 8kVA/kW

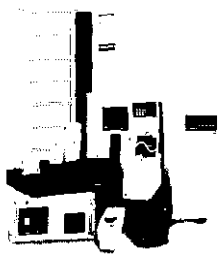
UNINTERRUPTIBLE POWER SYSTEMS

SPECIFICATIONS

Model	UT3K	UT4K	UT5K	UT8K
Rating	3kVA/3kW	4kVA/4kW	5kVA/5kW	8kVA/8kW
AC Input Voltage Range	147-276V (for nominal 200/208/220/230/240V output)			
Input Nominal Current at Full Load	200V=17A 208V=17A 220V=16A 230V=15A 240V=15A	200V=22A 208V=22A 220V=20A 230V=20A 240V=19A	200V=28A 208V=27A 220V=25A 230V=24A 240V=23A	200V=45A 208V=43A 220V=41A 230V=39A 240V=38A
Output Connection	Hardwired output is standard. (pre-configured models available -contact factory.)			
Efficiency (an line)	95%		96%	
Heat (an line): (BTU/hr.)	539	569	711	1138
(kW/hr.)	0.158	0.167	0.208	0.333
Audible Noise	<40dBA at 1 mete,			
Typical Runtime: (Full Load)	19	12	9	13
(minutes) (Half Load)	43	28	21	31
Battery Charger	5 amp			10 amp
Battery Recharge	2-3 hours			
Weight: (lb)	280		295	490
(kg)	127		134	222
Dimensions: H x W x D (inches)	29 x 10.5 x 25.75			32 x 13 x 33
(mm)	737 x 267 x 654			813 x 330 x 838

Lightning and Surge Protection: UL1449 listed. 300 joule surge suppression rating. Meets IEC 801-5. Tested to ANSI/IEEE C62.41 Categories A3 and B3 test. Zero surge clamping response time. 0.7% LTV.
Isolation (includes output N-10-G bond): Complete from line. Qualifies as a separately derived power source under NEC article 250-5d.
Noise Rejection: Common Mode - up to 50dB. Normal Mode - up to 90dB.
Regulation: ±5% of nominal output voltage (programmable to ± 3%). Exceeds recommended CBEMA and ANSI voltage regulation standards for computing equipment under any line. load, or battery conditions.
Continuous **No-Break** Power: Continuous, no-break power during a complete power outage or momentary power interruption.
Sine-Wave Power: Sine-wave. computer-grade power with 5% or less total harmonic distortion (THO) at rated kW load. Meets or exceeds GSA C22.2 No. 107.1 for harmonic distortion.
Load Compatibility: Guaranteed compatible with all computer loads. including power factor-corrected.
Intelligent, Interactive Interface: RS-232 port featuring full-duplex serial communication, alarm contacts, inverter contacts, and remote shutdown.
Reliability Engineered: Dual-track redundant configuration that utilizes either line or inverter source for power and is designed to meet or exceed an expected MTBF of 150,000 hours.
Protection: Overload alarm and microprocessor-controlled circuit breaker. Optional output receptacles protected by fuses or circuit breakers
Overload: 200% surge
Frequency: (50 Hz or 60 Hz nominal)
On line: output frequency tracks input within adjustable limits (±3 Hz default). On inverter: ±0.15 Hz.
Operating Temperature: 0° to +40° C, storage temperature: From -20" to +60° C (-20" to +40° C if battery is not removed)
Relative Humidity: 0 to 95% without condensation
Ventilation Requirement: Clean. dust-free air, free of corrosive chemicals or other contaminants must be available with proper air circulation.
High-Altitude Operation: Maximum ambient operating temperature drops by 1" C per 305 meters (1,000 feet) above sea level, with the maximum elevation being 3,050 meters (10,000 feet).
Safety Compliance: UL 1778, UL 1449, CSA (cUL), GS (TÜV), CE
EMC Compliance: FCC-A, Vfg 24311991, Vfg 4611992, CISPR 22
Testing Standards: ANSI/IEEE C62.41 (1980). C62.45 (1987): IEC 801-Z. 801-3, 801-4, 801-5

All specifications subject to change without notice.



Best Power offers a complete line of Uninterruptible Power Systems from 280VA to 220kVA.

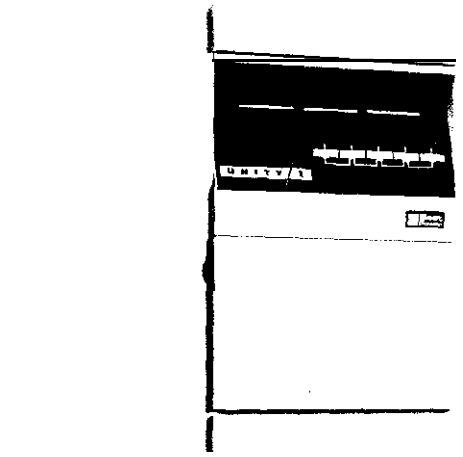
Best Power
UNINTERRUPTIBLE POWER SYSTEMS

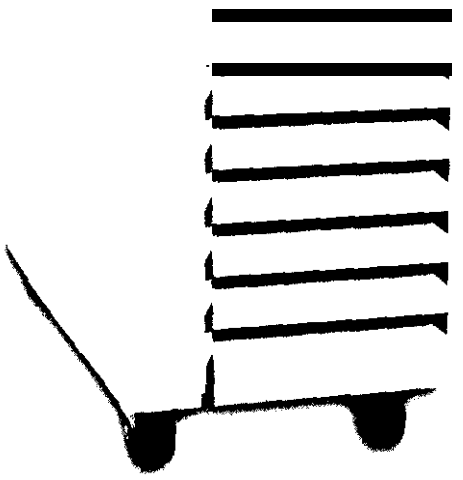
P.O. Box 280, Necedah, WI 54646 USA
Tel: 1-800-356-5794, Fax-On-Demand: 1-800-487-6813, Internet: www.bestpower.com

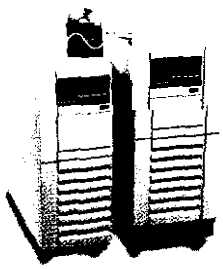
LTP-0212I 1/98

UNITY/I® SINGLE-PHASE 3kVA/kW TO 8kVA/kW

UNINTERRUPTIBLE POWER SYSTEMS







CheckUPS II software and cable provided **for** a ***complete power management solution.***

World-ready, flexible power protection for midrange and client/server computing.

SMART AND COST-EFFICIENT OPERATION

With one of power protection's most advanced microprocessors in charge, UNITY/I Single-Phase systems need only 4 percent of incoming power to protect critical systems and valuable data. This 96% efficiency minimizes system temperature, stress on components, and daily cost-to-operate. Credit the microprocessor for a very small parts count and fewer potential fault or failure points.

HIGH FAULT-TOLERANCE

UNITY/I Single-Phase safeguards include a dual power track configuration: if one power path develops a fault, the second takes over to keep UPS protection on-line. Also, an internal bypass switch ensures your equipment continues to receive power in the unlikely event of UPS failure.

EXCELLENT POWER CONDITIONING

UNITY/I Single-Phase is a universal system: it automatically selects frequency (50 or 60 Hz) and allows you to select operating voltages to meet requirements throughout the world

SOPHISTICATED SELF-MONITORING

UNITY/I Single-Phase systems monitor and report 18 separate alarm conditions. Every UNITY/I Single-Phase unit comes bundled with free CheckUPS® II Suite power management and shutdown software and connecting cable. This software CD-ROM contains on-line documentation and support for most major operating systems. A Best Power™ SNMP Adapter can be connected for remote network operations.

COMPACT AND QUIET

UNITY/I Single-Phase has the sleek look, small footprint, and whisperquiet operation that fii in any office environment. In fact, UNITY/I Single-Phase is more than twice as quiet (40 decibels at 1 meter] as other UPS models on the market.

UNSURPASSED WARRANTY

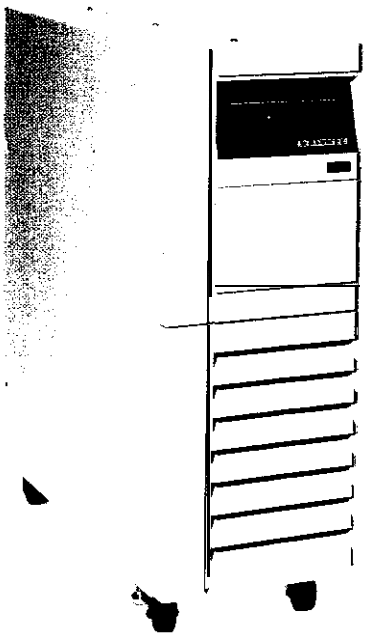
UNITY/I Single-Phase is covered by our two-year limited warranty against factory or workmanship defects. We up the ante with our limited "Double Lifetime" warranty* that repairs or replaces your UNITY/I Single-Phase if damaged by lightning, and covers up to US$25,000 for damage to connected equipment. Call the factory for details on these limited warranties.

*U.S. and Canada only.

Best Power
UNINTERRUPTIBLE POWER SYSTEMS

UNITY/I® SINGLE-PHASE 3kVA/kW TO 8kVA/kW

EXTERNAL BATTERY PACKS



Extend the runtime of your Best Power UPS.

RUNTIME EXTENSION

Best Power offers six external battery packs to extend your UNITY/I Single-Phase runtime. One pack can extend full load runtime up to one hour, 21 minutes while a combination of three can supply up to seven hours. 19 minutes.

EASY INSTALLATION

All battery packs are fully assembled and ready to plug into your UPS and each other, eliminating additional labor cost for the significant, increased protection time offered. No special battery connections must be made – they are already complete. (At present, the UT8K must be hardwired to the first battery pack.]

OFFICE-FRIENDLY

The external battery cabinets are designed to visually complement your UPS. They fit office environments with limited floor space, and require only standard ventilation.

MULTIPLE COMBINATIONS

Runtime extension can be tailored with any combination of up to three battery packs. Four different battery packs are available for use with UT3K, UT4K, and UT5K models, and two with UTBK.

❑ AITERYCHARGERUPGRADE

An auxiliary 15-ampere charger obtained in place of the UPS internal batteries enables faster recharge times with the external battery packs [most configurations of more than one external pack require the 15-amp charger). Recharge time to full load protection with external battery packs can be as little as 3 hours.

UNSURPASSED WARRANTY

UNITY/I Single-Phase External Battery Packs are covered by our two-year limited warranty against factory or workmanship defects Call the factory for details on this limited warranty.

Best Power
UNINTERRUPTIBLE
POWER SYSTEMS

UNITY/I® SINGLE-PHASE 3kVA/kW TO 8kVA/kW

EXTERNAL BATTERY PACKS

SPECIFICATIONS

Model		EBPUT1	EBPUT2	EBPUT6	EBPUT7	EBPUT21	EBPUT22
Application		UT3K, UT4K, UT5K				UT8K	
Dimensions: H x W x D	(inches)	29 x 10.5 x 25.75		32 x 13 x 33			
	(mm)	737 x 267 x 654		813 x 330 x 838			
Weight	(lb)	200	305	420	650	420	650
	(kg)	91	139	191	296	191	296
Batteries		(4) BAT-0065	(8) BAT-0065	(4) BAT-0103	(8) BAT-0103	(4) BAT-0103	(8) BAT-0103

Runtimes (@ 0.75 pf)*

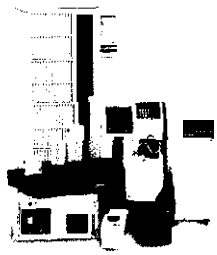
Battery Pack Configuration	UT3K Full/Half Load (min)	UT4K Full/Half Load (min)	UT5K Full/Half Load (min)	UT8K Full/Half Load (min)
STD	19/43	12/28	9/21	13/31
EBPUT1+STD	47/109	30/72	22/54	—
EBPUT2+STD	81/171	51/124	39/93	—
EBPUT7+Chrgr Upgrade	126/254	80/180	61/141	—
EBPUT1+EBPUT7+Chrgr Upgrade	160/320	107/227	81/179	—
EBPUT2+EBPUT7+Chrgr Upgrade	194/386	133/275	103/217	—
(2)EBPUT7+Chrgr Upgrade	277/555	186/396	146/310	—
EBPUT1+(2)EBPUT7+Chrgr Upgrade	312/628	213/445	168/350	—
EBPUT2+(2)EBPUT7+Chrgr Upgrade	348/697	238/495	188/390	—
(3)EBPUT7+Chrgr Upgrade	439/888	298/627	235/492	—
EBPUT21+STD	—	—	—	33/78
EBPUT22+STD	—	—	—	56/133
(2)EBPUT22+Chrgr Upgrade	—	—	—	82/184
(2)EBPUT22+EBPUT21+Chrgr Upgrade	—	—	—	110/237
(3)EBPUT22+Chrgr Upgrade	—	—	—	138/291

Recharge Time**

Battery Pack Configuration	UT3K Full load (hrs)	UT4K Full load (hrs)	UT5K Full load (hrs)	UT8K Full load (hrs)
STD	3.7	3.3	3	3.5
EBPUT1+STD	9.1	8.2	7.3	—
EBPUT2+STD	15.7	13.9	13.1	—
EBPUT7+Chrgr Upgrade	6.1	5.4	5.1	—
EBPUT1+EBPUT7+Chrgr Upgrade	7.8	7.3	6.8	—
EBPUT2+EBPUT7+Chrgr Upgrade	9.4	9	8.6	—
(2)EBPUT7+Chrgr Upgrade	13.4	12.8	12.4	—
EBPUT1+(2)EBPUT7+Chrgr Upgrade	15.1	14.5	14.1	—
EBPUT2+(2)EBPUT7+Chrgr Upgrade	16.8	16.2	15.7	—
(3)EBPUT7+Chrgr Upgrade	21	20.2	19.7	—
EBPUT21+STD	—	—	—	8.9
EBPUT22+STD	—	—	—	15
(2)EBPUT22+Chrgr Upgrade	—	—	—	8.9
(2)EBPUT22+EBPUT21+Chrgr Upgrade	—	—	—	11.8
(3)EBPUT22+Chrgr Upgrade	—	—	—	14.8

All specifications subject to change without notice.

*Runtimes are based on battery size, condition, and discharge-cycle history among other factors.
** Recharge time to 90% after full discharge to low battery shutdown.
Additional battery pack configurations are available, contact your Best Power representative.



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