TOSHIBA

UNINTERRUPTIBLE POWER SYSTEM

SINGLE PHASE- 2.0 kVA UPS

BLACK GOLD TB SERIES

MANUFACTURED IN THE U.S.A.

OPERATION MANUAL

January, 02
Part # 52777-000

NOTE

The instructions contained in this manual are not intended to cover all of the details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Toshiba sales office.

The context of this instruction manual shall not become a part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Toshiba International Corporation's UPS Division. The warranty contained in the contract between the parties is the sole warranty of Toshiba International Corporation's UPS Division and any statements contained herein do not create new warranties or modify the existing warranty.

Any electrical or mechanical modifications to this equipment, without prior written consent of Toshiba International Corporation, will void all warranties and may void UL listing and/or CSA certification. Unauthorized modifications also can result in personal injury, death, or destruction of the equipment.

UNINTERRUPTIBLE POWER SUPPLY

Please complete the Extended Warranty Card Supplied with this UPS and return it by prepaid mail to Toshiba. This activates the extended warranty. If additional information or technical assistance is required call Toshiba's marketing department toll free at (800) 231-1412 or write to: Toshiba International Corporation, 13131 W. Little York Road, Houston, TX 77041-9990

Please complete the following information for your records and to remain within this equipment manual.

Model Number:_____

Serial Number:_____

Date of installation:_____

Inspected By:_____

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CONTENTS

INTRODUCTION

Thank you for purchasing the BLACK GOLD TB SERIES UPS. This Series features the very latest state of the art microprocessor technology and also uses IGBT transistors for fast, high power and low noise PWM (pulse with modulation) switching. Also, the Series features a low impedance output transformer to provide isolation even during bypass operation.

It is the intent of this manual to provide a guide for ***safely*** installing, operating, and maintaining the UPS. This operation manual contains a section of general safety instructions and is marked throughout with warning symbols**. *Read this operation manual*** *thoroughly* before installation and operation of this electrical equipment.

All safety warnings must be followed to ensure personal safety.

General safety instructions are found on page 5 and important safety instructions are found on pages 6 and 7. Read and save these instructions for future reference.

This manual is divided into major sections of interest. Section 1 contains the product description with the theory of operation and applications. All of the initial inspection, storage, installation, operating, and pre-start precautions can be found in Section 2 and 3.

Section 4 contains the equipment standard specifications.

Section 5 outlines the operating modes, protective features, battery recharging, battery low voltage tolerances, and alarm-panel indicator functions.

Section 6 shows the control interface pin configurations.

Sections 7 and 8 are devoted to troubleshooting procedures, preventative maintenance techniques and periodic parts replacement. A fuse-rating chart is also shown.

Section 9 shows the front, rear, and side panel layout views with dimensional data. Labels, connectors and switch placement, and shipping weights are also shown.

We hope that you find this operation manual informative and easy to use. If additional information or technical assistance is needed, please call toll free (800) 231-1412 or write to Toshiba International Corporation, 13131 W. Little York, Houston TX 77041-9990.

Again, thank you for the purchase of this product.

TOSHIBA INTERNATIONAL CORPORATION

GENERAL SAFETY INSTRUCTIONS

Warnings in this manual appear in any of four ways:

1) *Danger* - The danger symbol is a lightning bolt mark enclosed in a triangle, which precedes the 3/16" high letters spelling the word "DANGER". The danger symbol is used to indicate imminently hazardous situations, locations, and conditions which, if not avoided, WILL result in death, serious injury, and/or severe property damage.

DANGER

2) *Warning* -The warning symbol is an exclamation mark enclosed in a triangle, which precedes the 3/16" high letters spelling the word "WARNING". The warning symbol is used to indicate potentially hazardous situations and conditions which, if not avoided COULD result in serious injury or death. Severe property damage COULD also occur.

WARNING

3) *Caution* -The caution symbol is an exclamation mark enclosed in a triangle, which precedes the 3/16" high letters spelling the word "CAUTION". The caution symbol is used to indicate potentially hazardous situations and conditions which, if not avoided COULD result in injury. Equipment damage may also occur.

CAUTION

4) *Attention warnings* -The attention warning symbol is an exclamation mark enclosed in a triangle, which precedes the 3/16" high letters spelling the word "ATTENTION". The Attention warning symbol is used to indicate situations and conditions that COULD cause operator injury and/or equipment damage.

ATTENTION

Other warning symbols may appear along with the *Danger* and *Caution* symbol. The additional symbols are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death:

1) *Electrical warnings* - The electrical warning symbol is a lighting bolt mark enclosed in a triangle. The Electrical warning symbol is used to indicate high voltage locations and conditions that COULD cause serious injury or death if the proper precautions are not observed:

2) *Explosion warnings* - The explosion warning symbol is an explosion mark enclosed in a triangle. The Explosion warning symbol is used to indicate locations and conditions where molten, exploding parts that COULD cause serious injury or death if the proper precautions are not observed:

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the BLACK GOLD TB Series that should be followed during the installation, operation, and maintenance of the UPS Systems.

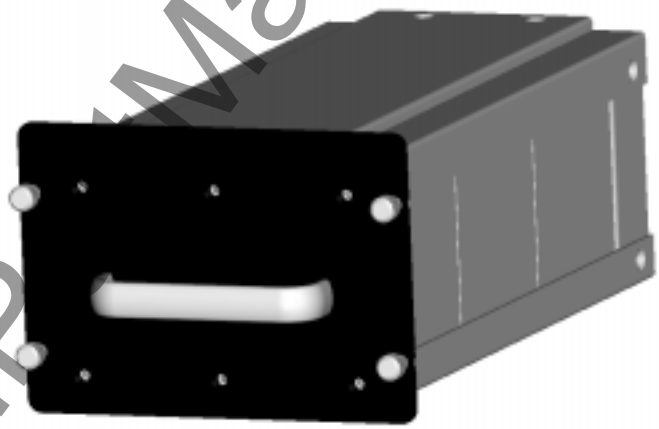
The maximum ambient temperatures in which the UPS should be operated or stored is 40°C (104°F).

The nominal battery voltage for these models is 72VDC.

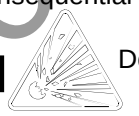
Servicing of the batteries should only be performed by a qualified Toshiba Representative who is knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

When replacing batteries, use the same number and type of sealed, lead acid batteries (do not mix types of batteries).

Model Capacity	BLACK GOLD TB 2.0kVA
Manufacture	Yuasa
Type	NPH5-12FR
Quantity	6



CAUTION Misuse of this equipment could result in human injury and equipment damage. In no event will Toshiba Corporation be responsible or liable for either indirect or consequential damage or injury that may result from the use of this equipment.

CAUTION  Do not dispose of the batteries in a fire. The batteries may explode.

CAUTION Do not open or mutilate the batteries. Released electrolyte is harmful to the eyes and skin and could also be toxic.

WARNING This unit contains sealed lead acid batteries. Lack of preventative maintenance could result in batteries exploding and emitting gasses and/or flame. An authorized, trained technician must perform annual preventative maintenance.

WARNING Failure to replace a battery before it becomes exhausted may cause the case to crack, possibly releasing electrolytes from inside the battery, and resulting in secondary faults such as odor, smoke, and fire.

IMPORTANT SAFETY INSTRUCTIONS (CONT.)

WARNING Personnel knowledgeable of batteries and the required precautions should perform installation and servicing of batteries. Keep unauthorized personnel away from the batteries.

WARNING Proper maintenance to the battery system of this unit must be done by a qualified service technician, this is essential to the safety and reliability of your UPS system. Refer to the service manual.

DANGER **A battery can present a risk of electrical shock and high short circuit current.** The following precautions should be observed when working with batteries:

1) Verify that the UPS is off and that the power cord is disconnected from the power source.
2) Remove watches, rings or other metal objects.
3) Use tools with insulated handles to prevent inadvertent shorts.
4) Wear rubber gloves and boots.
5) Do not lay tools or metal parts on top of batteries.
6) Determine if the battery is inadvertently grounded. If inadvertently grounded, remove source of ground. **Contact with any part of a grounded battery can result in electrical shock.** The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.
7) Verify circuit polarities prior to making connections.
8) Disconnect charging source and load prior to connecting or disconnecting terminals.
9) VRLA batteries contain an explosive mixture of hydrogen gas. Do not smoke, or create a flame or spark in the immediate area of the batteries. This includes static electricity from the body.
10) Do not attempt to open the batteries in order to add water or sample the specific gravity of the electrolyte. The batteries are valve regulated lead acid type and such servicing is not possible without damaging the battery.
11) Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.
12) Do not dispose of lead acid batteries except through channels in accordance with local, state and federal regulations.

1.0 Product Description

1.1 Theory of Operation

An Uninterruptible Power Supply (UPS) is a system that is installed between the utility power and the load equipment. The UPS provides steady AC output power during utility power fluctuations and interruptions.

During normal operation, the UPS utilizes utility AC power and removes high voltage spikes and transients caused by switching and faults on the main utility. The result of this process is maximum power conditioning and regulation.

If the AC power supplied to the UPS drops below a specified voltage level, the unit's batteries automatically begin supplying power instead of receiving it. This insures that the loads connected to the UPS continue to receive power with no interruption. This power is provided for a long enough time so that the load can be shut down in an orderly fashion. This prevents loss of data and possible damage to both hardware and software.

When AC input power becomes available again, operation returns to normal. The UPS batteries begin to recharge, so they will be ready for the next power interruption.

1.2 Application and use

Toshiba's BLACK GOLD TB on-line Uninterruptible Power Supply (UPS) system provides continuous computer-grade isolated AC power in a compact, efficient, high performance unit. The UPS assures safe, reliable operation of critical equipment, ranging from personal computers to mini-computers to local area networks (LAN). All units feature an audible alarm that sounds if the battery voltage drops below standard during use. This is an additional aid to help in retaining the valuable data storage, and all units allow for computer interfacing.

1.3 Power Backup

During an electrical power failure, the UPS unit's batteries automatically supply DC power to the inverter that supports the load equipment without interruption. For example, when used to support a computer, the UPS backup assures additional time to complete your activity and store data after a power failure occurs.

1.4 Power Conditioning

While utility power is present, the UPS supplies conditioned power to the load while maintaining its batteries in a charged condition. The UPS protects the connected load against the normal, everyday problems associated with heavy use of raw utility power, including power sags, surges, signal interference, and spikes. This protection keeps power-line problems from reaching your load, where it can cause equipment to operate erratically, or damage software and hardware.

2.0 Inspection/Storage/Disposal

2.1 Inspection of the new UPS equipment:

Upon receipt of the UPS, a careful inspection for shipping damage should be made.

After Uncrating:

1) Check the unit for loose, broken, bent or other damaged parts. If damage has occurred during shipment, keep all original crating and packing materials for return to the shipping agent. The equipment warranty will not apply to units that are damaged during shipment.

2) Check to see that the model number specified on the nameplate conforms to the order specifications.

2.2 Storage of UPS equipment

If the UPS equipment is to be subject to long or short-term storage, the following guidelines should be used.

Avoid:

1) Storage in sites subject to extreme changes in temperature or high humidity.

2) Storage in sites subject to exposure of high levels of dust or metal particles.

Before storing:

1) Charge the unit's batteries.

2) Place the STOP/RUN switch in the STOP position.

Storing:

1) Store within a temperature range of -20° to 40° C (-4° to 104° F).

2) For best results, store the UPS in the original shipping container and place on a wood or metal pallet.

3) The optimum storage temperature is 21° C (70° F). Higher ambient temperatures cause UPS batteries to need recharging more frequently.

After Storing:

1) If stored in an ambient temperature under 20° C (68° F); recharge the batteries every 9 months.

2) If stored in an ambient temperature of 20° to 30° C (68° to 86° F), recharge the batteries every 6 months.

3) If stored in an ambient temperature of 30° to 40° C (86° to 104° F), recharge the batteries every 3 months.

2.3 Disposal

Please contact your state environmental agency for details on proper disposal of electrical components and packaging in your particular area.

ATTENTION

It is illegal to dump lead-acid batteries in landfills or dispose of improperly. Please help our Earth by contacting the environmental protection agencies in your area, the battery manufacturer, or call Toshiba International Corporation toll-free at (800) 231-1412 for more information about recycling batteries.

3.0 Precautions

3.1 Installation Precautions (General)

1) Install the unit in a well-ventilated location; allow at least 10 cm (4 inches) on all sides for air ventilation and for maintenance.

2) Install the unit where the ambient is within the correct operation range (see Specifications Section 4.0).

3) Do not allow liquids or foreign objects to get inside the UPS.

4) Do not install the UPS in a location that is subject to high humidity. Also, do not install the unit in areas that are exposed to direct sunlight, or contaminated areas subject to high levels of airborne dust, metal particles, or flammable gas.

Ambient temperature range for operating the UPS is 0° to 40°C (32° ~ 104°F); **25°C (77°F) is the recommended operating temperature for maximum battery life.**

5) Avoid installation near sources of electrical noise. Always make sure that the unit's ground is intact to prevent **electrical shock** and help prevent electrical noise.

6) This UPS generates and radiates radio-frequency energy during operation. Although RFI noise filters are installed inside the unit, there is no guarantee that the UPS will not influence some sensitive devices, which are operating in near proximity. If such interference occurs, the UPS should either be installed farther away from the affected equipment and/or powered from a different source than the affected equipment.

3.2 Installation Precautions (Rack mounted) ! CAUTION

1) Install the UPS in a conventional rack-style structure. The recommended rack slide for the BLACK GOLD TB series UPS is General Devices, CTS-124 (Call Toshiba for further information on rack slides). The rack must be bolted to the floor, **secured** permanently to a wall, or otherwise secured to prevent toppling.

2) Allow at least 4 inches of open space in the front and rear of the unit for proper ventilation. Allow at least 6 inches of open space at the rear of the unit for operation and disconnect devices.

3) Two people handling is required when moving this unit into and out of the rack structure.

Front Panel Cutout

Use both handles when lifting entire weight of the unit, unit weight
119.00lbs. (53.98 kg.) for the 120Vac
111.00lbs. (50.35 kg.) for the 230Vac

3.0 Precautions (Cont.)

3.3 Prestart Precautions

1) Before connecting the UPS to a power source move all the breakers (MCCB1, 2, 3, and 4), on the front panel, to the OFF position and move the operation STOP/RUN, on the front panel (See Section 9 for location), to the STOP position.

3.4 Operating Precautions

CAUTION

1) The UPS should not be powered up until the entire operation manual has been reviewed and understood.

2) The input power source voltage must be within +10% to -30% of the rated input voltage. The input frequency must be within the rated input frequency range. Voltages and frequencies outside of the permissible range may cause internal protection devices to activate.

3) The UPS should not be used with a load whose rated input is greater than the rated UPS output.

4) Do not use the UPS to provide power to motors that require high starting current or a long starting time such as vacuum cleaners and machine tools.

5) Do not insert metal objects or combustible materials in the unit's ventilation slots.

6) Do not place, hang, or paste any objects on the top or on the exterior surfaces of the UPS.

7) Always use caution when connecting or disconnecting load equipment. **The UPS may be supplying power to the output load receptacles through the bypass circuit.** This can occur when the RUN/STOP switch is in the STOP position, the output breakers are on (MCCB2-4), and the unit is connected to a source of supply power (See Circuit-bypass Mode Section 5.1.3).

4.0 Specifications

4.1 BLACK GOLD TB Series Specifications

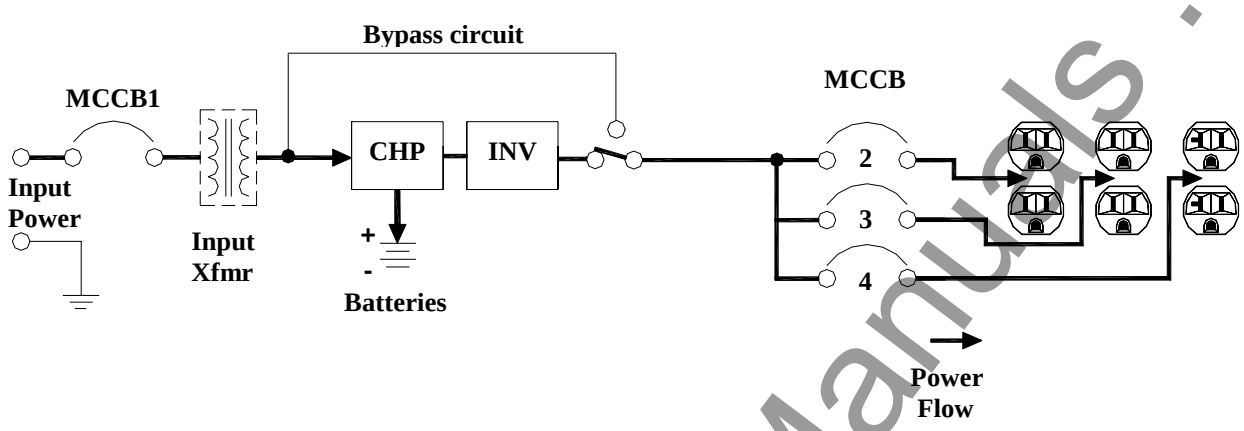
General Information	Model Number	UC1A1A020C6RKBIG	UC1E1E020C5RKBIG
	Rated Output Capacity	2000 VA (1.4 kW)	
	External Dimensions	16.75W X 24D X 5.25H in. (425W x 610D x 133H mm)	
Input	Rated Voltage	120Vac, Single Phase (*)	230Vac, Single Phase (*)
	Voltage Variation	+10% to –30% (*)	
	Rated Frequency	50/60 Hz	50 Hz
	Power Factor	Greater than .98 when in inverter mode	
	Harmonic Currents	Less than 10% THD	
Battery	DC Nominal (Voltage Range)	72Vdc (57.6 to 82.8 Vdc)	
	Float Charge (Regulation)	82.8Vdc (± 2%)	
	Ripple Voltage	2% R.M.S.	
	Rated Back-up Time when fully charged with .7pF at 77°F (25°C)	6 min. at full load (**) 18 min. at half load (**)	
	Recharge Time	Maximum 24hrs. to 100% (90% recharge after 8Hrs.) (***)	
	Rated Charge Current	0.40 Amps	
	Type of Batteries	Sealed lead-acid	
Output	Rated Voltage (Single phase)	120 Vac	230Vac
	Output Voltage Regulation	Within than +/- 3%, steady state	
	Output Frequency	50/60Hz +/- 0.5% in free running mode (Line sync range +/- 1Hz)	50Hz +/- 0.5% in free running mode (Line sync range +/- 1Hz)
	Output Voltage Waveform	Computer-grade sinewave with less than 3.0% THD with linear load.	
	Rated Current (RMS)	16.6 Amps	8.6 Amps
	Rated Power Factor	.7 lagging	
	Maximum overload capacity	150% for 90 seconds	
	Voltage Transient Characteristic	+/-5% under 100% load step change	
	Crest Factor	3.0	
Environment	Operating Temperature	32 to 104° F (0 to 40°C), optimal at 77°F (25°C)	
	Storage Temperature	-4 to 104° F (-20 to 40°C)	
	Operating Humidity	30% to 90% (no condensation)	
	Altitude (****)	Less than 3000 ft (1000 m) above sea level	
	Net. Weight	119.00 lbs. (53.98 kg)	111.00 lbs. (50.35 kg.)
	Acoustical Noise	<45 dB at max. output, measured 3.3 ft (1 m) from front panel	
	Efficiency (AC-DC-AC)	82%	
Bypass	An automatic transfer of load to bypass switch (with 4mS-transfer time) may be caused by an overload of the inverter output, or by an internal fault condition. Also, the load can be manually transferred to bypass by putting the rocker switch in the STOP position.		
Interface	IBM ™ AS/400	Pins 5 through 9	DB9 male connector
	LAN Manager	Pins 2 and 3	
	Fault detect and input power loss	Pins 1 and 4	
	RS232 ASCII	Pins 1 through 8	DB9 female connector (Pin 9 not used)
Options	Software for unattended computer shutdown.	Contact Toshiba for details on this option	

(*) Output capacity reduced when input voltage is between –15% and –30% of nominal.
(**) Battery backup time may vary depending on the operating conditions and ambient temperature at the installation site.
(***) An initial charge time of 24 hrs is necessary to obtain proper battery performance level before unit is used for battery backup.
(****) At 6000-ft (2000 m) above sea level, output capacity should be de-rated by 3%.

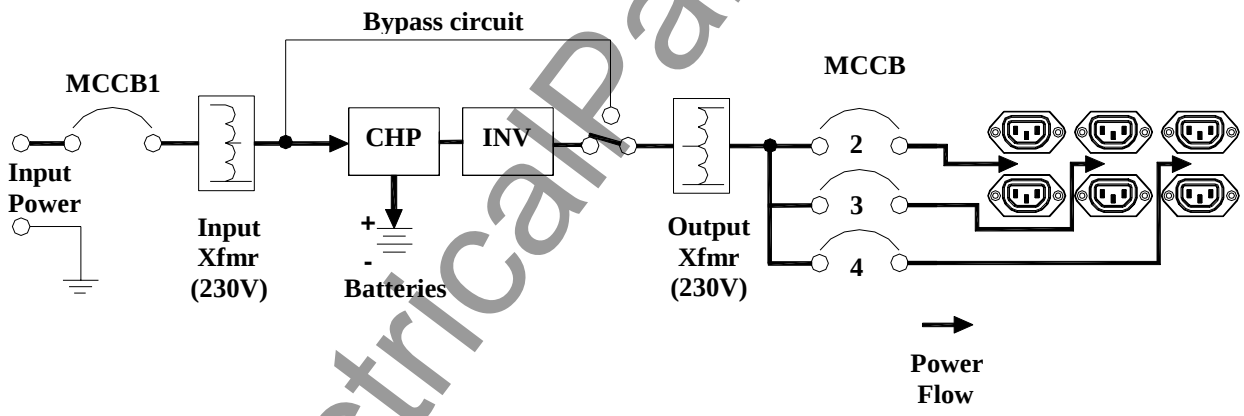
5.0 Operating the UPS

5.1 Operation Modes

5.1.1 AC Input Mode (normal operation)



Power flow in AC input mode for the 2000VA 120V BLACK GOLD TB Model



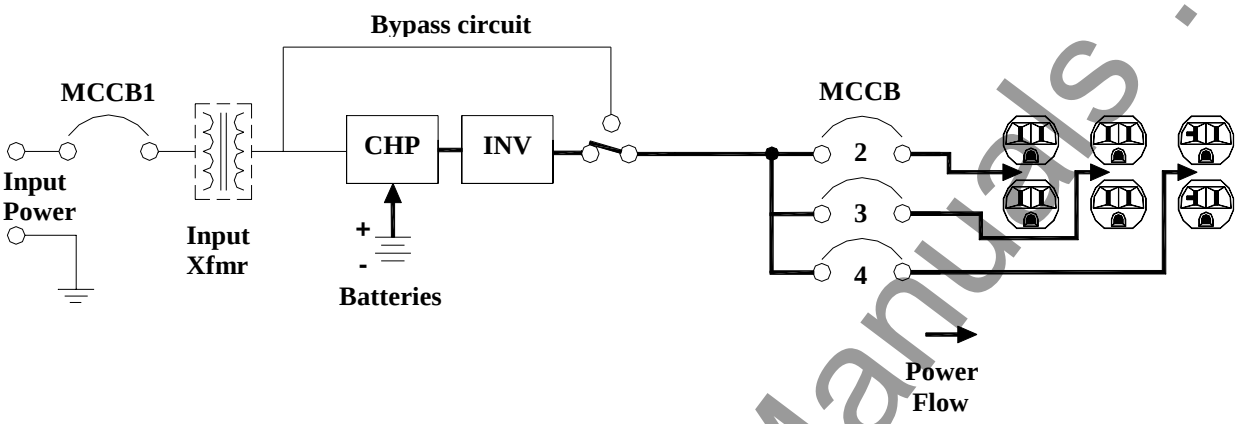
Power flow in AC input mode for the 2000VA 230V BLACK GOLD TB Model

Both of the above illustrations show circuit power flow in the ac-input mode. The UPS unit's rectifier, included in a boost chopper circuit, converts ac input power to dc power. This dc power runs the unit's transistor inverter and charges the batteries. The boost chopper circuit maintains a constant voltage, with current limiting, for charging the batteries and assures proper sine waveform generation for the output current. The unit's batteries are maintained in a constantly charged state when the UPS is in the normal operation mode.
On the front panel, LED's labeled "AC LINE" and "INVERTER" should be on and the "FAULT" LED should be off (See Section 5.4 Front Panel Layout).

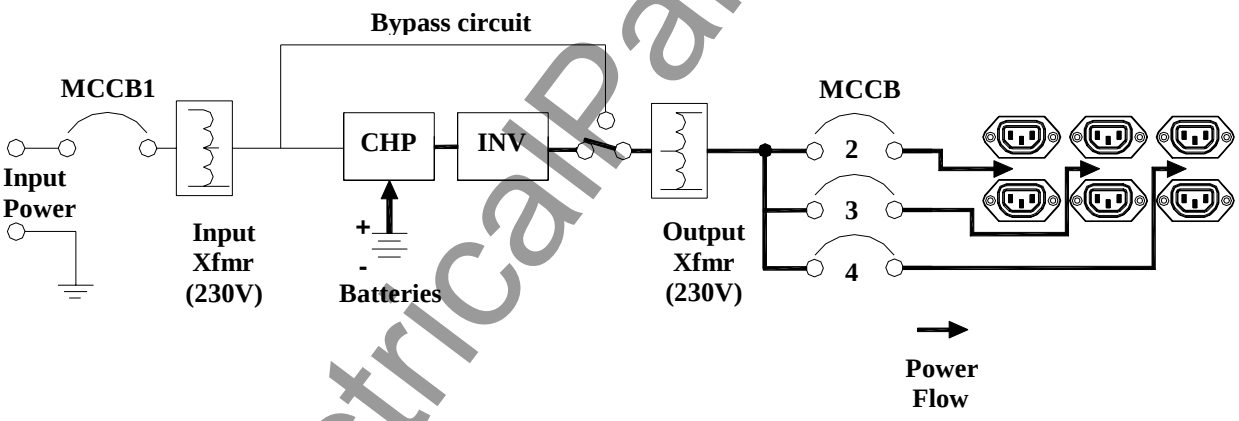
5.0 Operating the UPS

5.1 Operation Modes (Contd.)

5.1.2 Battery Backup Mode



Power flow in battery backup mode for the 2000VA 120V BLACK GOLD TB Model



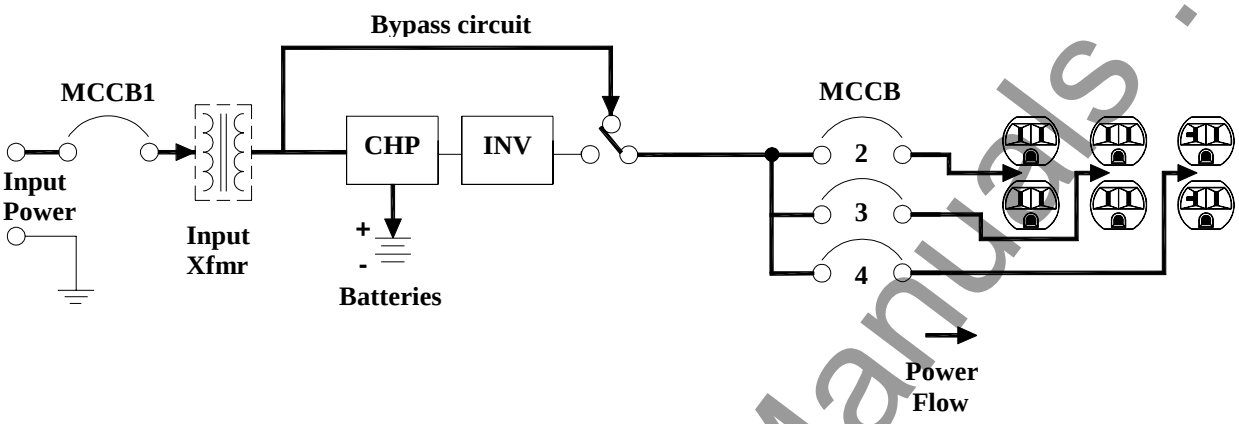
Power flow in battery backup mode for the 2000VA 230V BLACK GOLD TB Model

The above illustrations show power flow during the battery backup mode. When commercial ac power failures occur, the UPS's batteries instantly begin supplying dc voltage to the UPS's main inverter circuit. This circuit will change (invert) the dc power into ac power. The ac power is available at the unit's output receptacles. This back-up process will continue until the UPS battery voltage drops below a specific minimum level. When this occurs, the batteries will stop supplying power to the load. This minimum level is the rated minimum voltage (Vmin). The rated battery voltage chart on pages 5-6 (See Section 5.7 for battery backup time) shows (Vmin). On the front panel, LED's labeled "AC LINE" and "FAULT" should be off. The "INVERTER" LED should be on (See Section 5.4 Front Panel Layout).

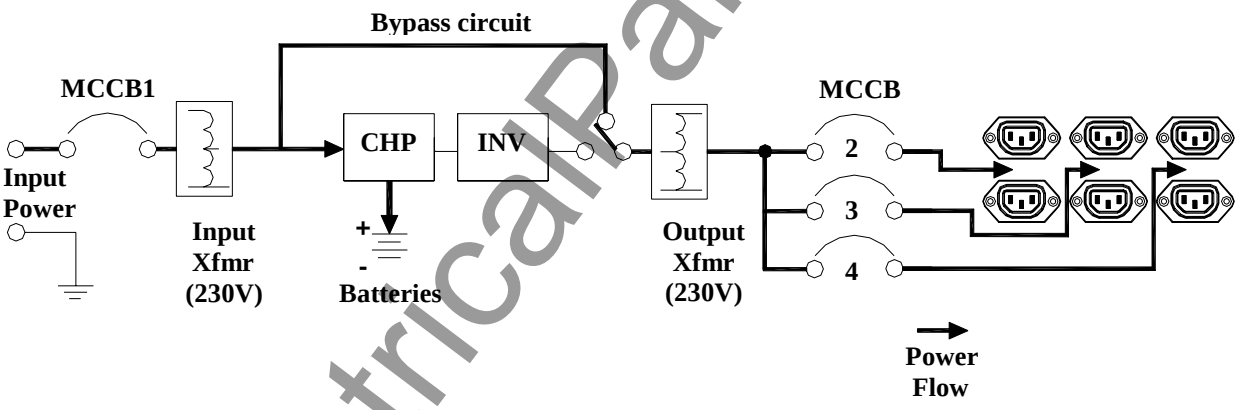
5.0 Operating the UPS

5.1 Operation Modes (Contd.)

5.1.3 Circuit-bypass Mode



Power flow in circuit-bypass mode for the 2000VA 120V BLACK GOLD TB Model



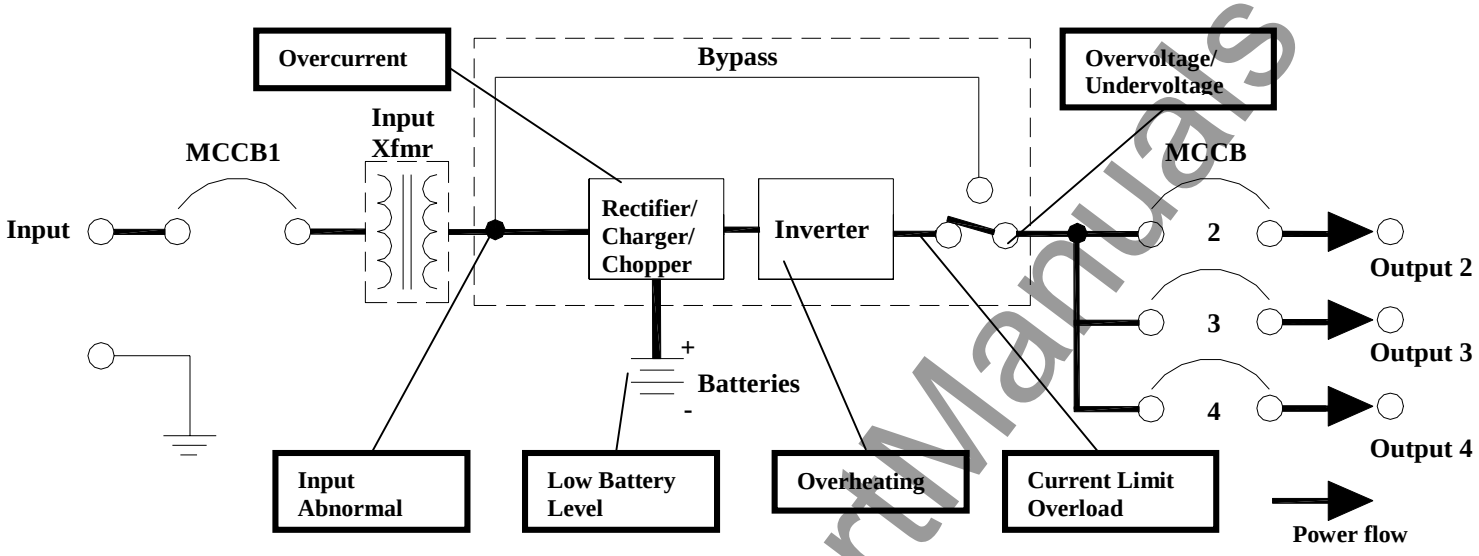
Power flow in circuit-bypass mode for the 2000VA 230V BLACK GOLD TB Model

If the UPS unit is overloaded or develops an internal fault, the power flow is automatically switched from the unit's main circuit to the bypass circuit mode. Power flow through the bypass is shown in the above illustrations. This change-over occurs automatically in approximately 4 milliseconds. The switching period is not long enough to cause interruptions to occur in most UPS equipment loads. ***The energy flow must be transferred manually from the UPS bypass circuit back to the inverter circuit after first correcting the fault.*** Toggle the STOP/RUN switch (on the unit's front panel) first to STOP and then back to RUN. This procedure resets the UPS and transfers back to inverter. On the front panel, the LED labeled "FAULT" should be off. The "INVERTER" LED and "AC LINE" LED should be on (See Section 5.4 Front Panel Layout).

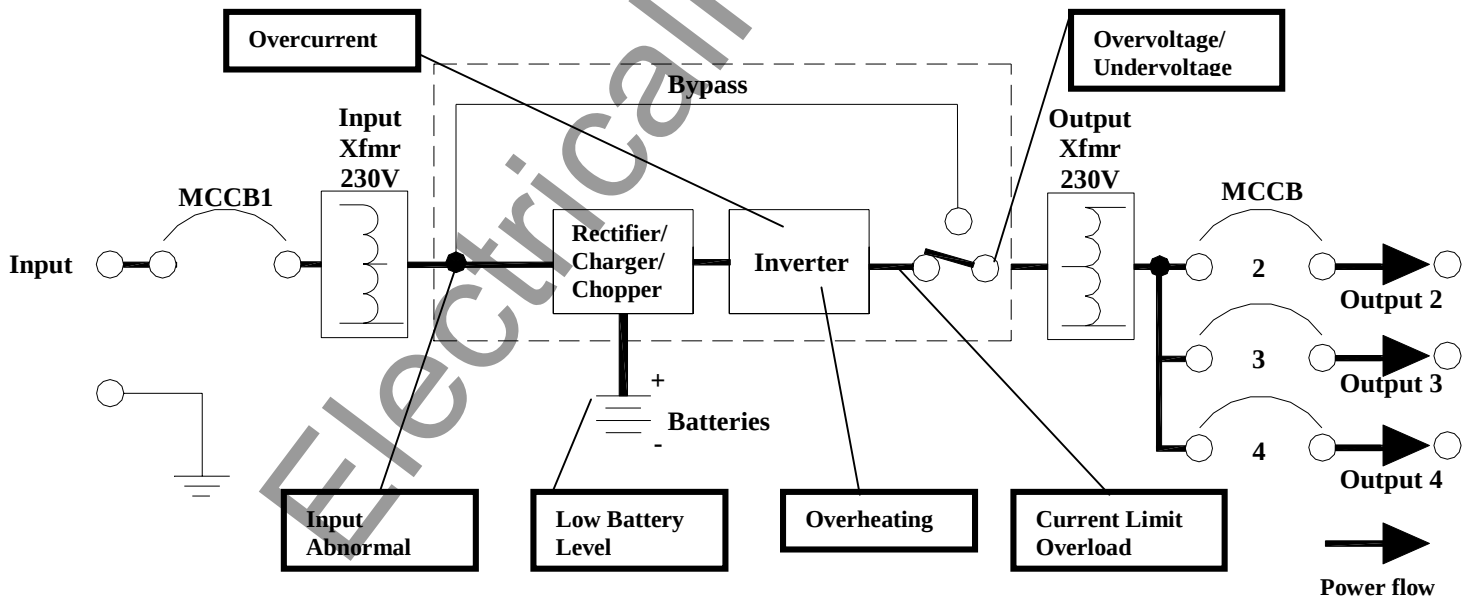
5.0 Operating the UPS

5.2 System Protection Features

The schematic shown below depicts the electrical locations of the protection devices on the 2000 VA 120V UPS model.



The schematic shown below depicts the electrical locations of the protection devices on the 2000VA 230V UPS model.



Note:

The three UPS rear panel output receptacles are supplied from the UPS inverter section through separate 20A breakers **(10A for the 230V model)**. Thus, an overload on one of the receptacle sets can cause a loss of power to it while the other receptacle sets remain active. If all of the UPS indicator lights appear normal and power is not available at one of the receptacle sets, check the associated output breaker.

5.0 Operating the UPS

5.3 Operation Monitoring

5.3.1 Visual Indicator Functions

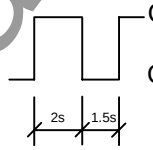
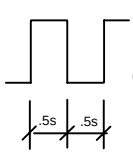
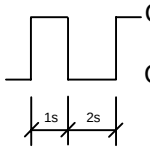
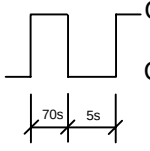
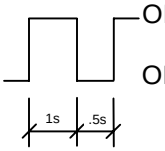
The following LED (light emitting diode) indicators are located on the front panel (See Section 5.4 Front Panel Layout). Refer to these lamps for visual information about the operating condition of the UPS (See Section 5.3.3 “Visual and Audible Indicator Function Chart”).

1) **AC LINE:** This green LED lights when normal ac input power is being supplied to the UPS unit.
2) **INVERTER:** This green LED lights when the inverter output voltage is normal.
3) **FAULT:** This red LED lights when an abnormal operating condition is detected. Operation of the unit’s inverter is inhibited until the fault has been corrected and the system reset (See Section 5.10 System Reset).

5.3.2 Audible Alarm Functions

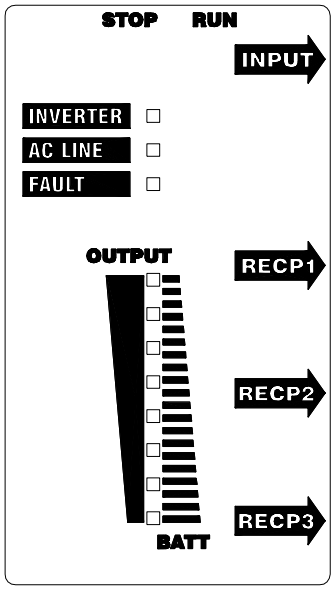
The UPS is equipped with an audible alarm system, which activates under various operating conditions. Sound patterns are used to indicate these conditions (See Section 5.3.3 Visual and Audible Indicator Function Chart). Alarms for the battery backup mode or low battery voltage will stop automatically when AC input voltage is restored. Alarms for a fault condition will continue to sound until the UPS has been reset (See Section 5.10 System Reset).

5.3.3 Visual and Audible Indicator Function Chart

Condition	Cause	Audible Alarm Pattern	Visual Indicators	UPS Operation
Overcurrent (OC)	Problem in chopper or inverter circuit.		1) “Fault” LED is **ON** 2) “Inverter LED is **OFF** 3) “AC Line” LED is **ON**	1) Auto transfer to bypass 2) Chopper stopped 3) Inverter stopped
DC Bus Overvoltage (DCOV)	Vout > 115% of rated.			
Output Overvoltage (OV)	Vout > 110% of rated.			
Undervoltage (UV)	Vout < 85% of rated.			
Overheat (OH)	Heatsink exceeds 90º C.			
Overload (OL)	Output current and over-load specifications have been exceeded.			
Battery problem	Problem in battery circuit.			
Normal battery backup operation	Loss of AC power		1) “Fault” LED is **OFF** 2) “Inverter” LED is **ON** 3) “AC Line” LED is O**FF**	1) Chopper running 2) Inverter running
Low battery voltage (voltage less than 90%)	Battery voltage too low.			

5.0 Operating the UPS

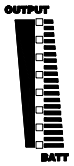
5.4 Front Panel Layout



AC LINE (green lamp)
Lights **green** when normal ac input is being supplied to the UPS Unit.

INVERTER (green lamp)
Lights **green** when the UPS unit is operating in the run mode and the output is normal.

Fault (red lamp)
Lights **red** when the UPS unit has tripped in the fault mode.



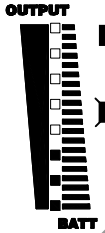
OUTPUT/BATTERY (green/red lamp level meter) The UPS unit's level meter consists of six green and two red LED lamps.

INPUT/RECPT1/RECPT2/RECPT3
Directs to the unit's input breaker and its respective set of receptacles.

5.5 UPS Inverter Mode Display

The following chart shows normal operating conditions when the UPS INVERTER lamp is green

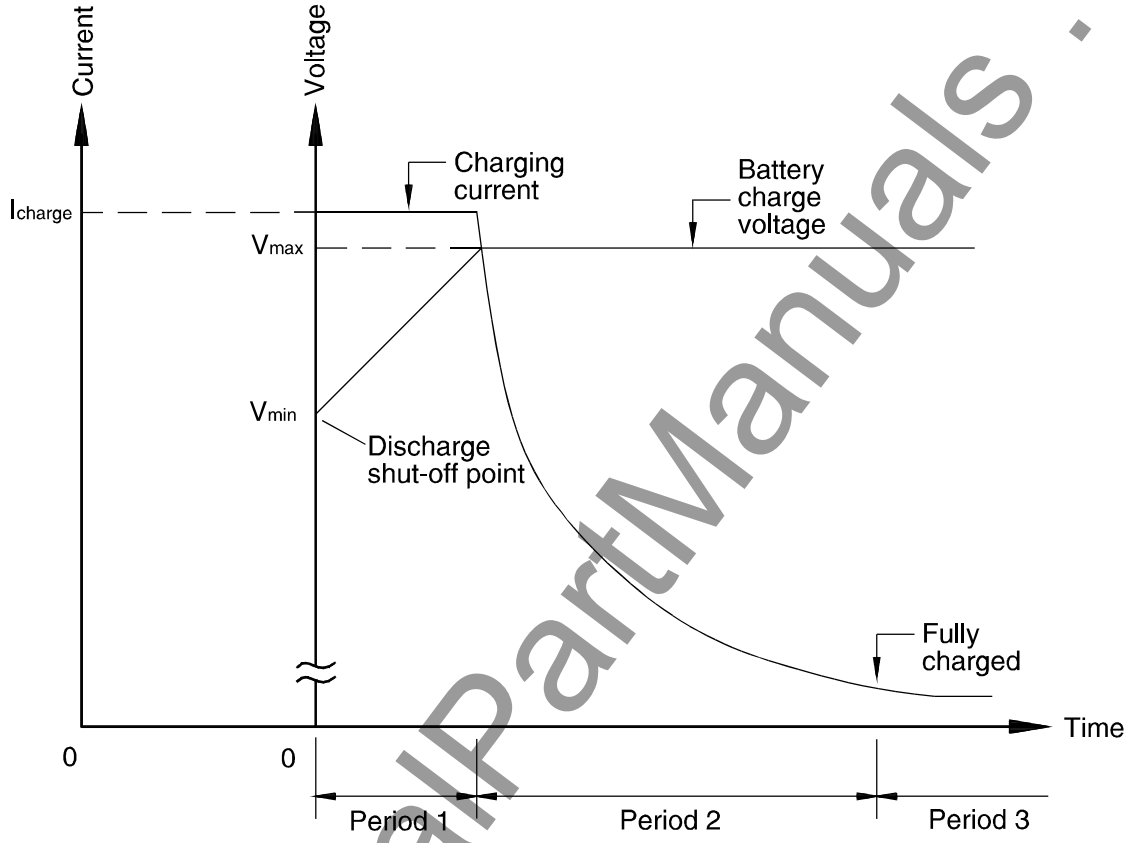
UPS Run Mode Display Chart

Output	Display Status	Explanation
Normal	 ■=Steady lit LED ■=Flashing LED	When output current is between 30% and 100%, the **green** lamps light in 15% increments (from bottom to top) to indicate relative output value (This sample display shows a value level of approximately 45% to 60% of available output current).
Overload	 ■=Steady lit LED ■=Flashing LED	All **green** lamps light and one or two **red** lamps flash once per second. **Remove overload as quickly as possible to prevent fault (fault timeouts vary depending on overload condition).**
Battery backup	 ■=Steady lit LED ■=Flashing LED	During battery backup all **green** and all **red** lamps flash once per second. As the batteries discharge, the green lamps extinguish from bottom to top to indicate remaining battery capacity (This sample display shows a value level of approximately 55% to 70% of available battery capacity).
Low battery during battery backup	 ■=Steady lit LED ■=Flashing LED	All green lamps are off and one or two **red** lamps continue to flash.

5.0 Operating the UPS

5.6 Battery Recharging

The graph below shows the typical voltage requirements for recharging the UPS unit's batteries.



The recharge process usually consists of three periods. During the first period, the current is maintained at approximately 0.4 amperes. In the second period, the constant voltage control starts and the current gradually decreases as the batteries continue to charge. In the third period, a slight current gradually decreases as the batteries continue to charge. In the third period, slight current flows into the batteries to keep them fully charged. After a complete discharge, a full recharge asually requires 24 hours (90% recharge in 8 hours).

The chart depicted below shows the rated maximum and minimum battery voltages, and the charge current.

Rated battery voltages

Model	Vmax.	Vmin.	Charge
2000 VA	82.8Vdc	57.6Vdc	0.4 (A)

5.0 Operating the UPS

5.7 Battery Backup Time

The 2000 VA UPS unit's batteries provide about 6 minutes of backup time. These times are valid when the unit is operating under full load. When the units are operating at half load, the batteries can power the load equipment about 3 times longer. The exact length of these times will depend on the condition of the batteries, amount of load, temperature, and other variables. See battery backup time in the standard specifications (Section 4.1).

5.8 Battery Low Voltage Tolerances

Excessive discharge will cause the UPS unit's battery voltage to drop. The chart shown below lists the voltage level at the UPS unit's low voltage alarm will sound and also at what level the low voltage condition will cause the unit to automatically shut down.

UPS Capacity in VA	2000
Nominal voltage in Vdc	72
Alarm voltage in Vdc	63.4
Shutdown voltage	57.6

5.9 Battery Check Function

Part of the UPS start-up procedure is an automatic 'Battery Check' to see if a problem exist in the battery circuit. When the UPS is started it will begin operation in the bypass mode. An automatic voltage level test of the batteries is made while operating in the bypass mode for 5 seconds. A failure of this first test will activate visual and audible alarms (See Section 5.3.3 Battery Problem). If this test is passed, then the UPS will auto-transfer from bypass mode to inverter operating mode. A 10 second automatic voltage check of the batteries is made after the UPS has auto-transferred from bypass to inverter mode. Normal inverter operation continues if the second test is passed. If the second test fails, then the "Fault" LED will flash and up to three additional automatic battery voltage checks are made at 3 hour intervals while the inverter continues to operate. If the batteries are found are found to be normal during one of these three tests then the "Fault" LED will stop flashing and normal inverter operation will continue. A failure of the third and final check will activate visual and audible alarms (See Section 5.3.3 Battery Problem) causing an auto-transfer back to bypass. **If the batteries are indicated "bad" then STOP the UPS and allow a 24-hour charge on the batteries before restarting.**

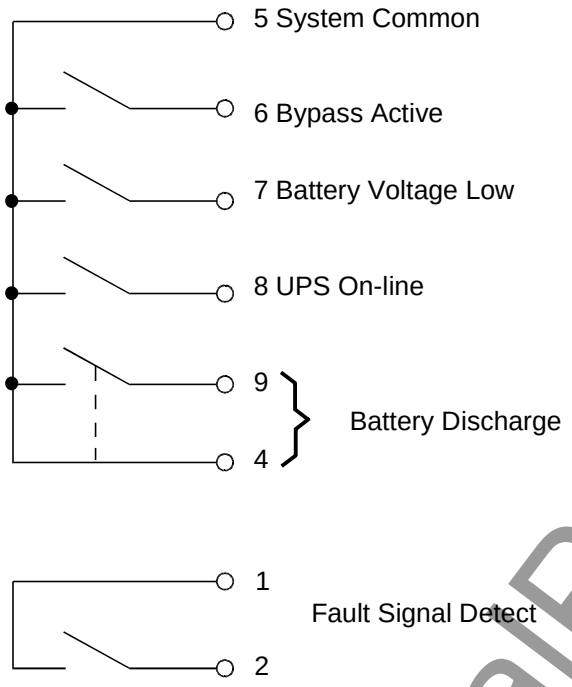
5.10 System Reset

Moving the STOP/RUN switch from "Run "to" Stop and then back to "Run" resets the UPS. Use the reset procedure to transfer from bypass back to inverter after a fault occurs. Some faults can only be cleared by shutting down the UPS, waiting for all LED on the front panel to go off, and then restarting the UPS.

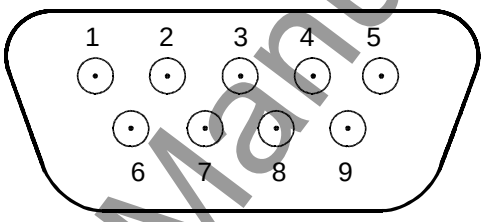
6.0 UPS Control Interface

6.1 Remote Contact and IBM AS/400

The AS/400 interface is standard feature and is available as dry switch contacts through a DB9 male connector located on the back side of the UPS (See Section 9.1). The AS/400 interface uses standard pins numbered 5 through 9. Pins number 1 through 4 are also assigned for usage in addition to AS/400. The following schematic shows the contact state and pin assignment for each signal output along with the associated DB9 connector pin out.



DB9 Male Connector Outline
(Facing Connector)



Notes:

1) Pin "switches" are shown in their **inactive states** (ex: if battery voltage is low then pin 7 will be connected to pin 5 common "GND").

2) Contacts are rated as followed.

DC: 48V, 0.1A
AC: 30Vrms (42V-peak), 0.07A (0.1A-peak)

6.0 UPS Control Interface (Contd.)

6.2 RS-232C Communication Interface

The RS-232C serial communication interface is a standard feature and is available through a DB9 female connector located on the back side of the UPS (See Section 9.1). This interface allows monitoring and control of UPS in conjunction with Toshiba UPS software accessories. The available data from the UPS, via the RS-232C communication link, is shown below:

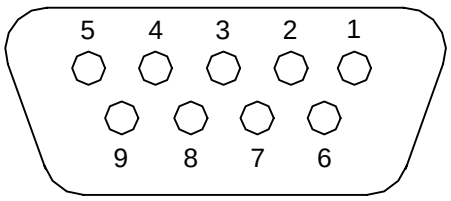
Operating conditions	Output voltage Output current Battery voltage Input frequency Output frequency
UPS operating status (described as 'yes' or 'no')	Utility power OK Low battery voltage detected UPS in BYPASS mode UPS in NORMAL mode Input and output frequency synchronized UPS 'fault' occurred
'Fault' details (described as 'occurred' or 'not occurred')	DC bus overcurrent DC bus overvoltage DC bus undervoltage Input overcurrent Overheat Overload being timed Overload (allowable time exceeded) Output overvoltage (during NORMAL mode) Output undervoltage (during NORMAL mode)

The connector pin assignment and female connector outline are illustrated below.

RS-232C Connector Pin Assignment

Pin	I/O	Symbol	Description
1	This pin is not used		
2	Input	RXD	Receive data
3	Output	TXD	Transmit data
4	Output	DTR	Data terminal ready
5	—	SG	Signal ground
6	Input	DSR	Data set ready
7	Output	RTS	Request to send
8	Input	CTS	Clear to send
9	This pin is not used		

DB9 Female Connector Outline
(facing connector)



6.2.1 UPS Shutdown (via RS-232C)

When the UPS is operating from its internal batteries, a 'shutdown' order can be sent to the UPS telling it to turn OFF after a user-specified amount of time. This function can allow the user to stop discharging the UPS batteries after an orderly system shutdown has been completed. The UPS can be programmed to turn OFF up to 8 minutes after the 'shutdown' command is given. This command can be cancelled before the specified time has elapsed. Once power is restored after this command is issued, the UPS must be manually reset to once again operate on-line. See Section 5.10 System Reset.

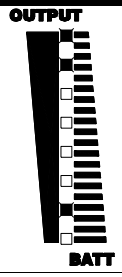
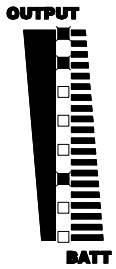
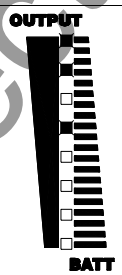
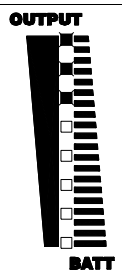
7.0 Troubleshooting Procedures

Faults are those abnormal conditions that can occur and cause the unit to shutdown normal operation. The faults are detected by the protection circuitry (See System Protection Features Section 5.2) in the unit. The UPS FAULT lamp will light **red** whenever a fault condition has been detected. "Troubleshooting" involves monitoring the OUTPUT/BATTERY level meter lamps on the front panel and then interpreting the readout by using the fault mode display charts.

7.1 Non-Fatal Fault Mode

Non-fatal faults may or may not cause the unit to shut down; non-fatal faults normally will cause the UPS to transfer to bypass mode. Use System Reset procedures (See Section 5.10). Use the following chart to decode the display.

Non-Fatal Fault Mode Display Chart

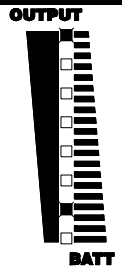
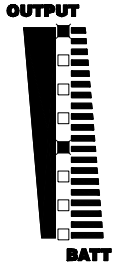
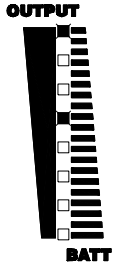
Fault	Display Status	Problem Cause	Corrective Action
Output low voltage	 Red and Green LED flash alternately	Inverter fault or short circuit in UPS output	Remove cause of short circuit. If none is found, contact your Toshiba service representative.
Output overvoltage	 Red and Green LED flash alternately	Resonance with load equipment	Remove load equipment one piece at a time.
DC undervoltage	 Red and Green LED flash alternately	Chopper fault	Contact your Toshiba service representative.
Cooling fan overheating	 Red and Green LED flash alternately	Cooling fan outage or closed cooling airflow path	Check for airflow restriction. If none is found, contact your Toshiba service representative.
Battery problem	 Red and Green LED flash alternately	Battery damaged or something wrong in the battery circuit (battery not connected)	Contact your Toshiba service representative.

7.0 Troubleshooting Procedures (Cont.)

7.2 Fatal Fault Mode

Fatal faults may or may not cause the UPS to shutdown. Use System Reset procedures (See Section 5.10). Use the following chart to decode the display.

Fatal Fault Mode Display Chart

Fault	Display Status	Problem Cause	Corrective Action
DC overcurrent	 Red and Green LED flash alternately	Inverter fault	Contact your Toshiba service representative.
DC overvoltage	 Red and Green LED flash alternately	Chopper fault	
Input overcurrent	 Red and Green LED flash alternately	Chopper fault	
UPS system error	 Red and Green LED flash alternately	Trouble with the control PWB	Contact your Toshiba service representative.

■ = Flashing LED

8.0 Preventive and Scheduled Maintenance/Parts

8.1 Preventive Maintenance

Toshiba's Uninterruptible Power Systems have been designed to provide years of trouble-free operation requiring a minimum of preventive maintenance.

The best preventive measure that the UPS user can take is to keep the area around the unit, particularly the air inlet vents, clean and free of moisture and dust accumulations. If the atmosphere of the installation site is very dusty, use a vacuum cleaner to periodically remove dust accumulations from the system. Schedule authorized service centers to perform internal parts inspections annually.

CAUTION **Before performing any maintenance the technician should be familiar with and follow the important safety instructions located on pages 5, 6 and 7.**

WARNING **Proper maintenance of the battery system by a qualified service technician is essential to the safety and reliability of your UPS system.**

8.2 Parts Replacement

The following list shows intervals for periodic maintenance and replacement of certain UPS parts.

1) Batteries: VRLA batteries are maintenance free with respect to electrolyte only. The charging voltage, temperature, performance and connection resistance must be monitored periodically. Necessary corrective actions must be made in order to assure safe reliable power is supplied by the UPS. The aforementioned items affect the life of batteries, so replacement should be done once every 3 to 5 years at a minimum. All of the batteries must be replaced at the same time.

   Quarterly maintenance
   a) Visual checks
      1) Leakage
      2) Corrosion on positive terminal
   b) Check battery temperature at the negative terminal.
   c) Measure and record the system float charging voltage.
   d) Measure and record the individual unit's float charging voltage.

   Semi-Annual maintenance
   a) Repeat the quarterly checks.
   b) Perform a 10-second high rate (e.g. 100 amp) load test on the individual batteries.
   c) Optionally test for the purpose of trending the battery over time.
   d) Re-torque all inter-battery connecting hardware (if applicable).
   e) Perform inter-battery connector resistance checks.

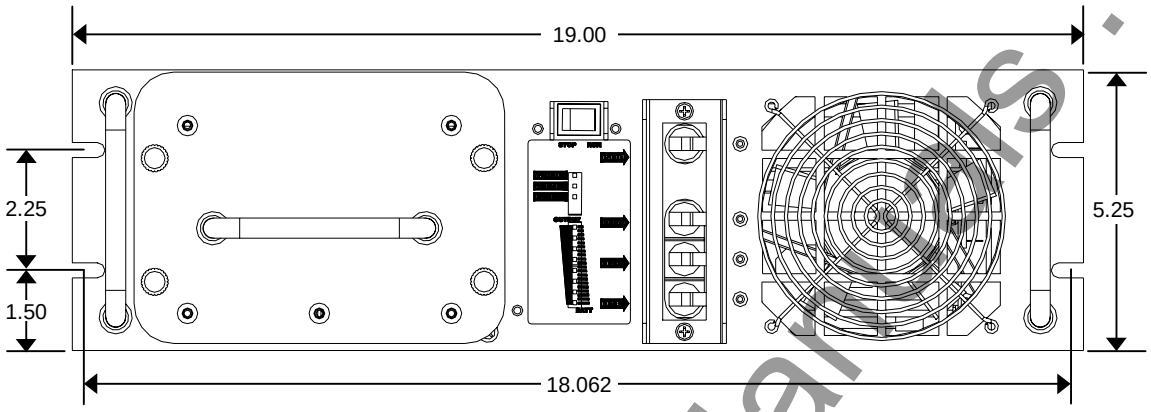
2) Aluminum electrolytic capacitors: Replace once every 5 years.

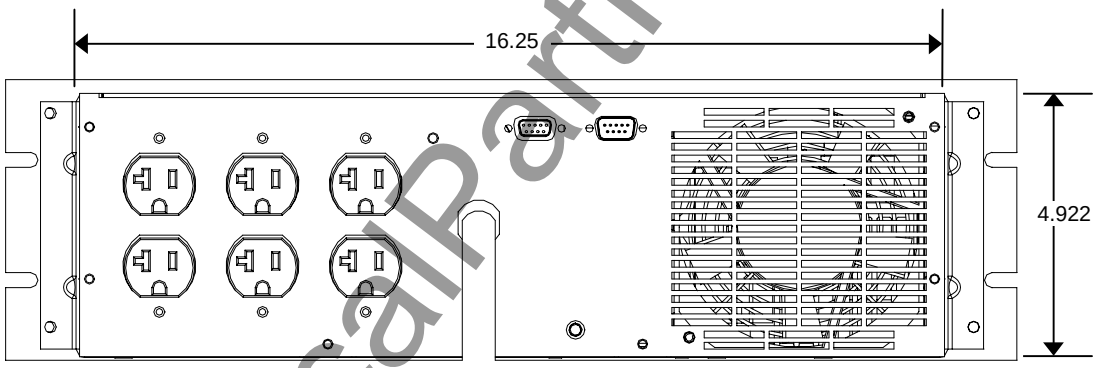
3) Fuses: Replace once every 7 years.

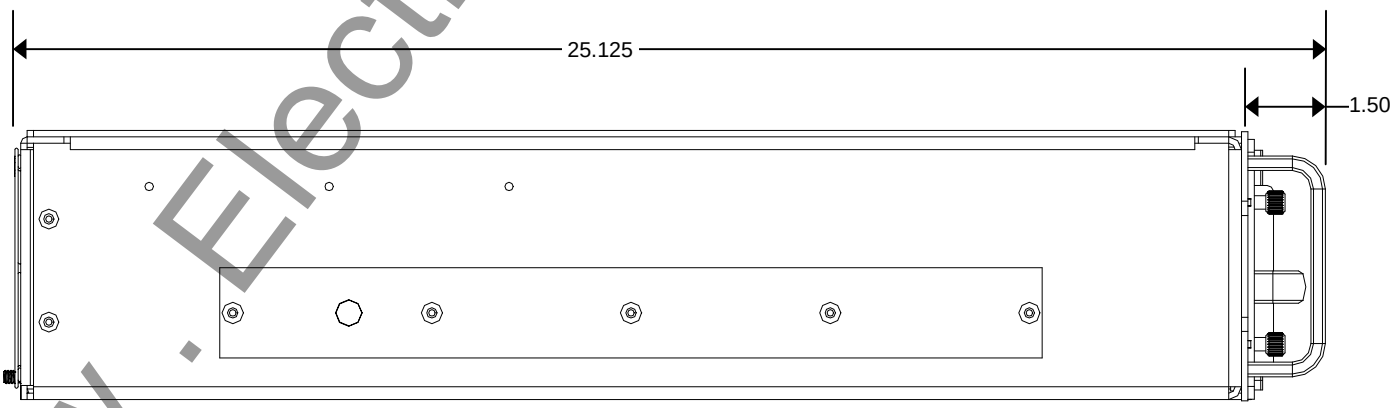
4) Cooling fan: Replace once every 3 years.

9.0 External Dimensions/Shipping Weights/Panel Layout

9.1 External Dimensions for the 2000 VA (120V and 230V) BLACK GOLD TB Model.

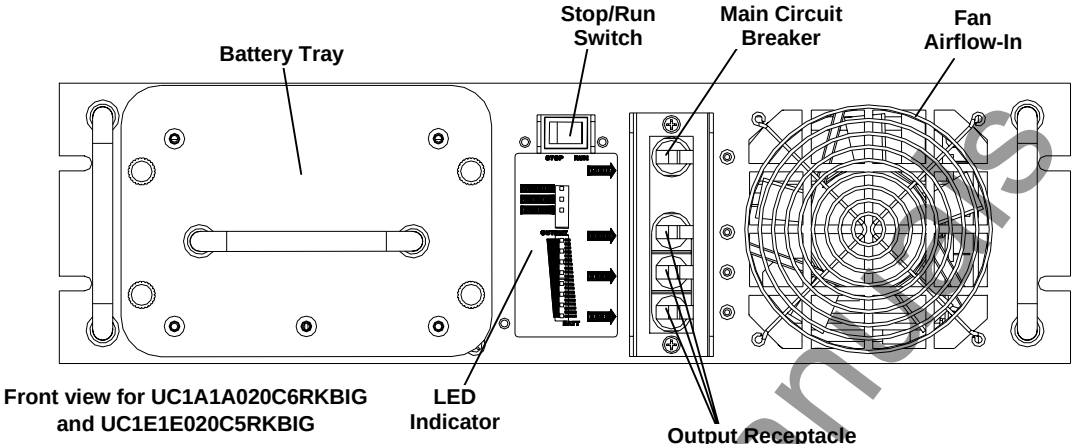


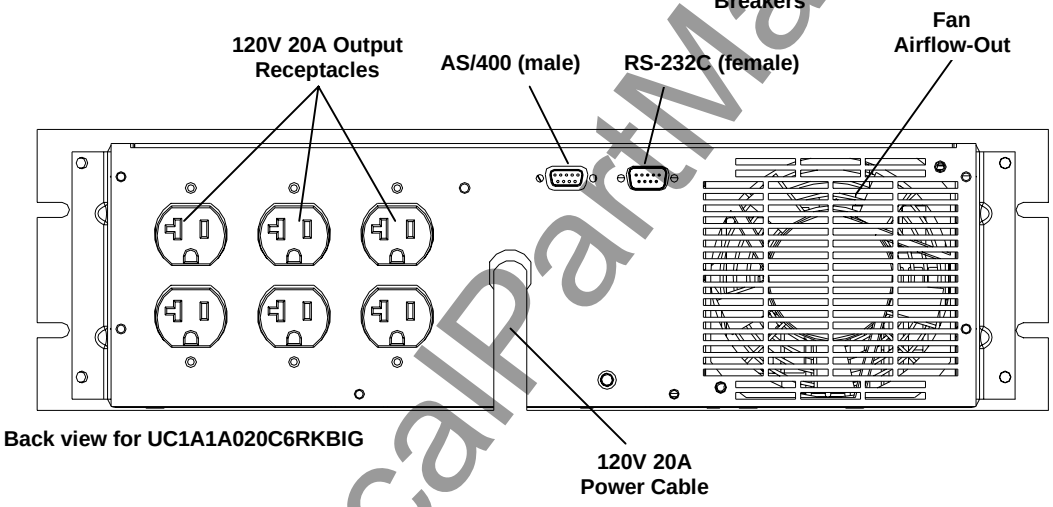


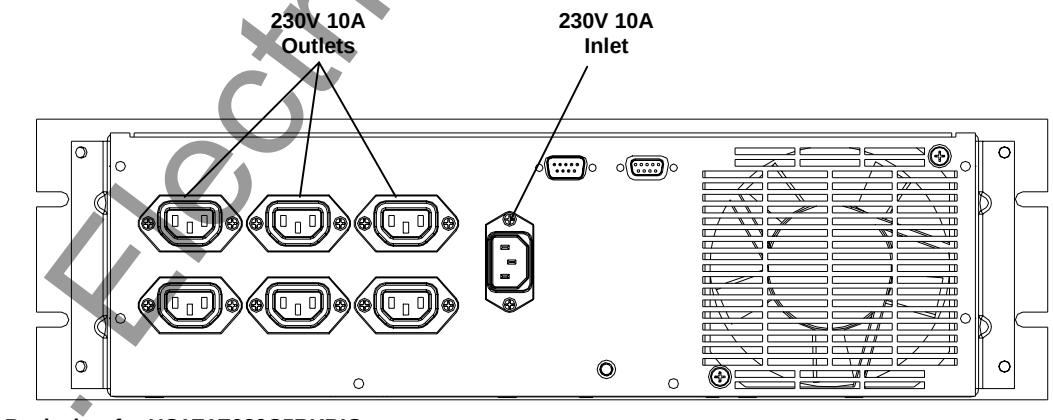


9.0 External Dimensions/Shipping Weights/Panel Layout

9.2 Panel Layout/Shipping Weight







BLACK GOLD TB Unit	Shipping Weight
UC1A1A020C6RKBIG	137.00 lbs. (62.14 kg.)
UC1E1E020C5RKBIG	129.00 lbs. (58.51 kg)

TOSHIBA

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